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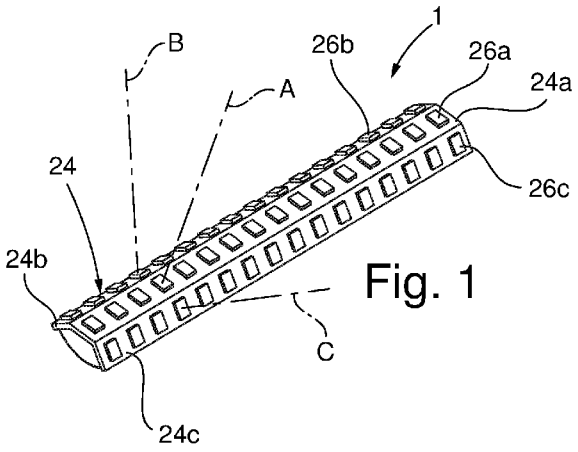

Fig. 1

(57) Abstract: The device (1; 10) comprises a support structure (24) having two mutually inclined parts (24a, 24b, 24c; 24a, 24b); a fitting portion (12) constrained to the support structure (24) and configured for being connected to an external source of electric power; a plurality of light sources (26a, 26b, 26c; 26a, 26b), in particular a plurality of LEDs, connected to the fitting portion (12) and configured for receiving electric power therefrom. The light sources (26a, 26b, 26c; 26a, 26b) are mounted on the mutually inclined parts (24a, 24b, 24c; 24a, 24b). Each one of the light sources (26a, 26b, 26c; 26a, 26b) is configured for emitting a substantially conical light beam developing around a respective axis of illumination (A, B, C; B, C). The axes of illumination (A, B, C; B, C) are mutually inclined. The support structure (24) is equipped with a heat sinking structure (28), which extends from the mutually inclined parts (24a, 24b, 24c; 24b, 24c), and which is located on the side opposite to the light sources (26a, 26b, 26c; 26a, 26b).

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LIGHTING DEVICE CONFIGURED FOR EMITTING A PLURALITY OF INCLINED LIGHT BEAMS

DESCRIPTION

Technical field

The present invention relates to a lighting device.

Background art

Different types of lighting devices are commonly known in the industry, such as, for example, lamps, configured for emitting light from electric power.

In particular, in the lighting engineering field, lighting bulbs including LEDs (Light Emitting Diodes) are being increasingly used as replacements for traditional light sources, such as incandescent or fluorescent lamps. Generally, LED-equipped devices offer the advantage of providing light having a proportionally greater intensity than traditional lamps.

However, LEDs generally emit light distributed over a light cone centred around an axis of illumination, which spreads out starting from the point of origin, unlike incandescent lamps which, on the contrary, emit light which is distributed in a substantially spherical fashion. Therefore, LED-equipped devices tendentially have a less homogeneous light distribution than can be obtained through traditional incandescent lamps. In such devices, in fact, the LEDs are generally arranged according to a matrix that produces parallel light beams, i.e. wherein the axes of illumination are substantially parallel to one another. In particular – though not exclusively – in LED-equipped lamps this arrangement is unfavourable because it creates a light beam distribution that develops in just one direction, which is typically oriented in accordance with the

longitudinal dimension of the lamp itself.

Summary of the invention

It is one object of the present invention to provide a lighting device which can create a luminous emission having, as a whole, a significantly wide light beam and a more homogeneous distribution than that emitted by devices realized in accordance with the teachings of the prior art. As an alternative, it is also possible, according to the invention, to create light beams that are more specifically directed, e.g. only towards the ceiling or towards the table.

According to the present invention, this and other objects are achieved through a device having the technical features set out in the appended independent claim.

It is to be understood that the appended claims are an integral part of the technical teachings provided in the following detailed description of the invention. In particular, the appended dependent claims define some preferred embodiments of the present invention, which include optional technical features.

Further features and advantages of the present invention will become apparent from the following detailed description, which is supplied by way of non-limiting example with particular reference to the annexed drawings, which will be summarized below.

Brief description of the drawings

Figures 1 and 2 are different perspective views from opposite sides of the same lighting device designed in accordance with one exemplary embodiment of the present invention.

Figures 3 and 4 a different plan views from opposite sides of the lighting device shown in Figures 1 and 2.

Figure 5 is a perspective view of a lamp in accordance with an illustrative embodiment of the present invention.

Figure 6 is an axial or longitudinal sectional view of the lamp shown in the preceding figures.

Figure 7 is a perspective view of a portion of the lamp shown in the preceding figures.

Figure 8 is a perspective view of a lamp in accordance with a further illustrative embodiment of the present invention.

Detailed description of the invention

With particular reference to Figures 1 to 4, numeral 1 designates as a whole a lighting device designed in accordance with an illustrative embodiment of the present invention.

Device 1 comprises a support structure 24 having an intermediate part 24a and a pair of lateral parts 24b, 24c located in mutually opposite positions and inclined relative to base part 24a. In addition, device 1 has a fitting portion (not numbered) constrained to support structure 24 and configured for being connected to an external source of electric power. Furthermore, the device comprises a plurality of light sources 26a, 26b, 26c, in particular a plurality of LEDs, mounted on intermediate part 24a and on lateral parts 24b, 24c. Each one of light sources 26a, 26b, 26c is configured for emitting a substantially conical light beam developing around a respective axis of illumination A, B, C. Support structure 24 is equipped with a heat sinking structure 28 extending from intermediate part 24a and from lateral parts 24b, 24c on the side opposite to light sources 26a, 26b, 26c.

As can be seen in the drawings, the axes of illumination A, B, C are mutually inclined.

Through the use of a support structure having a plurality of mutually inclined parts (at least two), on which the light sources are mounted, it is possible to create a light beam having a wider and, on the whole, more homogeneous distribution in the surrounding space. Moreover, the particular position of the heat sinking structure, behind the light sources mounted on the inclined parts, allows obtaining a compact solution.

In particular, light sources 26a, 26b, 26c are mounted on the mutually inclined parts 24a, 24b, 24c in such a way that each one of the axes of illumination A, B, C is substantially perpendicular to the surface of part 24a, 24b, 24c whereon such light sources 26a, 26b, 26c are mounted.

In the illustrated embodiment there are three different mutually inclined parts, i.e. intermediate part 24a and each one of lateral parts 24b, 24c. It will however be apparent to a man skilled in the art that variants which are simpler or more complex than the one shown in Figures 1 to 4 may also be conceived in accordance with the principle of the invention.

In particular, in further simplified embodiments of the present invention (not shown), the support structure may have the intermediate part and only one lateral part located on just one side of the intermediate part and inclined relative thereto. In this case, the light sources are situated on the intermediate part and on the support part.

Moreover, in variants (not shown) that are less advantageous than the embodiment shown in Figures 1 to 4, it is also conceivable to place the light sources on two inclined parts only, selected from the intermediate part

and the two lateral parts (e.g. on the intermediate part and on just one lateral part; or on both lateral parts, with no LEDs on the intermediate part).

In the illustrated embodiment, support structure 24 has a substantially longitudinal extension, wherein the width of intermediate part 24a and of lateral parts 24b, 24c define the minor transversal extension. Variants may however be conceived wherein the support structure has different shapes, e.g. square or circular.

In the illustrated embodiment, support structure 24 has a substantially rectilinear development. In other embodiments, however, a support structure having a curvilinear shape may also be conceived.

In other variant embodiments, support structure 24 may be closed in a ring-like fashion, thus defining, for example, a polygonal, elliptical or circular shape.

In the illustrated embodiment, lateral parts 24b, 24c are inclined in the same direction with respect to intermediate part 24a (in other words, away from same side or face of intermediate part 24a). In particular, lateral parts 24b, 24c form, together with intermediate part 24a, a cross section of support structure 24 which is shaped substantially like a C. In other variant embodiments, however, the lateral parts may be inclined in opposite directions relative to the intermediate part.

In the illustrated embodiment, lateral parts 24b, 24c mutually diverge from intermediate part 24a. In other variant embodiments, however, the lateral parts may converge towards each other from the intermediate part.

Preferably, heat sinking structure 28 extends along support structure 24 and includes a plurality of fins 32 delimited by the inclined parts, i.e. in this case, by

intermediate part 24a and by lateral parts 24b, 24c, and protruding in a direction opposite to light sources 26a, 26b, 26c. In particular, fins 32 extend transversally relative to the extension of support structure 24. In the illustrated embodiment, fins 32 have an arched shape.

As an alternative, the fins may also extend in a different direction than illustrated and described herein. For example, in a variant not shown, said fins may be conceived to extend in a longitudinal direction relative to the extension of the support structure.

In particular, heat sinking structure 28 is made of a material having high thermal conductivity, such as a metal, e.g. aluminium. As an alternative, heat sinking structure 28 may be made of ceramic, or also plastic based on thermally conductive polymers.

With particular reference to Figures 5 to 7, reference numeral 10 designates as a whole a lamp structured in accordance with a further illustrative embodiment of the present invention.

Components or elements having a structure or a function similar to those previously described and illustrated with reference to the embodiment shown in Figures 1 to 4 have been assigned the same alphanumerical references. As far as the various aspects and characteristics thereof are concerned, therefore, reference should be made to the above-described embodiment.

With particular reference to Figure 5, lamp 10 comprises a fitting portion 12 configured for being connected to a lamp-holding structure electrically supplied by an external source of electric power, e.g. the electric mains, typically through an electric outlet. Lamp 10 further comprises a control module 14 mounted on fitting

portion 12 and configured for receiving electric power through the latter. Furthermore, the lamp comprises a lighting portion (or bulb) 16 mounted on control module 14 and electrically connected to the latter in such a way as to be able to provide a luminous emission.

In the illustrated embodiment, fitting portion 12 has a peripheral screw-type outer thread 13 to be inserted into a corresponding complementary inner thread in the lamp holder in order to establish the electric connection with the external source of electric power. In particular, fitting portion 12 acts as a male connection element adapted to be electrically connected to the lamp holder, which acts as a female connection element.

In the illustrated embodiment, control module 14 comprises a casing 18 that houses a printed circuit board (not shown).

In particular, casing 18 is mechanically connected to fitting portion 12, thus supporting it and connecting it to lighting portion 16. The printed circuit board is configured for being electrically connected, in a manner per se known to those skilled in the art, to fitting portion 12 so as to be able to receive the electric power supplied by the external source of electric power.

By way of example, casing 18 is made of plastic material, e.g. by injection moulding. Preferably, casing 18 is made of biodegradable plastic, e.g. derived from maize cellulose.

In the illustrated embodiment, the printed circuit board can convert (in a manner per se known to those skilled in the art) the electric power received at its input, typically alternating current from the electric mains, in such a way as to output direct-current power. In

particular, the printed circuit board has a shape which is substantially complementary to the axial or longitudinal section of casing 18.

In the illustrated embodiment, lighting portion 16 comprises a hollow body 22 made of transparent or semi-transparent material (or anyway a material that can be crossed by a luminous emission within the visible light range), and secured to fitting portion 12. Preferably, hollow body 22 is removably connected (in particularly, reversibly screwed) to casing 18. In particular, the base (not numbered) of hollow body 22 is reversibly screwed at a perimetric edge (also not numbered) of the mouth of casing 18. As an alternative, it is also conceivable to use different fastening means between hollow body 22 and casing 18, e.g. snap-type coupling means.

In the illustrated embodiment, hollow body 22 is reversibly disassembleable.

In particular, lighting portion 16 further comprises a support structure, in particular a ring 24, carried by hollow body 22. Ring 24 is fitted with a plurality of light sources 26a, 26b, which are aimed transversally towards the inside of hollow body 22, and which are electrically connected to the printed circuit board.

As can be seen in Figure 2, each one of light sources 26a, 26b is configured for emitting a respective conical light beam developing, in particular in a substantially cantered manner, around an axis of illumination A, B. Each axis of illumination A, B is inclined relative to a longitudinal axis X of said lamp 10. Also, each axis of illumination A, B converges towards longitudinal axis X away from fitting portion 12.

In the illustrated embodiment, the light beam that

each LED is configured for emitting has a substantially conical shape, e.g. with an angular extension or width of approx. 120°, cantered around the respective axis of illumination A, B. Of course, the angular width mentioned herein is merely exemplificative and does not limit the claimed protection scope.

Preferably, the plurality of light sources comprises a plurality of ring-like arrangements of light sources 26a, 26b, which are arranged in a substantially radial pattern around the longitudinal axis. Advantageously but not necessarily, in each ring-like arrangement light sources 26a, 26b are equally spaced in angular terms. In other variant embodiments, as will be apparent to those skilled in the art, the angular distance between consecutive light sources 26a, 26b may vary.

In the illustrated embodiment, the light sources are attached to a first ring-like arrangement of light sources 26a and a second ring-like arrangement of light sources 26b, which are axially spaced from each other. In particular, the first ring-like arrangement of light sources 26a is closer to fitting portion 12, while the second ring-like arrangement of light sources 26b is farther from fitting portion 12.

In the illustrated embodiment, the axis of illumination A, B of each one of the light sources 26a, 26b defines a respective angle of inclination α, β relative to longitudinal axis X of lamp 10. In other words, the intersection of each axis of illumination A, B with the longitudinal axis X defines a respective angle of inclination α, β. As will be apparent to a man skilled in the art, in other variants of the present invention the angles of inclination α, β may be changed as desired

according to the direction in which the light needs to be sent.

In the illustrated embodiment, the angle of inclination α, β is substantially the same for light sources 26a, 26b situated and lying in the same ring-like arrangement. In further variant embodiments, the angles of inclination α, β may be different for light sources 26a, 26b situated in different angular-like arrangements.

Preferably, the value of the angle of inclination α, β of light sources 26a, 26b belonging to different ring-like arrangements decreases as the axial distance increases between fitting portion 12 and the ring-like arrangement to which the respective light source belongs. In particular, the first angle of inclination α (referred to the plurality of light sources 26a situated in the first ring-like arrangement, which is closer to fitting portion 12) is approx. 60°, whereas the second angle of inclination β (referred to the plurality of light sources 26b situated in the second ring-like arrangement, which is farther from fitting portion 12) is approx. 30°. Of course, also for these values mentioned herein by way of example, a man skilled in the art will appreciate that their width can be changed as necessary according to specific implementation requirements.

In particular, each one of the ring-like arrangements of light sources 26a, 26b lies in a respective section of ring 24 that is inclined relative to the longitudinal axis X. In particular, as can be appreciated in Figure 3, the first light sources 26a lie in a first inclined section 27 of ring 24, and the second light sources 26b lie in a second inclined section 29 of ring 24.

In the illustrated embodiment, the first inclined

section is situated in a radially inward position, whereas the second inclined section 29 of ring 24 is situated in a radially outward position relative to the longitudinal axis X. In particular, the first inclined section 27 is in a position that is axially closer to fitting portion 12, whereas the second inclined section 29 is in a position that is axially farther from fitting portion 12.

Preferably, the first inclined section 27 and the second inclined section 29 are connected in a substantially axial direction by a substantially cylindrical intermediate section (not numbered) of the ring. At its axial ends, ring 24 is connected, on opposite sides, to half-shells 34 of hollow body 22 by means of substantially cylindrical edges or end sections (also not numbered).

As previously mentioned, in the illustrated embodiment light sources 26a, 26b are of a substantially punctiform type and are evenly distributed over the transversally internal annular surface of ring 24.

Preferably, light sources 26a, 26b comprise a plurality of LEDs. In particular, though not necessarily, the surface of each LED faces towards the inside of hollow body 22.

For example, the electric connection between light sources 26a, 26b and printed circuit board 20 can be established, in a per se known manner, by means of electric cables or electrically conductive tracks (not shown) coming from casing 18 and entering hollow body 22.

In the illustrated embodiment, ring 24 protrudes transversally, in particular radially, out of hollow body 22. In particular, ring 24 is at least partly exposed to the air.

In particular, ring 24 comprises a heat-sinking

structure 28 arranged in a transversally, in particular radially, external position, and a substrate (not numbered) arranged in a transversally internal position, whereon light sources 26a, 26b are secured.

In the illustrated embodiment, light sources 26a situated in a first ring-like arrangement 24a have their axes of illumination A converging substantially in a same first point Pa of longitudinal axis X of hollow body 22.

In the illustrated embodiment, light sources 26b situated in the second ring-like arrangement 24b have their axes of illumination converging in a same second point Pb of longitudinal axis X of hollow body 22.

Preferably, the first point Pb and the second point Pc are axially spaced from each other along longitudinal axis X. In further alternatives, structure 24 may be configured in such a way that the first point Pa and the second point Pb coincide.

As will be apparent to those skilled in the art, the configuration of heat-sinking structure 28 will advantageously be able to dissipate heat regardless of the position and orientation of lamp 10 when mounted to the lamp holder. In particular, whether lighting portion 16 is oriented - upwards or downwards- the heat-sinking performance will remain substantially unchanged.

In the illustrated embodiment, the substrate is, -for example- glued (or otherwise secured) to the inside of heat-sinking structure 28.

Preferably, heat-sinking structure 28 has a substantially annular shape and includes a plurality of fins 32 arranged in a sunburst pattern and protruding transversally, in particular radially, towards the outside of hollow body 22. In particular, fins 32 have a

longitudinally or axially arched shape. Thus, the user can comfortably grasp lamp 10 when it is off, which - thanks to this expedient - will be ergonomical to the touch. In further variant embodiments, a traditional heat sinking structure 28 may however be implemented as a substitute for the one shown in the drawings.

In the illustrated embodiment, heat sinking structure 28 is made of a material having high thermal conductivity, e.g. metal, such as aluminium. As an alternative, heat sinking structure 28 may be made of ceramic, or plastic based on thermally conductive polymers.

In the illustrated embodiment, hollow body 22 comprises a pair of half-shells 34, preferably cup-shaped, to be assembled together with their cavities facing each other. In particular, half-shells 34 may also have shapes other than the cup-like shape proposed in the drawings, forming a hollow body 22 having a geometry and a shape that can virtually be adapted at will.

In particular, ring 24 is axially interposed between the mutually facing edges of half-shells 34, and preferably connected thereto by mechanical interference. In the illustrated embodiment, at least half-shell 34 which is farther from control module 14 is connected to ring 24 in a removable manner. This facilitates the task of disassembling lamp 10, in particular lighting portion 16 thereof, thus making for faster removal, repair, replacement and recycling of the components contained therein.

In particular, as Figures 5 and 6 clearly show, during the assembly process, the opposed edges of half-shells 34 are transversally superimposed on the outside of ring 24. For example, the opposed edges of half-shells 34 are

superimposed on heat-sinking structure 28. Advantageously, but not necessarily, in the assembled configuration of lamp 10 said edges axially abut against projecting fins 32 of heat-sinking structure 28.

In the illustrated embodiment, the base (not numbered) belonging to half-shell 34 which is closer to control module 14 is removably connected, e.g. reversibly screwed, to casing 18. In particular, the base of said half-shell 34 is reversibly screwed to a perimetric edge (not numbered) of the mouth of casing 18, e.g. at the cup-like portion (also not numbered) of said casing 18. As aforementioned, it is also conceivable, as an alternative, to use different fastening means between said half-shell 34 and casing 18, e.g. snap-type coupling means.

By way of example, half-shells 34 are made of plastic material, e.g. by injection moulding. Preferably, the half-shells are made of biodegradable plastic, e.g. derived from maize cellulose.

With reference to Figure 8, there is schematically shown a lamp 10 designed in accordance with a further embodiment of the present invention.

In such an embodiment, hollow body 22 has a central pass-through cavity, wherein intermediate element 24 is clutched between half-shells 34; therefore, intermediate element 24 extends with its heat sinking part 28 radially towards the inside of lighting element 16.

In this embodiment, the layout of light sources 26a and 26b is different compared to the previously illustrated embodiment. In particular, the first light sources 26a are arranged radially outwards, whereas the second light sources 26b are oriented in the axial direction, slightly inclined towards fitting portion 12. Thus, the axes of the

light beams emitted by the first light sources 26a will converge towards central axis X.

At any rate, also this embodiment includes inclined parts 24a and 24b that carry said light sources 26a and 26b.

Of course, without prejudice to the principle of the invention, the forms of embodiment and the implementation details may be extensively varied from those described and illustrated herein by way of non-limiting example, without however departing from the scope of the invention as set out in the appended claims.

For example, unlike the illustrated embodiment, the heat-sinking structure and the substrate of the ring may be made as one piece, of course by using a material having appropriate thermal conductivity properties, so as to promote the cooling required because of the lighting action of the light sources. In particular, the ring may be wholly made of metal, e.g. aluminium.

In particular, according to an implementation variant wherein the ring is made of thermally conductive material, it is possible to solder the LEDs directly to the ring, without needing a printed circuit board or other elements.

The illustrated embodiment includes just one ring in the lighting portion. However, as will be apparent to a man skilled in the art, in alternative embodiments the lighting portion may also include a plurality of such rings, respectively spaced in the axial direction. In further implementation variants, it is conceivable to use a plurality of rings axially spaced from each other, with transparent intermediate annular structures in between coupled to the adjacent rings as described for the half-shells of the hollow body. In other words, it is possible

to design a modular structure of the lighting portion which extends in the axial direction with multiple rings and intermediate annular structures placed on top of one another.

In the illustrated embodiment, the axis of the ring is substantially aligned with the longitudinal axis of the hollow body. However, in further implementation variants the ring may be arranged on an oblique plane relative to the longitudinal axis of the hollow body.

CLAIMS

1. Lighting device (1; 10) comprising:

- a support structure (24) having at least two mutually inclined parts (24a, 24b, 24c; 24a, 24b);
- a fitting portion (12) constrained to said support structure (24) and configured for being connected to an external source of electric power; and
- a plurality of light sources (26a, 26b, 26c; 26a, 26b), in particular a plurality of LEDs, connected to said fitting portion (12) and configured for receiving electric power therefrom; said light sources (26a, 26b, 26c; 26a, 26b) being mounted on said mutually inclined parts (24a, 24b, 24c; 24a, 24b); each one of said light sources (26a, 26b, 26c; 26a, 26b) being configured for emitting a substantially conical light beam developing around a respective axis of illumination (A, B, C; A, B); said axes of illumination (A, B, C; A, B) being mutually inclined;

said support structure (24) being equipped with a heat sinking structure (28), which extends from said mutually inclined parts (24a, 24b, 24c; 24b, 24c), and which is located on the side opposite to said light sources (26a, 26b, 26c; 26a, 26b).

2. Device (1) according to claim 1, wherein said at least two inclined parts of said support structure (24) comprise an intermediate part (24a) and at least one pair of lateral parts (24b, 24c) extending axially or transversally from said intermediate part (24a) on opposite sides.

3. Device (1) according to any one of the preceding claims, wherein said support structure (24) has a prevalently longitudinal and rectilinear extension.

4. Device (1) according to any one of the preceding claims, wherein said heat sinking structure (28) extends

along the support structure (24) and includes a plurality of fins (32) delimited by said inclined parts (24a, 24b, 24c) and protruding on the side opposite to the side on which said light sources (26a, 26b, 26c) are located.

5. Device (10) according to claim 1, wherein said support structure (24) is closed in a ring-like fashion and said at least two inclined parts (24a, 24b) face transversally inwards.

6. Device (10) according to claim 5, comprising a lighting bulb (16) having a hollow body (22) made of transparent or semi-transparent material; said hollow body (22) comprising said support structure (24), wherein said mutually inclined parts comprise a first ring-like arrangement (24a) and a second ring-like arrangement (24b) axially spaced from each other, wherein said light sources (26a, 26b) are arranged in a radial pattern on said ring-like arrangements (24a, 24b) and have their respective axes of illumination converging towards the inside of said hollow body (22).

7. Device (10) according to claim 6, wherein the light sources (26a) arranged on the first ring-like arrangement (24a) have their axes of illumination converging substantially in the same (first) point (Pa) of a longitudinal axis (X) of said hollow body (22).

8. Device (10) according to claim 6 or 7, wherein the light sources (26b) arranged on the second ring-like arrangement (24b) have their axes of illumination converging in the same (second) point (Pb) of a longitudinal axis (X) of said hollow body (22).

9. Device (10) according to claims 7 and 8, wherein said first and second points are axially spaced.

10. Device (10) according to any one of claims 6 to 9,

wherein said first ring-like arrangement (24a) is situated radially inwards, whereas the second ring-like arrangement (24b) is situated radially outwards with respect to said longitudinal axis (X).

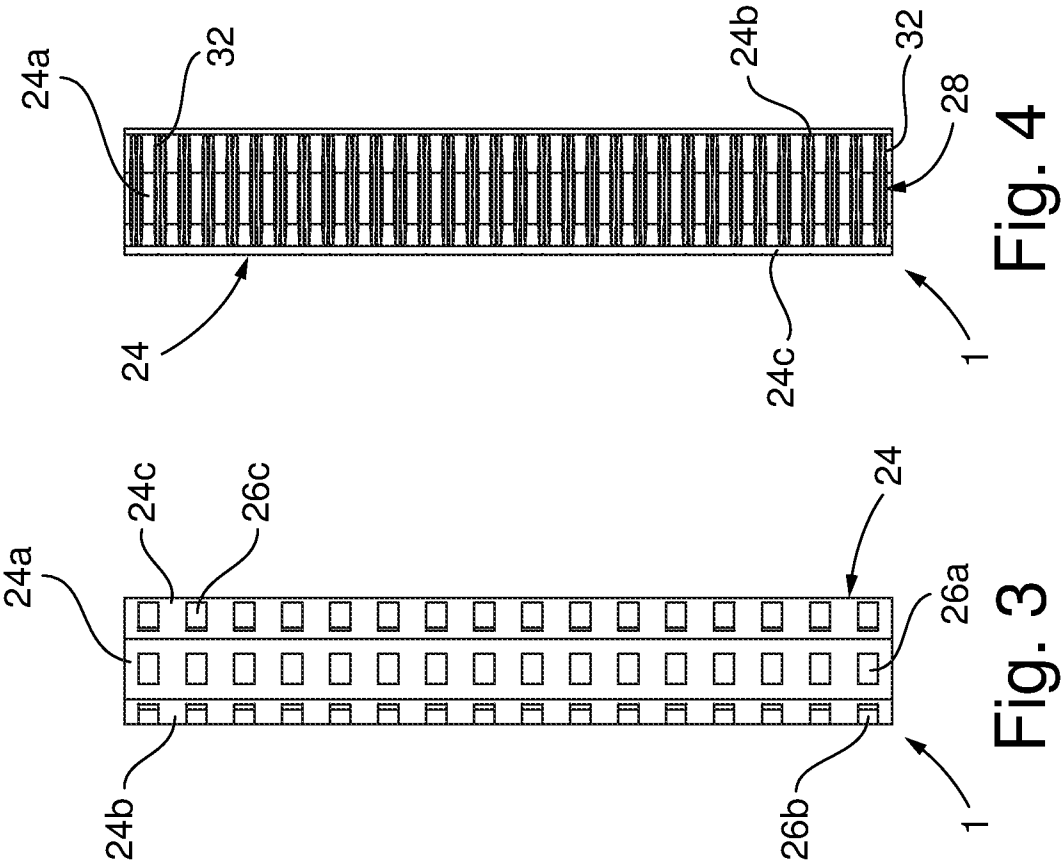

Fig. 4

Fig. 3

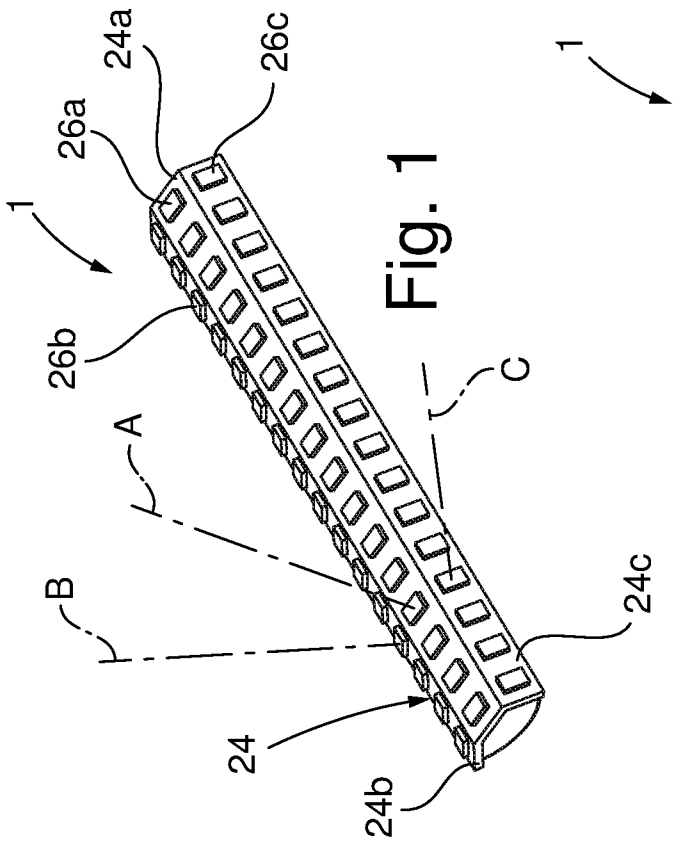

Fig. 1

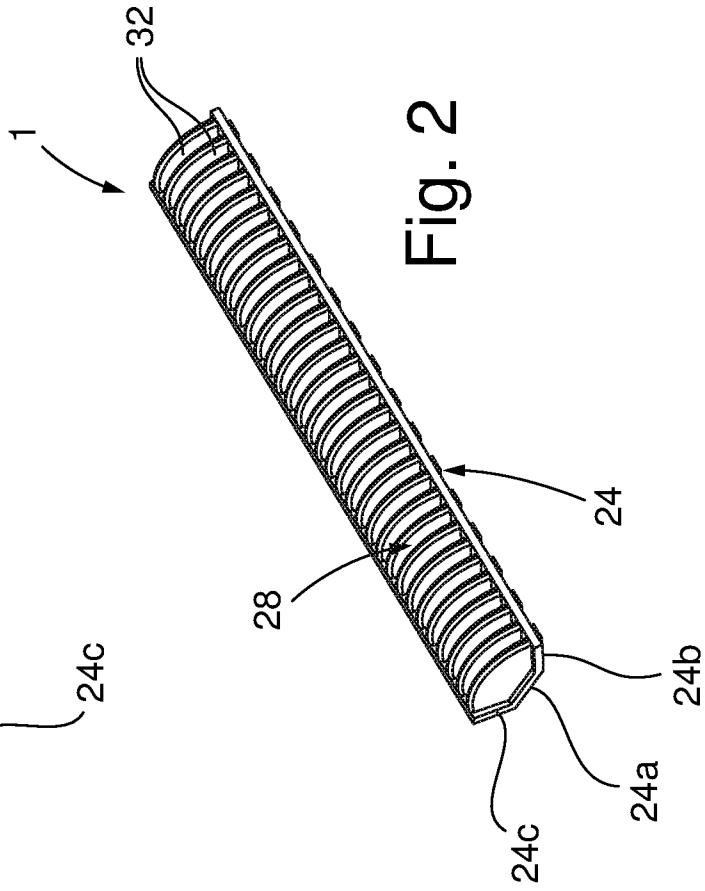

Fig. 2

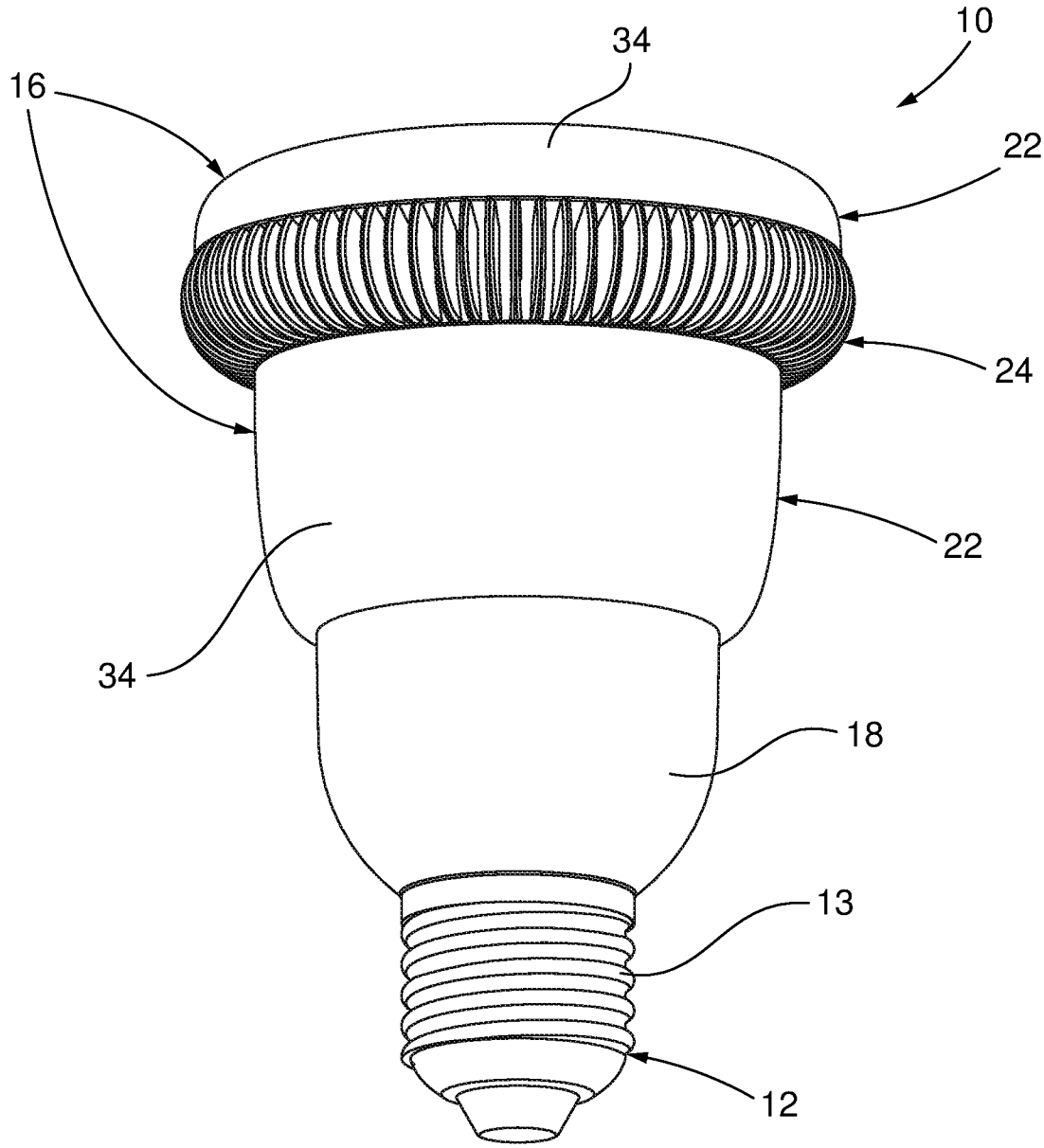

Fig. 5

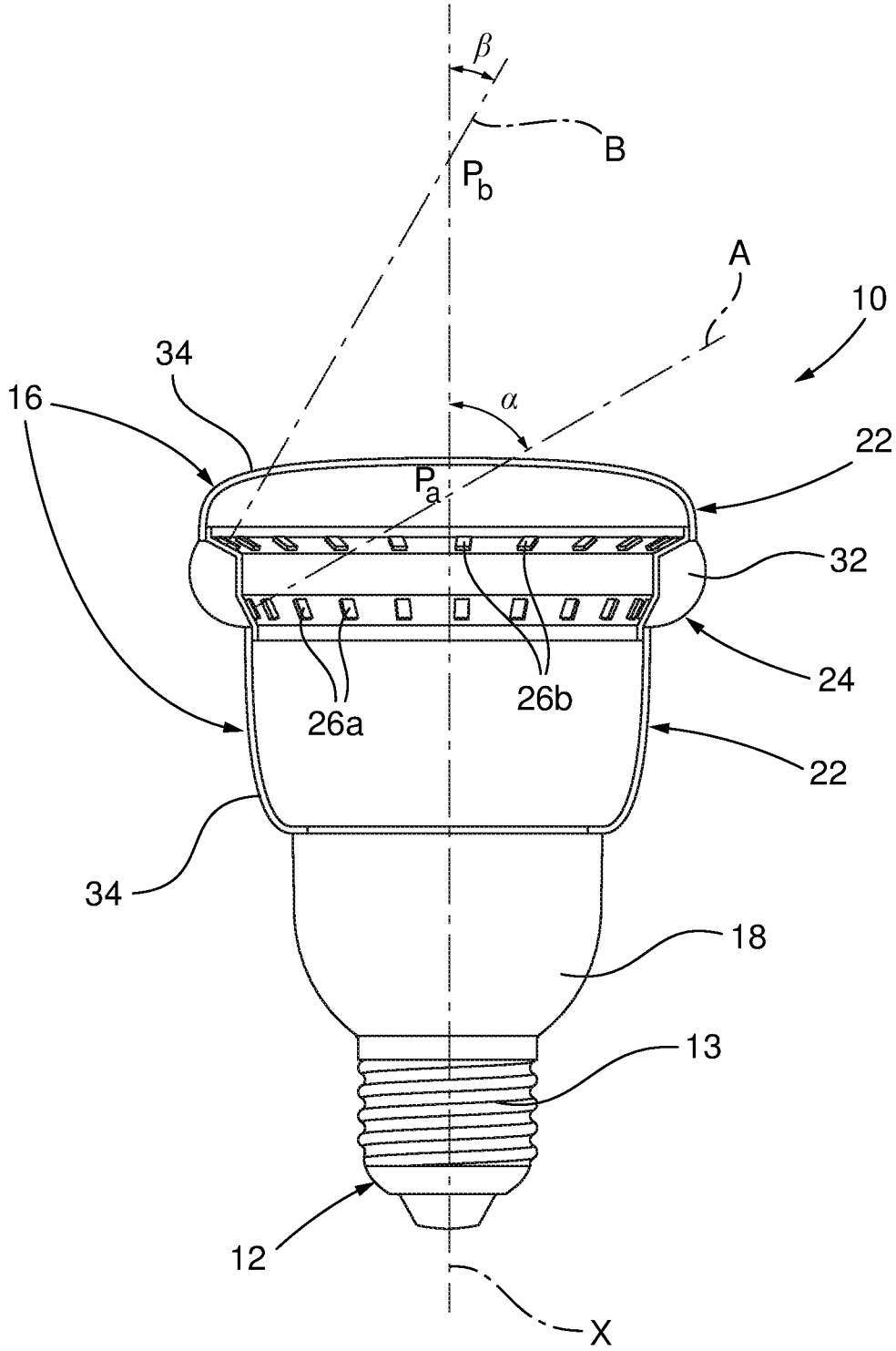

Fig. 6

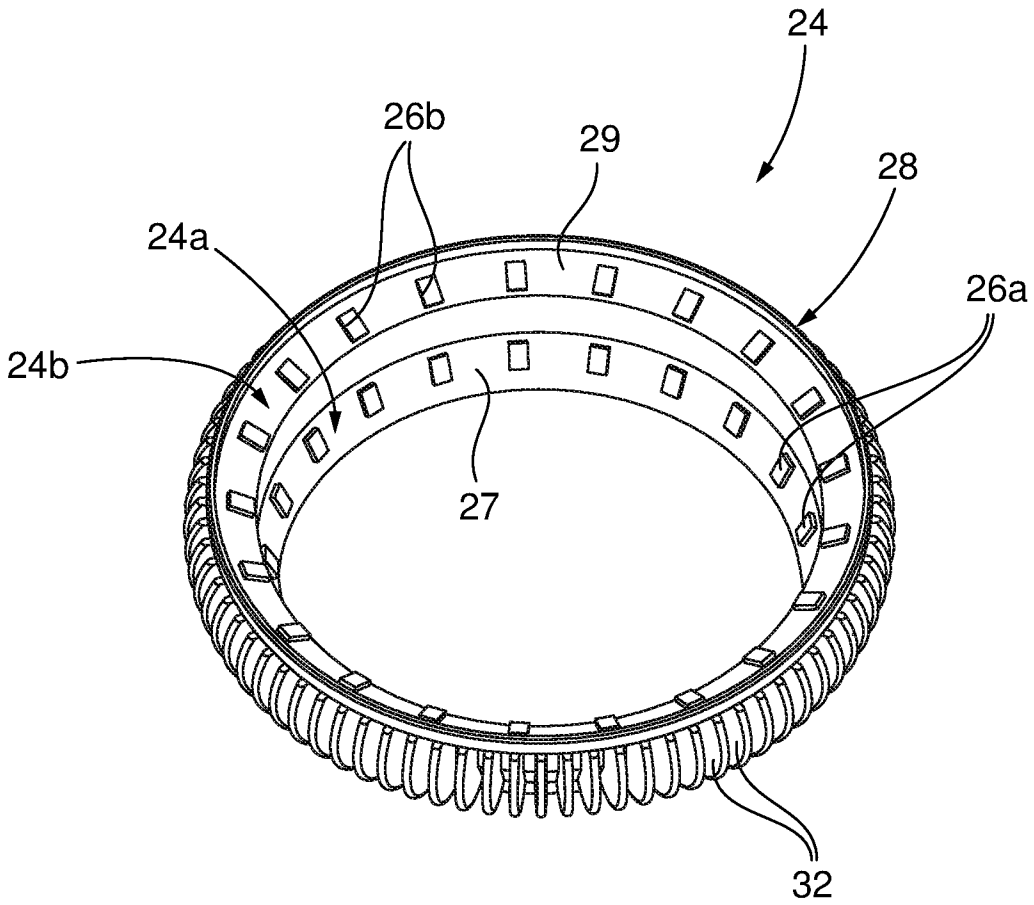

Fig. 7

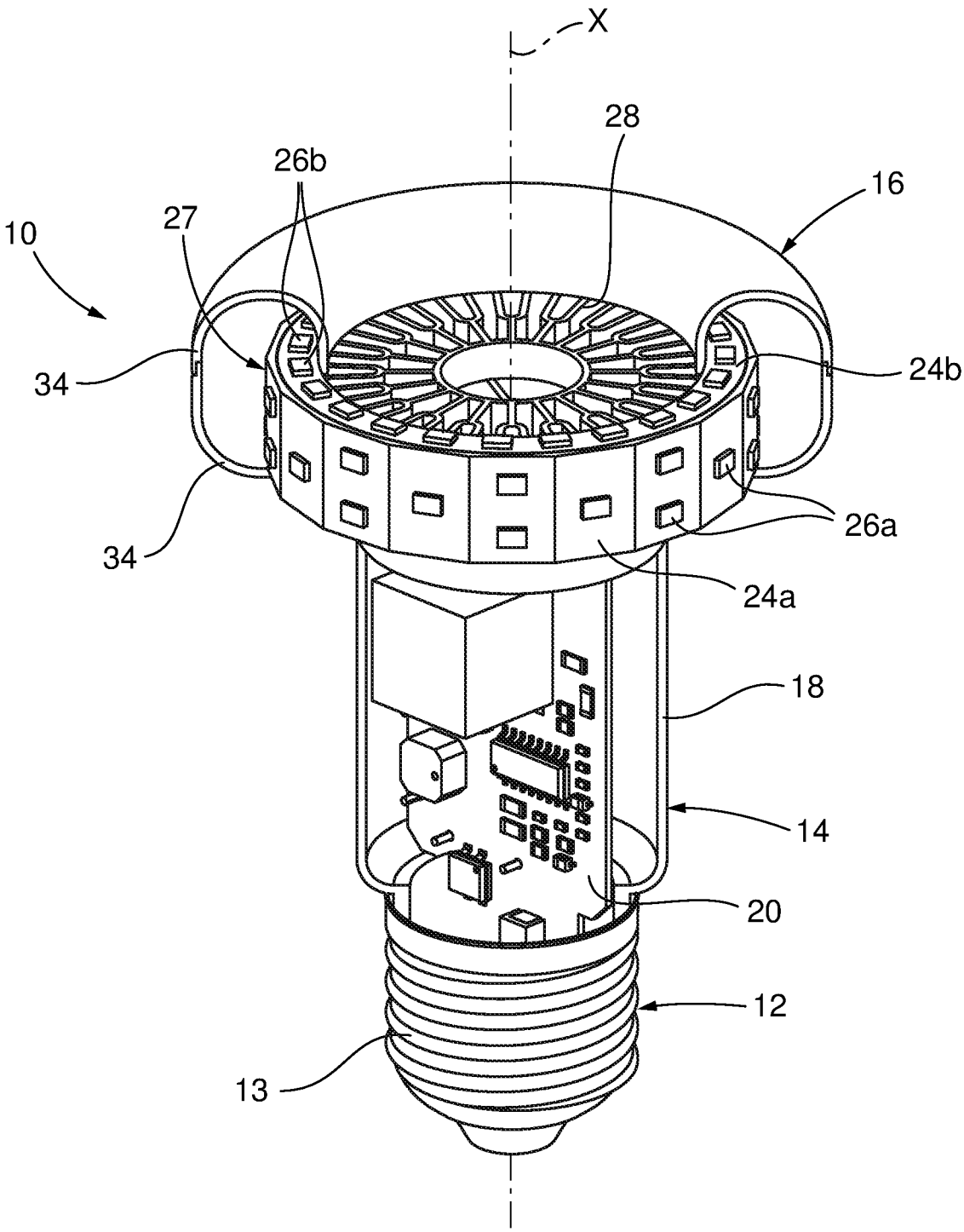

Fig. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/052268

A. CLASSIFICATION OF SUBJECT MATTER
INV. F21K99/00 F21V29/83
ADD. F21Y103/00 F21Y111/00

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)
F21K F21Y F21V

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 5 806 965 A (DEESE RAYMOND E [US]) 15 September 1998 (1998-09-15) column 9, line 19 - line 30; claim 6; figure 10	1-3 6-10

X	US 2014/063794 A1 (PAREKH ESMAIL KHALID [US]) 6 March 2014 (2014-03-06) paragraph [0014]; figure 1	1,2,4

X	US 2014/268771 A1 (HEIKMAN STEN [US]) 18 September 2014 (2014-09-18) figures 5,8	1,2,5

☐ 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
30 June 2016	08/07/2016

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

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2016/052268

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5806965	A	15-09-1998	NONE
US 2014063794	A1	06-03-2014	NONE
US 2014268771	A1	18-09-2014	NONE