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(54) **Lighting device and luminaire**

(57) Disclosed is a lighting device (1) comprising a housing (10) comprising a circular aperture (15); a solid state lighting arrangement comprising at least one solid state lighting element (12) mounted in said housing and arranged to emit light towards said circular aperture; and a circular cover plate (20) mounted in said circular aperture, said circular cover plate facing said arrangement and comprising M different optical elements (22, 24, 26,

32, 34), wherein M is a positive integer having a value of at least 2, wherein the cover plate is fitted such that it can be rotated in the plane of said aperture between M positions, wherein in each of said M positions a different one of said optical elements is aligned with the at least one solid state lighting element. A luminaire including such a lighting device is also disclosed.

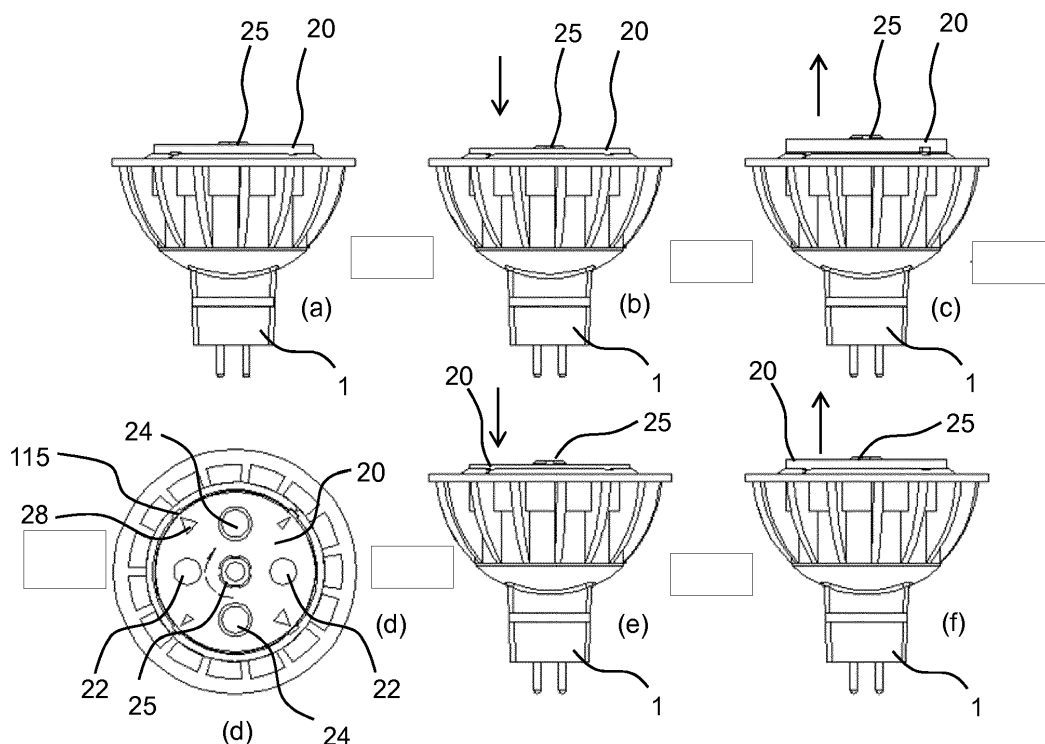


FIG. 3

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a lighting device comprising a housing comprising a circular aperture, a solid state lighting arrangement comprising at least one solid state lighting element mounted in said housing and arranged to emit light towards said circular aperture and a circular cover plate comprising a plurality of lens elements movably mounted in said circular aperture.

[0002] The present invention further relates to a luminaire comprising such a lighting device.

BACKGROUND OF THE INVENTION

[0003] Lighting devices based on solid state lighting (SSL) elements such as light-emitting diodes (LEDs) are rapidly increasing in popularity because such devices are considered an energy-friendly alternative to traditional lighting devices such as incandescent or halogen light bulbs. However, one of the main drawbacks of SSL element-based lighting devices is the higher cost of such devices compared to their traditional counterparts. Although this is offset by the superior lifetime of the SSL element-based lighting devices, this nevertheless forms a barrier for further market penetration of the SSL element-based lighting devices.

[0004] Part of the reason for the higher cost of SSL element-based lighting devices is that SSL elements generate light having completely different beam characteristics than for instance incandescent lighting devices. For this reason, SSL element-based lighting devices tend to comprise optical elements such as collimators and/or lenses to create a lighting device producing a desirable illumination profile, e.g. a spot light or the like.

[0005] It is not always apparent to the consumer which type of SSL-based lighting element is best suited for the consumer's needs. This may lead to the consumer purchasing one or more SSL-based lighting devices only to find that the devices do not produce the desired luminous output. This of course is entirely unsatisfactory. Also, the consumer may wish to use the SSL element-based lighting devices for different applications, in which case some configurability of the luminous output of the SSL element-based lighting devices is desirable.

[0006] EP 2,314,912 B1 discloses a LED lamp with an infinitely adjustable radiation angle whereby several LEDs are located on a carrier plate and a lens plate including a lens array of Fresnel lenses is located at an adjustable distance in front of the carrier plate. The lens plate is located in a retaining ring which with its outer contour fits into the guide thread of a guide ring that itself is turnable guided. The guide ring may be turned such that the retaining ring with the lens plate is secured by means of the side guides in the turning movement of the retaining ring to the LED plate depending on the turning direction either toward or away from this, and whereby

the defined stages of the radiation angle between 10° and 60° are set by locking positions of the retaining ring or are indicated by marks on the retaining ring.

[0007] A drawback of this LED lamp is that the optical performance of the Fresnel lenses is typically dependent of the distance of the lens to the LED, i.e. has an optimal distance to the LED. If the Fresnel lens is positioned at a suboptimal distance, the luminous output of the lamp may be negatively affected. Also, if the Fresnel lens array is too close to the LEDs, overheating may occur. Consequently, although the LED lamp of EP 2,314,912 B1 can produce beam angles in the range of 10° to 60°, the luminous output of the LED lamp at some of these beam angles may be unsatisfactory.

SUMMARY OF THE INVENTION

[0008] The present invention seeks to provide a lighting device according to the opening paragraph that may be reconfigured in a satisfactory manner.

[0009] The present invention further seeks to provide a luminaire comprising such a lighting device.

[0010] According to an aspect, there is provided a lighting device comprising a housing comprising a circular aperture; a solid state lighting arrangement comprising at least one solid state lighting element mounted in said housing and arranged to emit light towards said circular aperture; and a circular cover plate mounted in said circular aperture, said circular cover plate facing said arrangement and comprising M different optical elements, wherein M is a positive integer having a value of at least 2, wherein the cover plate is fitted such that it can be rotated in the plane of said aperture between M positions, wherein in each of said M positions a different one of said optical elements is aligned with the at least one solid state lighting element.

[0011] The lighting device of the present invention includes a plurality of different optical elements that are each selected to produce a desirable luminous output characteristic for the lighting device. As the distance between the different optical elements and the SSL elements of the lighting device is well-defined, i.e. does not vary due to the fact that the cover plate is rotated in the plane of the aperture only, it can be ensured that the optical elements produce the desired luminous flux, whilst overheating may also be prevented. Consequently, a lighting device is provided that produces satisfactory luminous outputs in each of its optical element configurations. It is furthermore noted that although some embodiments of the lighting device may comprise redundant optical elements in each of its configurations, i.e. optical elements that are not in use, such optical elements can be provided in a cost-effective manner and therefore do not significantly add to the cost of the lighting device.

[0012] In an embodiment, the solid state lighting arrangement comprises a plurality of solid state lighting elements distributed over N locations, wherein N is a positive integer having a value of at least 2; and the circular

cover plate comprises M*N optical elements organized in M groups of different optical elements, wherein in each of said M positions the optical elements of one of said groups are aligned with the solid state lighting elements in the N locations on said surface. The presence of a plurality of SSL elements is preferred to ensure that the lighting device produces sufficient luminous output.

[0013] The plurality of solid state lighting elements may include solid state lighting elements of different color and/or solid state lighting elements of different power. The solid state lighting elements in a first of said N locations may be different to the solid state lighting elements in a second of said N locations.

[0014] In an embodiment, the different optical elements comprise lenses having different optical characteristics such as different optical power.

[0015] In an embodiment, the different optical elements comprise diffusers having different diffusion characteristics.

[0016] In an embodiment, the different optical elements comprise different color adjustment elements.

[0017] The circular cover plate may be mounted in said circular aperture such that it can be toggled between a locked position and a released position in which the circular cover plate can be rotated in the plane of the circular aperture. For instance, the circular cover plate may be toggled between said locked position and said released position by pushing the circular cover plate towards said surface. This allows for a straightforward switching of the circular cover plate between the different optical functions of the lighting device.

[0018] In an embodiment, the housing comprises a central recess and the cover plate comprises a central protrusion spring-loaded into said central recess in order to facilitate the toggling of the cover plate between the locked and released positions.

[0019] In order to assist a user in correctly aligning the cover plate in the circular aperture, the circular aperture may comprise a plurality of guide slots around its inner perimeter and the circular cover plate may comprise a plurality of guide members for engaging with said guide slots such that the cover plate can only be put in its locked position if the guide members correctly align with the guide slots. Alternatively, the circular cover plate may comprise the plurality of guide slots and the circular aperture may comprise the plurality of guide members around its inner perimeter for engaging with said guide slots.

[0020] The lighting device may be a light bulb such as a spot light bulb. Suitable bulb sizes include but are not limited to MR11, MR16, GU10, AR111, Par38, Par30, BR30, BR40, R20, and R50 light bulbs. MR type light bulbs are particularly suitable.

[0021] According to another aspect, there is provided a luminaire comprising an embodiment of the lighting device of the present invention. Such a luminaire may for instance be a holder of the lighting device or an apparatus into which the lighting device is integrated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] Embodiments of the invention are described in more detail and by way of non-limiting examples with reference to the accompanying drawings, wherein:

Fig. 1 schematically depicts a lighting device in accordance with an embodiment of the present invention in a first configuration;

Fig. 2 schematically depicts a lighting device in accordance with an embodiment of the present invention in a second configuration;

Fig. 3 schematically depicts a method of toggling a lighting device according to an embodiment of the present invention between different configurations;

Fig. 4 schematically depicts a cross-section of a lighting device in accordance with an embodiment of the present invention;

Fig. 5 schematically depicts a magnified aspect of the lighting device of Fig. 4;

Fig. 6 schematically depicts a cross-section of an aspect of a lighting device in accordance with an embodiment of the present invention;

Fig. 7 schematically depicts a lighting device in accordance with another embodiment of the present invention in a first configuration;

Fig. 8 shows a luminous distribution plot of the lighting device of Fig. 7;

Fig. 9 schematically depicts a lighting device in accordance with another embodiment of the present invention in a second configuration;

Fig. 10 shows a luminous distribution plot of the lighting device of Fig. 9;

Fig. 11 schematically depicts an aspect of a lighting device in accordance with yet another embodiment of the present invention;

Fig. 12 schematically depicts details of a part of the lighting device of Fig. 11;

and

Fig. 13 schematically depicts a part of the lighting device of Fig. 12 in an exploded view.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0023] It should be understood that the Figures are merely schematic and are not drawn to scale. It should also be understood that the same reference numerals are used throughout the Figures to indicate the same or similar parts.

[0024] Fig. 1 schematically depicts a light exit surface of a lighting device 1 according to an embodiment of the present invention. The lighting device 1 comprises a housing 10, which may be any suitably shaped housing. The housing typically comprises at least one solid state lighting (SSL) element 12, which may for instance be mounted in the housing in any suitable manner, e.g. on a suitable carrier such as a printed circuit board and/or a heat sink. The at least one SSL element 12 may com-

prise one or more light emitting diodes (LEDs), which may be inorganic or organic semiconducting LEDs. In FIG. 1, the lighting device 1 is shown to have a single SSL element 12 by way of non-limiting example only.

[0025] The housing 10 delimits a circular aperture 15, which may be dimensioned in accordance with the size requirements of the lighting device 1. A cover plate 20 is rotatably mounted in the circular aperture 15 such that the cover plate 20 can be rotated in the plane of the circular aperture 15 as will be explained in more detail later. The rotation may be in any suitable direction, e.g. clockwise as indicated by the dashed arrow or counter-clockwise. In the context of the present application, rotation in the plane of the circular aperture 15 means that the distance between the cover plate 20 and the at least one SSL element 12 does not change during the rotation. In other words, the position of the cover plate 20 relative to the circular aperture 15 does not change during the rotation.

[0026] In an embodiment, the cover plate 20 comprises a plurality of different optical elements, i.e. elements having different optical characteristics. Generally, for a lighting device 1 comprising N SSL elements 12, wherein N is an integer having a value of at least 1, the cover plate 20 comprises M groups of different optical elements, wherein M is an integer and is a multiple of N. Each of said M groups comprises N optical elements that may be identical to each other. In other words, the lighting device 1 has M configurations, wherein in each of said M configurations one of the M groups of N optical elements is aligned with the N SSL elements, wherein the lighting device 1 may be switched between different configurations by replacing one of the M groups of N optical elements with another of the M groups of N optical elements, thereby changing the optical manipulation of the luminous output of the lighting device 1, e.g. from a narrow beam angle to a wide beam angle or vice versa.

[0027] In Fig. 1, $M = 3$ and $N = 1$ by way of non-limiting example. In other words, the cover plate 20 of the lighting device 1 comprises a first lens 22, a second lens 24 and a third lens 26 distributed in a radial pattern along the perimeter of the cover plate 20. The radius of the pattern typically matches the distance of the SSL element 12 to the central axis of the lighting device 1 such that each of the first lens 22, second lens 24 and third lens 26 can be aligned with, i.e. positioned over, the SSL element 12 in the different configurations of the lighting device 1. The first lens 22, the second lens 24 and the third lens 26 typically have different optical characteristics, e.g. different optical powers such that the luminous output distribution produced by the lighting device 1 can be altered when changing the configuration of the cover plate 20. For instance, whereas in Fig. 1 the first lens 22 is aligned with the SSL element 12, the cover plate 20 may be rotated clockwise as indicated by the dashed arrow to align the third lens 26 with the SSL element 12, as is shown in Fig. 2. A further rotation may align the second lens 24 with the SSL element 12 (not shown).

[0028] The different lenses of the cover plate 20 may be the same type of lenses, e.g. Fresnel lenses, having different designs to achieve the different optical characteristics or may be different lens types, e.g. a Fresnel lens, a dome lens and so on. The optical elements may form part of the cover plate 20 in any suitable manner. For instance, the cover plate 20 may comprise a plurality of apertures into which the optical elements are fitted. Alternatively, areas of the cover plate 20 may be modified, e.g. etched, to form the optical elements. In yet another embodiment, the cover plate 20 may carry the optical elements, e.g. the optical elements are mounted on the cover plate 20. Other feasible implementations will be apparent to the skilled person.

[0029] Fig. 3 schematically depicts a non-limiting example of a suitable mechanism for switching the lighting device 1 between different configurations. In this embodiment, the cover plate 20 is spring-loaded into the circular recess 15 of the housing 10 and can be toggled between a working position in which the cover plate 20 is locked into place in the circular recess 15 and an adjustment position in which the cover plate 20 is released from the circular recess 15. In other words, the cover plate 20 is mounted in the circular recess 15 by means of a self-locking push button mechanism.

[0030] The working position of the cover plate 20 is shown in (a). In order to release the cover plate 20 from its working position in the circular recess 15, the cover plate 20 may comprise a central cap 25 acting as the push button. The central cap may be pressed down to press the cover plate 20 into the circular recess 15 as shown by the arrow in step (b). The pressure on the central cap 25 is subsequently released, which leads to the cover plate 20 popping out of the circular recess 15 as indicated by the upward arrow in step (c). This brings the cover plate 20 in the released position in which the cover plate 20 can be (freely) rotated in the plane of the circular recess 15.

[0031] The cover plate 20 is subsequently rotated in the plane of the circular recess 15 as shown in step (d), in which for instance the alignment of the first lenses 22 with the SSL elements of the lighting device 1 may be reconfigured to yield a configuration in which the second lenses 24 are aligned with the SSL elements of the lighting device 1. The cover plate may comprise one or more alignment aids, e.g. markers 28, that indicate the level of rotation required for the cover plate 20 to ensure that the desired optical elements are appropriately aligned with the SSL elements of the lighting device 1. Such markers 28 may have any suitable shape or form, e.g. may take the shape of an arrow or triangle pointing at a guide member or guide slot of the cover plate 20. The circular recess 15 may for instance comprise a guide slot 115 for receiving the guide member of the cover plate 20 or may instead comprise a guide member 115 for engaging with a guide slot on the cover plate 20. Generally speaking, the circular recess 15 may comprise a first guide element and the cover plate 20 may comprise a

second guide element, wherein the first guide element and the second guide element are designed to engage with each other to ensure that the selected set of optical elements is appropriately aligned with the underlying SSL elements.

[0032] Upon appropriately positioning the desired optical elements over the SSL elements of the lighting device, the central cap 25 may be pressed down again into the circular recess 15 to toggle the cover plate 20 from its released position into its secured or operating position. This is shown by the downward arrow in step (e). The aforementioned guide elements if present may be forced into their engaging position in this step, e.g. by inserting a guide member into a matching guide slot and improper alignment of the guide elements may prevent the cover plate 20 from being inserted into the circular recess 15, thereby prevent incorrect alignment of the selected optical elements with the SSL elements of the lighting device 1. By releasing the pressure on the central cap 25, the cover plate 20 will ease into its operating position as shown by the upward arrow in step (f).

[0033] Fig. 4 schematically shows a cross-section of the lighting device 1 as shown in Fig. 3, and Fig. 5 shows a magnified aspect of this cross-section. The housing 10 comprises a self-locking pushing mechanism, comprising the end cap 25 engaging with a self-locking push button mechanism 125. Such self-locking push button mechanisms are known per se and will therefore not be explained in further detail for the sake of brevity only. The lighting device 1 may further comprise a carrier 112 such as a PCB or the like onto which one or more SSL elements 12 are mounted in any suitable manner. As can be seen in FIG. 4 and 5, the first optical elements 22 in the cover plate 20, e.g. first lenses, are positioned over the SSL elements 12 inside the circular recess 15.

[0034] Fig. 5 further shows an embodiment of the aforementioned first and second guide elements. In this embodiment, the inner wall of the housing 10 delimiting the circular recess 15 comprises a trench acting as a guide slot 115 for receiving a protrusion on the outer perimeter of the cover plate 20 acting as a guide member 120. The guide member 120 fits into the guide slot 115 and ensures that the first optical elements 22 are appropriately aligned with the underlying SSL elements 12. Although not specifically shown, it should be understood that the inner wall of the housing 10 may comprise a plurality of such guide slots 115 and/or the cover plate may comprise a plurality of such guide members 120 to ensure that for each optical element configuration an appropriate alignment with the SSL elements 12 is achieved. It is of course equally feasible if the inner wall of the housing 10 comprises the guide members and the outer perimeter of the cover plate 20 comprises the guide slots, and it should be understood that other suitably shaped guide elements may also be used.

[0035] Fig. 6 and 7 schematically depict an alternative embodiment of the lighting device 1 in which the SSL elements 12 are each mounted on a lens 14 such as a

Fresnel lens. The lenses 14 may be individual lenses or may form part of a lens plate 11 as shown in Fig. 6. The use of a lens plate 11 facilitates the manufacture of the lighting device 1 as only a single element has to be fitted into the housing 10 of the lighting device 1. The cover plate 20 in this embodiment comprises groups of different diffusers. In Fig. 7, two groups of diffusers are shown by way of non-limiting example; a first group comprising first diffusers 32 and a second group comprising second diffusers 34. It will be understood that any suitable number of groups of different optical elements, i.e. different diffusers, may be present in the cover plate 20 as previously explained.

[0036] The cover plate 20 may be manufactured in any suitable manner. For instance, a transparent cover plate 20 may be provided, e.g. made of a suitable transparent polymer such as poly(methyl methacrylate) (PMMA), polycarbonate (PC) or polyethylene terephthalate (PET), wherein selected regions of the cover plate 20 are etched or sandblasted to form the desired diffusers. Alternatively, the cover plate 20 may be manufactured using double injection molding techniques. Other manufacturing techniques will be apparent to the skilled person. In an embodiment, the first optical element 32 may be a transparent portion of the cover plate 20 such that the luminous output of a SSL element 12 aligned with this optical element is only manipulated by the lens 14 over the SSL element 12.

[0037] Different diffusers may for instance be used to achieve different beam angle characteristics of the lighting device 1. For example, in Fig. 7 a configuration of the lighting device 1 is shown in which the SSL elements 12 are aligned with the first diffusers 32 in the cover plate 20. This produces a narrow beam angle of approximately 15° as shown in the light distribution plot in Fig. 8. By reconfiguring the lighting device 1 such that the second diffusers 34 are aligned with the SSL elements 12, for instance using the reconfiguration mechanism as disclosed in detail in Fig. 3 and its detailed description, a different beam angle may be generated. Fig. 9 schematically depicts the configuration of the lighting device 1 in which the second diffusers 34 are aligned with the SSL elements 12 and Fig. 10 shows the light distribution plot that is generated using the configuration in Fig. 9. As can be seen in Fig. 10, a wider beam angle of approximately 30° is generated in the second configuration of the lighting device 1.

[0038] Fig. 11 shows yet another embodiment of a lighting device 1. Whereas in the lighting devices of e.g. Fig. 1 and Fig. 7 the different optical elements were defined as circular apertures in the cover plate 20, in the embodiment of Fig. 11 the first optical elements 22 are defined as such apertures and the second optical elements 24 are located in between these apertures. This has the advantage that a higher density of optical elements can be obtained on the cover plate 20, such that a higher density of SSL elements 12 may be used, thus producing a lighting device 1 that is capable of producing

a particularly high luminous flux. The cover plate 20 may be mounted in the circular aperture 15 delimited by the housing 10 as previously explained with the aid of Fig. 1-5.

[0039] Fig. 12 depicts a cross-section of an aspect of the lighting device 1 along the lines A-A shown in Fig. 11. In this embodiment, the first optical element 22 is a total internal reflection collimator and the second optical element 24 is a donut-shaped lens. Such optical elements for instance may be used to reconfigure the lighting device 1, e.g. change its beam angle, from a PAR-type lighting device in which the total internal reflection collimators, e.g. Fresnel lenses, are in use, to a BR-type lighting device in which the donut-shaped lenses are in use. It is noted that a TIR collimator and donut-shaped lens are shown as different optical elements by way of non-limiting example only. The skilled person may choose any suitable type of optical element, e.g. lens or collimator, in order to match one of the configuration modes of the lighting device 1 to a particular application domain.

[0040] Fig. 13 schematically depicts an embodiment of the cover plate 20 of the lighting device 1 of Fig. 11 in an exploded view. The cover plate 20 is assembled from a lens holder 220 onto which an annulus 222, e.g. an integrated lens package, comprising the first optical elements 22 and the second optical elements 24, e.g. TIR collimators and donut lenses respectively, is placed. A top plate comprising a first outer ring 224 and a second inner ring 224' engages with the lens holder 220 to form a housing in which the annulus 222 can rotate. This housing prevents longitudinal movement of the annulus 222 (movement in the direction perpendicular to the plane of the rings). Instead of two separate rings, the top plate may also comprise a single ring engaging with the lens holder 220 to prevent such longitudinal displacement of the annulus 222. The various components of the cover plate 20 may be made of any suitable material, e.g. transparent polymers such as PMMA, PC or PET.

[0041] At this point, it is noted that the optical elements in the cover plate 20 are not limited to beam shaping elements. It is for instance equally feasible that the different optical elements are different color filters such that the lighting device 1 can produce different colors in its different configurations of the cover plate 20. Alternatively, the different optical elements may be different wavelength converting materials to alter the color produced by the SSL elements 12. A non-limiting example of such different wavelength converting materials is different phosphors.

[0042] In at least some embodiments, the cover plate 20 may comprise a combination of beam shaping elements, e.g. lenses and/or collimators and color-manipulating elements such as color filters such that in certain configurations the SSL elements 12 are aligned with a group of beam shaping elements whereas in certain other configurations the SSL elements 12 are aligned with color-manipulating elements.

[0043] In at least some embodiments, the SSL elements 12 of the lighting device 1 may be identical. In some other embodiments, the SSL elements 12 may be different, e.g. SSL elements producing different colors.

[0044] In some embodiments, the cover plate 20 may comprise M groups of N optical elements for a lighting device comprising N SSL elements 12 as previously explained. In other words, in these embodiments the lighting device comprises more optical elements than SSL elements such that in each configuration of the lighting device some of the optical elements are not in use (i.e. are redundant).

[0045] However, in some other embodiments the number of optical elements may match the number of SSL elements. This is for instance particularly interesting when the lighting device 1 comprises different SSL elements 12, e.g. SSL elements 12 producing different colors, such that the lighting device 1 may have M different groups of N optical elements and M different groups of N SSL elements 12. For instance, by aligning different optical elements with different color SSL elements, the color output of the lighting device 1 may be tuned.

[0046] For example, a lighting device 1 may comprise a first group of yellow light SSL elements 12 and a second group of blue light SSL elements 12, and two groups of optical elements for producing a narrow and wide beam angle respectively. In a first configuration, the yellow SSL elements 12 may be aligned with the narrow beam angle generating optical elements and the blue SSL elements 12 may be aligned with the wide beam angle generating optical elements, whereas in a second configuration, the blue SSL elements 12 may be aligned with the narrow beam angle generating optical elements and the yellow SSL elements 12 may be aligned with the wide beam angle generating optical elements in order to change the color characteristics of the lighting device 1.

[0047] In at least some of the aforementioned embodiments, the SSL elements 12 of the lighting device may have different powers, i.e. produce different luminous intensities such that the lighting device 1 may have M different groups of N optical elements and M groups of N SSL elements 12 of different power. For instance, by aligning different optical elements with different power SSL elements, the luminous distribution of the lighting device 1 may be tuned.

[0048] For example, a lighting device 1 may comprise a first group of lower power SSL elements 12 and a second group of higher power SSL elements 12, and two groups of optical elements for producing a narrow and wide beam angle respectively. In a first configuration, the lower power SSL elements 12 may be aligned with the narrow beam angle generating optical elements and the higher power SSL elements 12 may be aligned with the wide beam angle generating optical elements to produce a light distribution with higher intensity at wider beam angles. In a second configuration, the higher power SSL elements 12 may be aligned with the narrow beam angle generating optical elements and the lower power SSL

elements 12 may be aligned with the wide beam angle generating optical elements in order to produce a light distribution in which the higher light intensity is focused in the center of the luminous output of the lighting device 1.

[0049] In some embodiments, the lighting device 1 is a light bulb such as a spot light bulb. The light bulb may have any suitable size, e.g. MR11, MR16, GU10, AR111, Par38, Par30, BR30, BR40, R20, and R50 light bulbs and any other suitable size.

[0050] The lighting device 1 according to embodiments of the present invention may be advantageously included in a luminaire such as a holder of the lighting device, e.g. a ceiling light fitting, or an apparatus into which the lighting device is integrated, e.g. a cooker hood or the like to produce a configurable luminaire.

[0051] It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. The word "comprising" does not exclude the presence of elements or steps other than those listed in a claim. The word "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. The invention can be implemented by means of hardware comprising several distinct elements. In the device claim enumerating several means, several of these means can be embodied by one and the same item of hardware. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

Claims

1. A lighting device (1) comprising:

- a housing (10) comprising a circular aperture (15);
- a solid state lighting arrangement comprising at least one solid state lighting element (12) mounted in said housing and arranged to emit light towards said circular aperture; and
- a circular cover plate (20) mounted in said circular aperture, said circular cover plate facing said arrangement and comprising M different optical elements (22, 24, 26, 32, 34), wherein M is a positive integer having a value of at least 2, wherein the cover plate is fitted such that it can be rotated in the plane of said aperture between M positions, wherein in each of said M positions a different one of said optical elements is aligned with the at least one solid state lighting element.

2. The lighting device (1) of claim 1, wherein:

- the solid state lighting arrangement comprises a plurality of solid state lighting elements (12) distributed over N locations, wherein N is a positive integer having a value of at least 2; and
- the circular cover plate (20) comprises M*N optical elements (22, 24, 26, 32, 34) organized in M groups of different optical elements, wherein in each of said M positions the optical elements of one of said groups are aligned with the solid state lighting elements in the N locations on said surface.

3. The lighting device (1) of claim 2, wherein the plurality of solid state lighting elements (12) include solid state lighting elements of different color.

4. The lighting device (1) of claim 2 or 3, wherein the plurality of solid state lighting elements (12) include solid state lighting elements of different power.

5. The lighting device (1) of any of claims 2-4, wherein the solid state lighting elements (12) in a first of said N locations are different to the solid state lighting elements in a second of said N locations.

6. The lighting device (1) of any of claims 1-5, wherein the different optical elements (22, 24, 26) comprise lenses having different optical characteristics.

7. The lighting device (1) of any of claims 1-6, wherein the different optical elements (32, 34) comprise diffusers having different diffusion characteristics.

8. The lighting device (1) of any of claims 1-7, wherein the different optical elements comprise different color adjustment elements.

9. The lighting device (1) of any of claims 1-8, wherein the circular cover plate (20) is mounted in said circular aperture (15) such that it can be toggled between a locked position and a released position.

10. The lighting device (1) of claim 9, wherein the circular cover plate can be toggled between said locked position and said released position by pushing the circular cover plate towards said surface.

11. The lighting device (1) of any of claims 1-10, wherein the housing (10) comprises a central recess and the cover plate (20) comprises a central protrusion spring-loaded into said central recess.

12. The lighting device (1) of any of claims 9-11, wherein the circular aperture (15) comprises a plurality of guide slots (115) around its inner perimeter and the circular cover plate comprises a plurality of guide members (120) for engaging with said guide slots.

13. The lighting device (1) of any of claims 9-11, wherein the circular cover plate comprises a plurality of guide slots and the circular aperture (15) comprises a plurality of guide members around its inner perimeter for engaging with said guide slots. 5
14. The lighting device (1) of any of claims 1-13, wherein the lighting device is a light bulb.
15. A luminaire comprising the lighting device (1) of any of claims 1-14. 10

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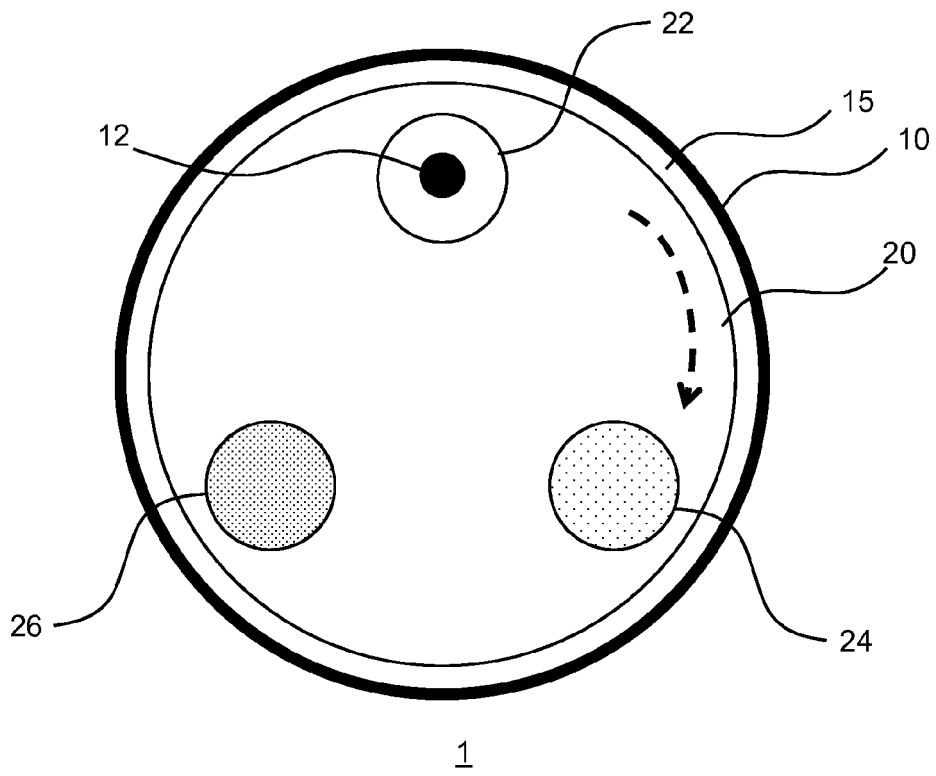


FIG. 1

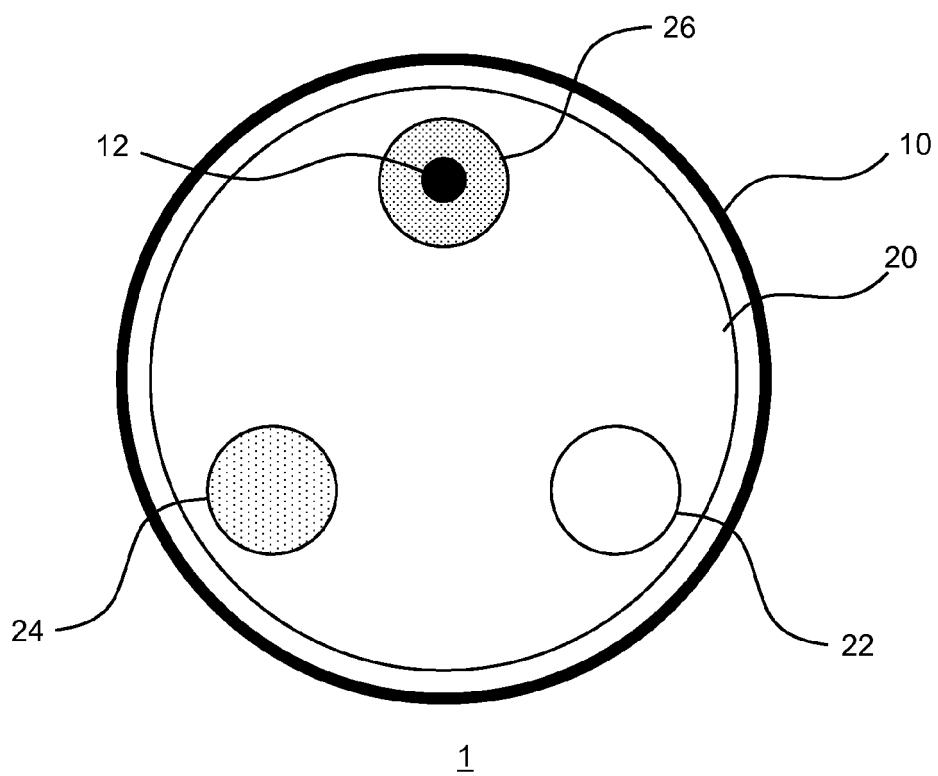


FIG. 2

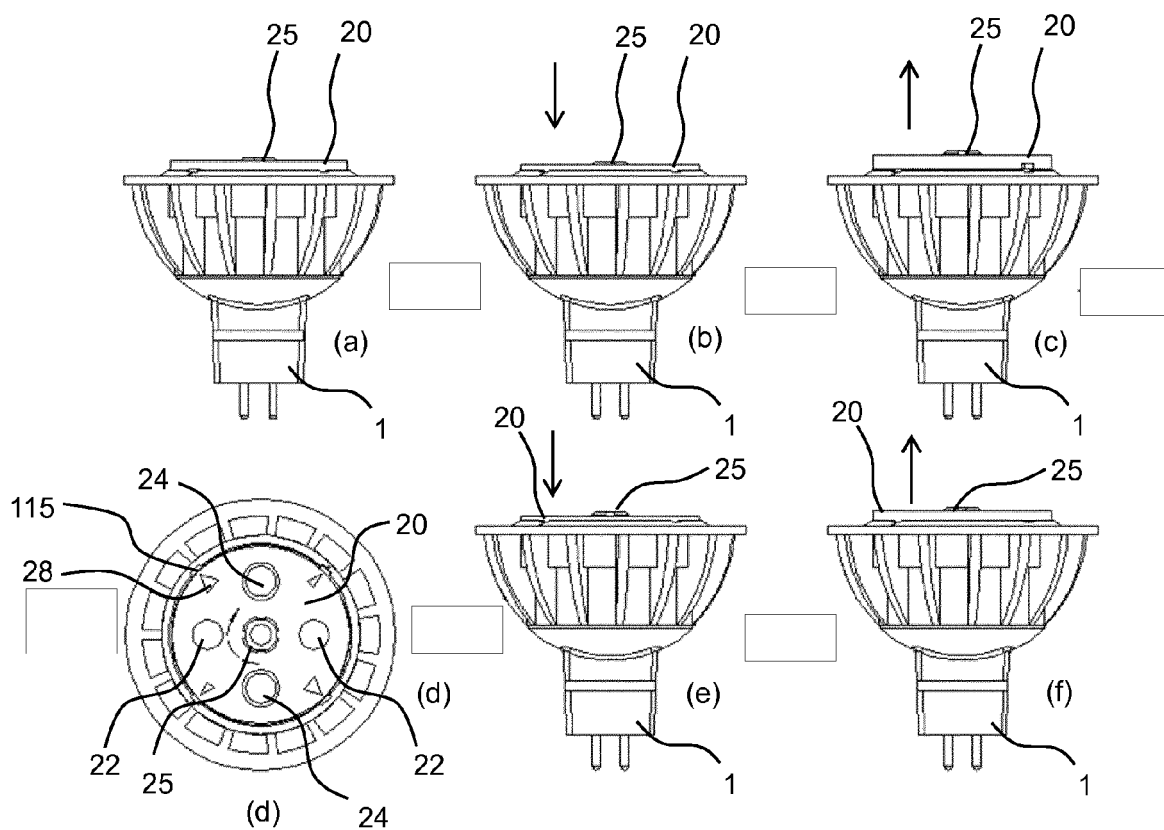


FIG. 3

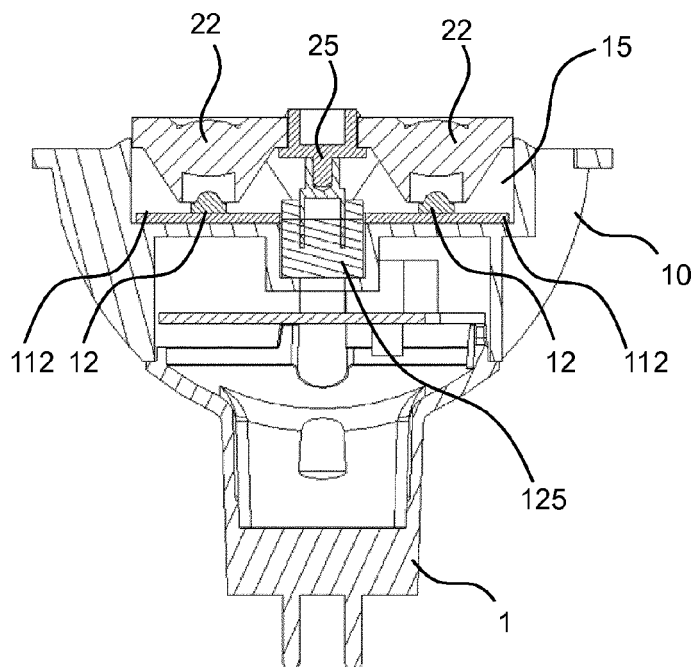


FIG. 4

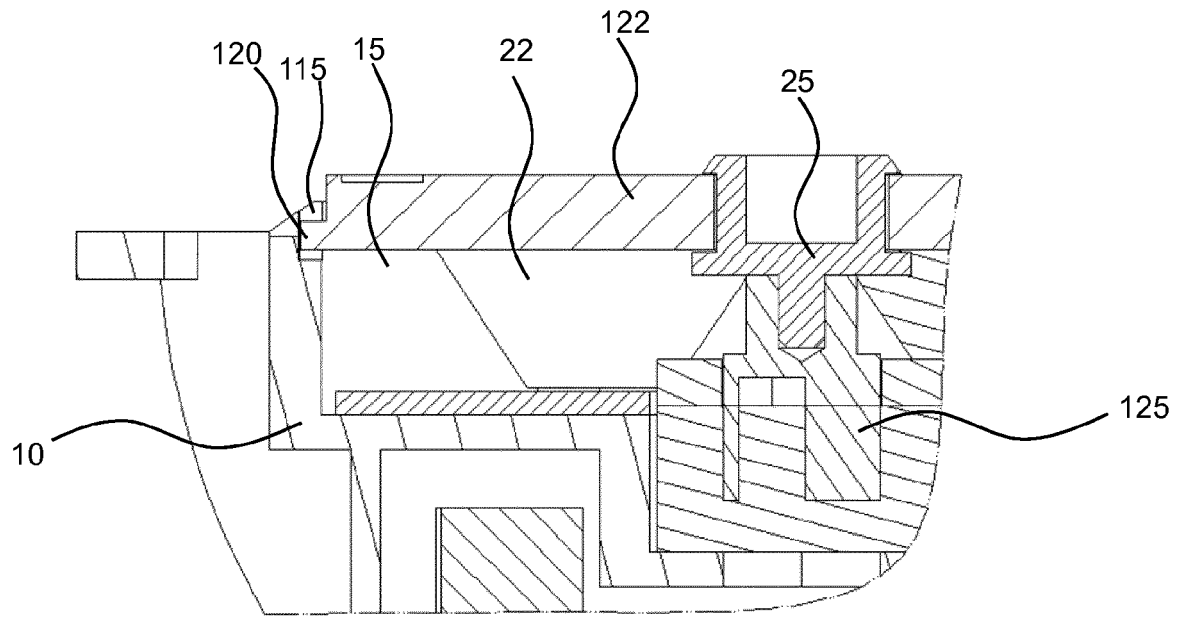


FIG. 5

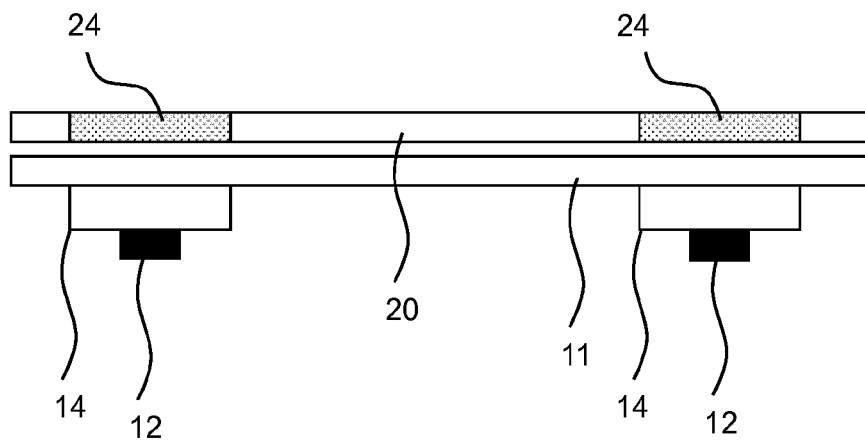


FIG. 6

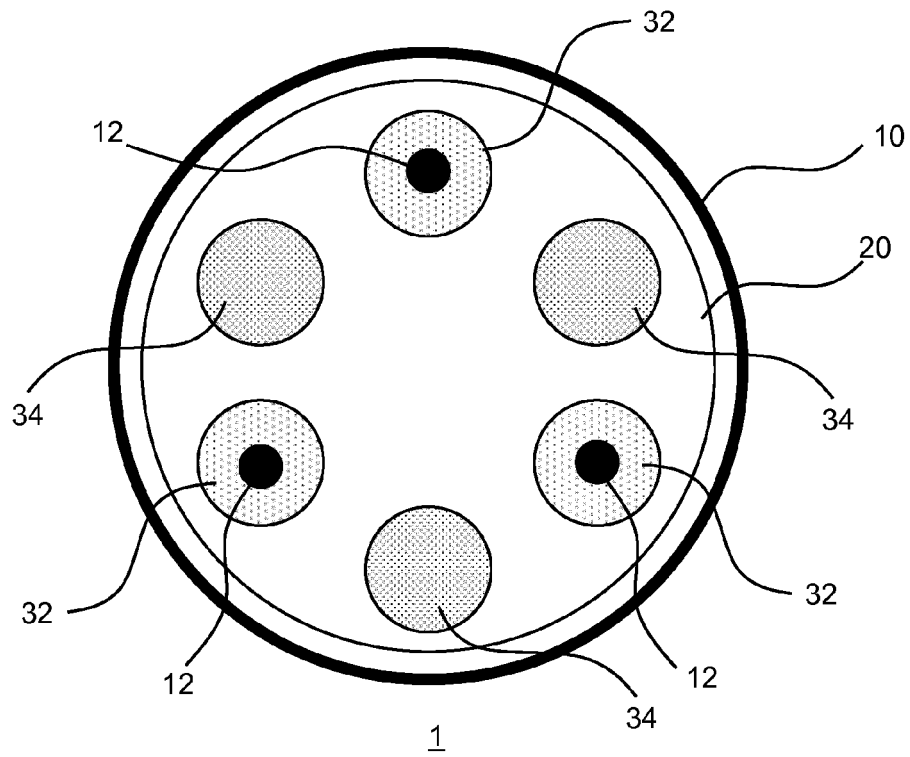


FIG. 7

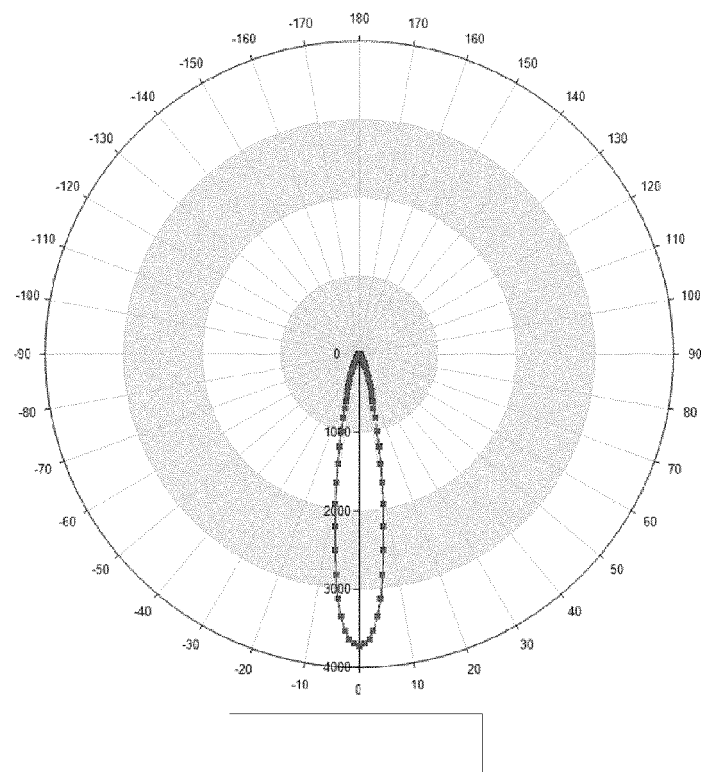


FIG. 8

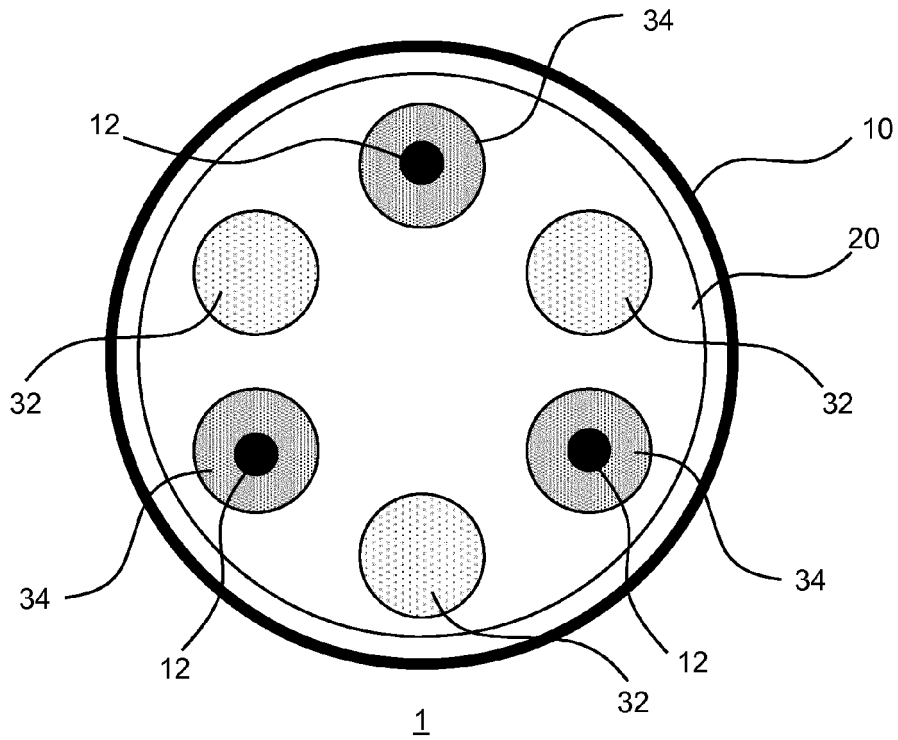


FIG. 9

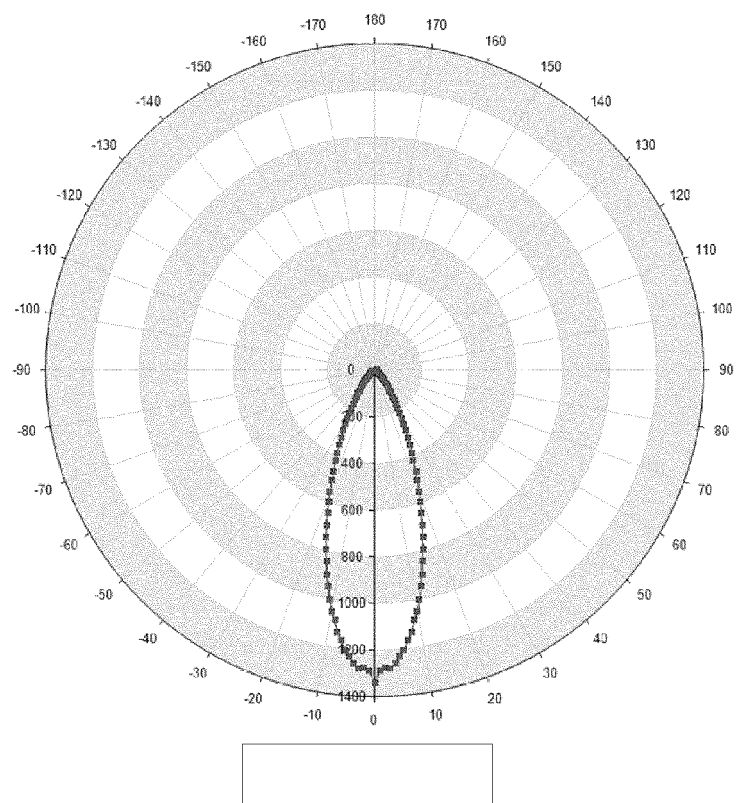


FIG. 10

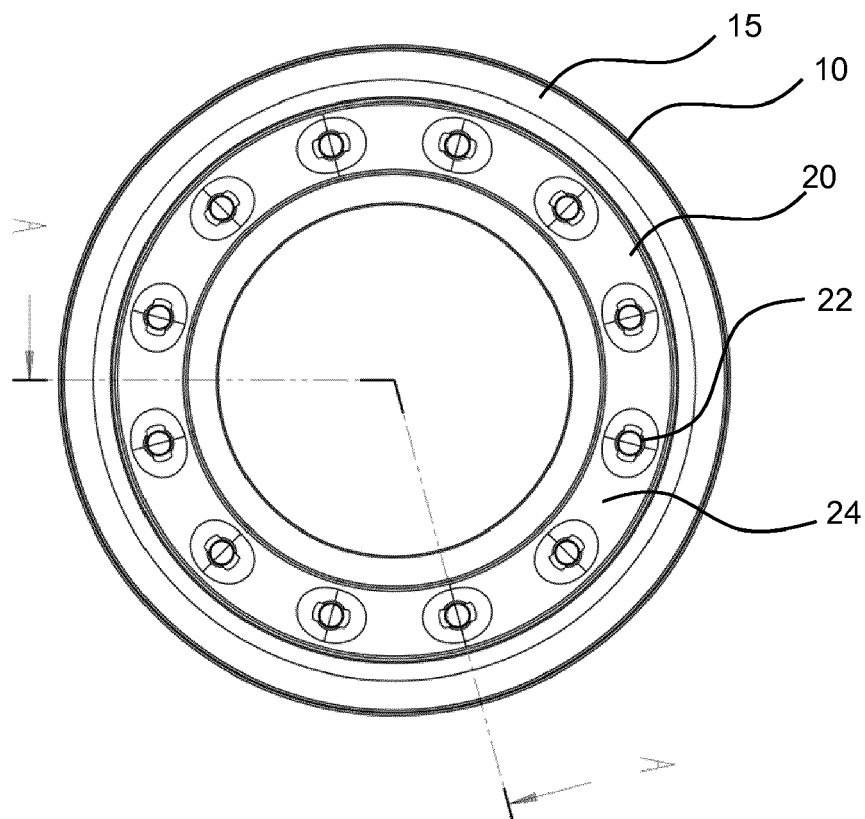


FIG. 11

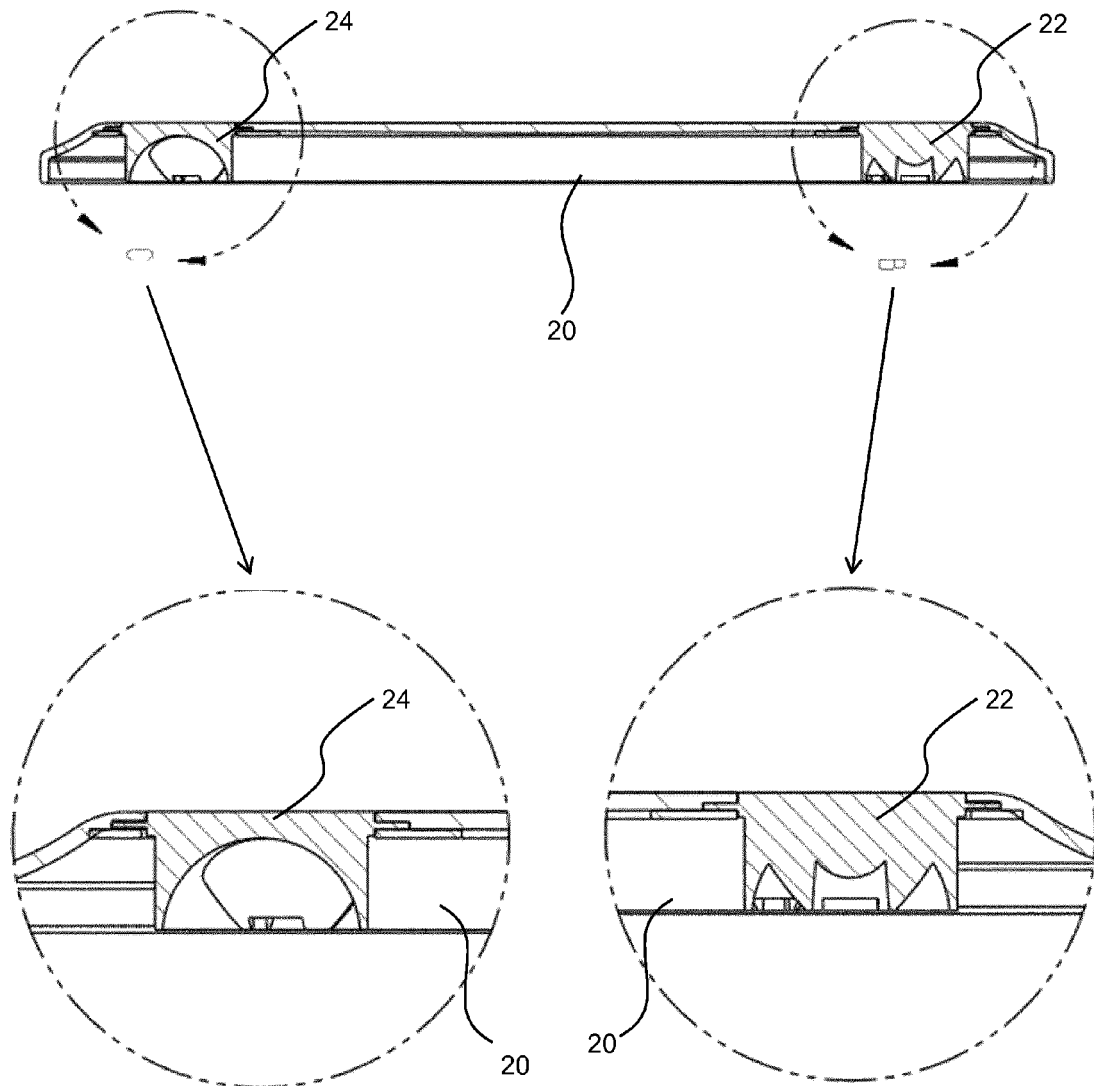


FIG. 12

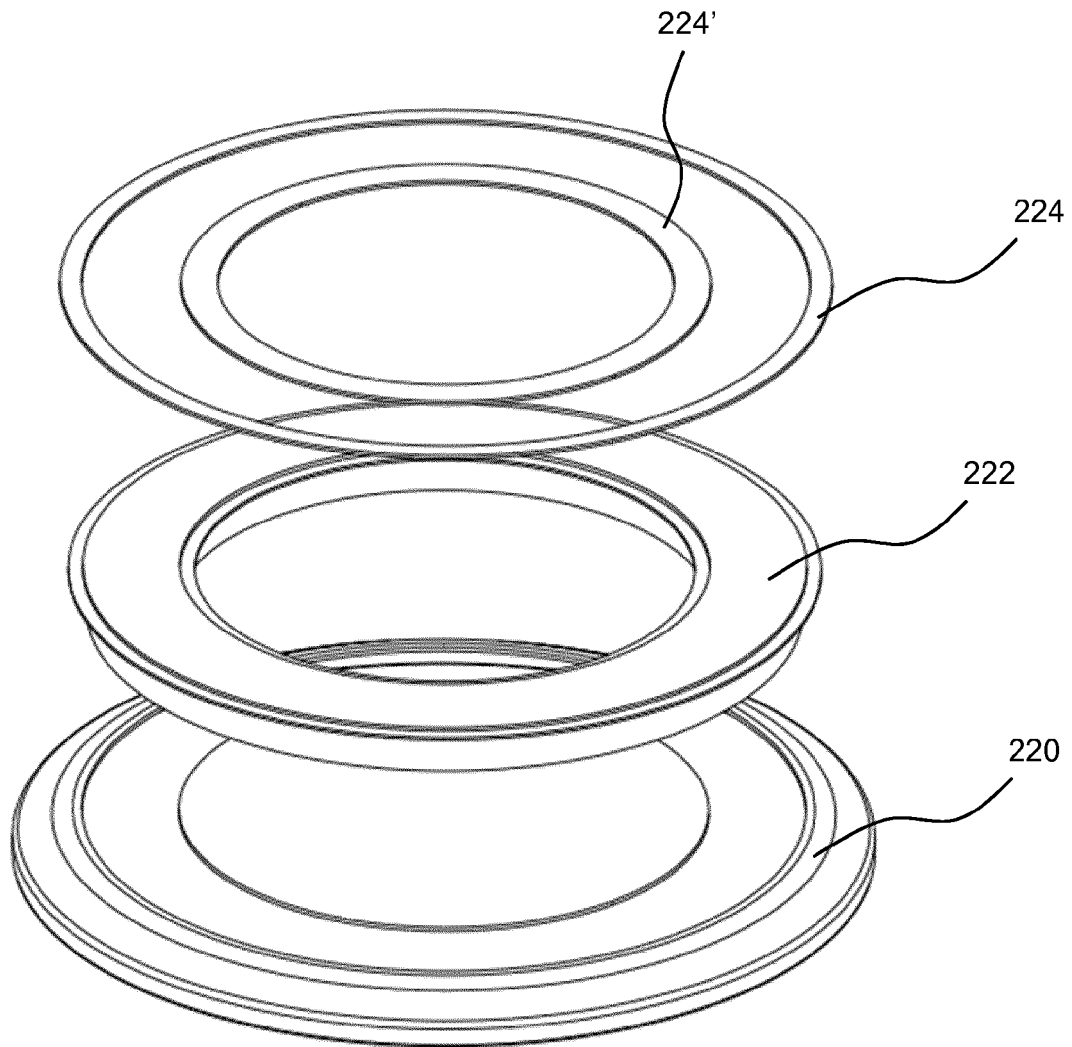


FIG. 13



EUROPEAN SEARCH REPORT

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Place of search The Hague		Date of completion of the search 28 February 2014	Examiner Sacepe, Nicolas
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