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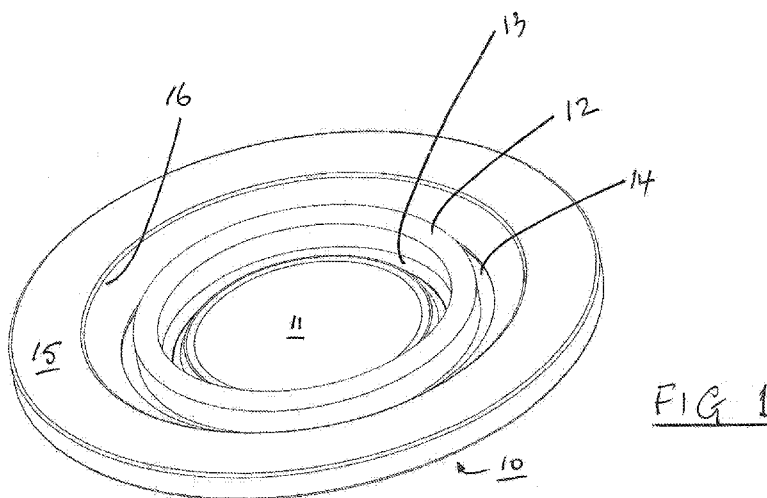
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(54) Title: IP RATED LUMINAIRES



(57) Abstract: The present invention describes an IP rated lens (10) for a luminaire, said luminaire including a light source adapted to emit light from the front of the luminaire, said lens comprising: (i) a first region (11) through which light from the light source is emitted; (ii) a second region (12, 13, 14) which is resiliently deformable, thus allowing the light source in the luminaire to move with respect to the plane of the front of the luminaire, whilst retaining IP protection when the light source is out of the normal plane. The first (11) and second regions (12, 13, 14) may be made of the same or different materials. In a preferred embodiment the first region comprises an optical lens (10) capable of focussing light from a light source. In this embodiment the IP rated lens may replace the conventional lens used to focus light from an LED module.

IP RATED LUMINAIRES

Field of the Invention

- 5 The present invention relates to IP (Ingress Protection) rated light fittings and luminaires. It is particularly applicable, but in no way limited, to light fittings with a lens across the front of the fitting, such as downlights.

Background to the Invention

- 10 When light fittings or luminaires are used in harsh conditions, such as near water in a bathroom or shower room, then a fitting with the appropriate Ingress Protection Marking or IP Code must be fitted in order to comply with local regulations. IP Codes or International Protection Marking is set out in IEC Standard 60529, as published by the International Electrotechnical Commission (IEC). By way of
15 example, a downlight for use in a shower room might require a rating of IP 65. An illustration, by way of example only, of some rating figures for IP Rated Enclosures using this current system are shown in the listings below:-

First Digit (intrusion protection)

- 20 0. No special protection.
1. Protection from a large part of the body such as a hand (but no protection from deliberate access); from solid objects greater than 50mm in diameter.
 2. Protection against fingers or other object not greater than 80mm in length and 12mm in diameter.
 - 25 3. Protection from entry by tools, wires etc, with a diameter of 2.5 mm or more.
 4. Protection against solid bodies larger than 1mm (e.g. fine tools/small etc).
 5. Protected against dust that may harm equipment.
 6. Totally dust tight.

30 Second Digit (moisture protection)

0. No protection.
1. Protection against condensation.
 2. Protection against water droplets deflected up to 15° from vertical.
 3. Protected against spray up to 60° from vertical.
 - 35 4. Protected against water spray from all directions.
 5. Protection against low pressure water jets (all directions).
 6. Protection against strong water jets.

7. Protected against temporary immersion.
8. Protected against prolonged effects of immersion under pressure.

5 *A number replaced by x indicates that the enclosure is not rated for that specification.*

10 In order to achieve IP 65 rating a waterproof or water resistant barrier must be created around that part of the luminaire which might be exposed to water. It is relatively straightforward to make a fixed downlight IP rated, for example by forming a watertight seal between the lens and the bezel, or by incorporating a waterproof cover over the downlight either over or beneath the bezel, thus creating an effective waterproof seal. However, in the case of an adjustable downlight, where the lamp and/or lens is pivotally mounted so as to move out of the plane of the front of the downlight in order to direct the light at an angle, a good IP rating is more difficult to
15 achieve.

20 Furthermore, creating the required IP rating generally involves the use of an additional component, in addition to the conventional light focussing lens which is used to focus the light from the light source. This inevitably entails additional cost as well as an additional step in the manufacturing process.

It is therefore an objective of the present invention to overcome, or at least mitigate, some or all of the problems described above.

25 Summary of the Invention

According to a first aspect of the present invention there is provided an IP rated lens according to Claim 1. Thus there is provided an IP rated lens for a luminaire, said luminaire including a light source adapted to emit light from the front of the luminaire, said lens comprising:-

- 30 (i) a first region through which light from the light source is emitted;
- (ii) a second region which is resiliently deformable, thus allowing the light source in the luminaire to move with respect to the plane of the front of the luminaire, whilst retaining IP protection when the light source is out of the normal plane.

35 This new type of lens may be sealed to or incorporated into a wide range of luminaires, especially downlights. In this context the term 'lens' has a very broad

meaning and refers to any light transmissive optical device. Therefore the term 'lens' includes, but is not limited to, a substantially planar light transmissive plane or sheet of material where the opposing sides of the plane are substantially parallel to each other, as well as optical lenses that affect the focus of a light beam through
5 refraction. The planar light transmissive sheet serves to allow the light emitted from the light source and associated lens in the luminaire to pass through the IP rated lens without significant deviation.

10 Preferably the second region is integral with the first region. By forming the two regions as one, the whole lens is naturally watertight. The second region preferably substantially surrounds the first region and thus takes the form of a flexible flange around a light focussing or light transmitting central lens region.

15 Preferably the first region and the second region are formed from the same material.

In the alternative preferred embodiment the first region and the second region are formed from different materials. This enables the light emitting region to be formed from highly light transparent material whereas the second region may be formed from a material that is less transparent to visible light but is still highly flexible, if that
20 is advantageous.

In one preferred arrangement the first region and the second region are bonded together. Typically the two regions are formed from plastics materials, as selected by the materials specialist, and there are a wide number of known ways of bonding
25 plastics together.

In a further preferred arrangement the first region and second region are formed by an injection moulding process and preferably by a multi-shot injection moulding process.

30 Preferably the second region includes an engagement means adapted to enable the lens to attach to the front of the luminaire in order to achieve the required IP rating. This engagement means can take a wide variety of forms, such as an elastically deformable channel that fits over part of the luminaire

35

Preferably the first portion comprises an optical lens, being a lens capable of focussing light, and preferably the optical lens is adapted to focus light from the light source into a light cone having an angle between 15 degrees and 60 degrees about a central axis of the luminaire.

5

Preferably the optical lens comprises a substantially conical body formed from a transparent or translucent material, said conical body having a first, narrow end and a second wider end and an outer surface designed to substantially totally reflect light towards the second end of the cone, said conical body having a primary axis
10 extending from the first end to the second end, wherein the outer surface of the conical body comprises a plurality of reflecting facets or reflecting surfaces.

In a particularly preferred embodiment the second region comprises one or more corrugations. These corrugations act like flexible bellows, allowing for the angular
15 adjustment in an adjustable luminaire.

Preferably the IP rated lens is adapted to comprise a primary lens in the luminaire.

Preferably the perimeter of the IP rated lens is adapted to be covered by a bezel,
20 and optionally held in place by the bezel. This arrangement is particularly applicable to downlights.

Preferably a seal is provided between the luminaire and the IP rated lens.

25 In summary, an IP rated lens or lens cover according to the present invention comprises a first region adapted to transmit light from a light source in a luminaire and a second flexible, resiliently deformable region that is adapted to flex sufficiently to accommodate the movement of an adjustable light source whilst retaining the desired IP rating, such as the movement of an adjustable downlight. The first and
30 second regions may be made of the same or different materials. In a preferred embodiment the first region comprises an optical lens capable of focussing light from a light source. In this embodiment the IP rated lens may replace the conventional lens used to focus light from an LED module.

35 The invention extends to include a luminaire incorporating an IP rated lens according to the present invention, especially downlights.

Brief Description of the Drawings

- Preferred embodiments of the present invention will now be described by way of example only, with reference to the accompanying drawings wherein :
- Figure 1 shows a perspective view of an IP rated lens from below, being the side that engages with the luminaire;
- Figure 2 shows a perspective cross section through the lens of Figure 1;
- Figure 3 shows a perspective view from below of the lens in Figures 1 & 2;
- Figure 4 shows how a portion of an IP rated lens according to the present invention can flex out of the general plane of the lens to accommodate an adjustable luminaire such as a downlight;
- Figure 5 shows how an IP rated lens as shown in Figure 1 would engage with the front of a downlight;
- Figures 6 and 7 show perspective and perspective cross section views respectively of an IP rated lens where the centre of the lens comprises an optical lens capable of focussing light from an LED module;
- Figure 8 shows how an IP rated lens as shown in Figures 6 & 7 can flex out of the general plane of the lens to accommodate an adjustable luminaire such as a downlight;
- Figure 9 shows an IP rated lens as shown in Figure 6 on the front of a downlight;
- Figure 10 shows in exploded format a downlight, an IP rated lens and a front bezel.

Description of the Preferred Embodiments

- Figures 1 to 4 show various views of an IP rated lens or lens cover designed to attach to the front of a downlight. Referring to Figures 1 and 2, these show a lens having a central region or first region 11 which in this example is substantially planar and is substantially optically transparent to visible light. This lens does not necessarily have the ability to focus light. Light from a light source in a luminaire, which is typically an LED light source, is emitted through this central region 11. The perimeter of the lens 15, which in this example is substantially circular, includes a compartment or pocket 16 into which the front flange of a luminaire/downlight can fit. This compartment or continuous channel 16 is shown more clearly in Figure 2.
- Around the central lens region 11 is a corrugated or second region 12, 13, 14 which is formed from a flexible, resiliently deformable material. This corrugated or pleated

region acts like bellows to allow articulation of the central lens region such that the light source in the luminaire behind the lens can be directed at an angle to the general plane of the front of the luminaire. An example of this type of luminaire is an adjustable downlight. It is preferred that this pleated or corrugated region 12, 13, 14 and the perimeter region 15 are formed from the same flexible, resiliently deformable material, and more preferably are formed as one component.

The corrugated region, when viewed as a perspective cross section through the lens as shown in Figure 2, takes the form of a depression, groove or channel 13 attached to a ridge 12, which in turn is attached to a second depression, groove or channel 14. This region is preferably formed from a thin, flexible, resiliently deformable material such as a thermoplastic elastomer (TPE). There are many types of TPE and other suitable plastics materials available, and the most appropriate type for this application will be selected by the materials specialist, including materials not available at the time of drafting but that become available in the future. These materials include silicone polymers, which are particularly suitable for this application, flexible polystyrene, flexible PCC, flexible PMMA and other flexible acrylic plastic materials. These plastic materials are included by way of example only, and serve to illustrate the very wide choice of materials already available to the materials expert.

It will be appreciated that because of the flexibility of the corrugated region, the central lens portion or region can be tilted in any desired direction as necessary. It will also be appreciated that while this example shows a substantially circular IP rated lens or lens cover, this lens cover could be any desired shape such as square, rectangular, hexagonal or polygonal, and the same principles of construction would apply. The second region substantially surrounds the first region, allowing movement out of the plane in any desired direction.

Figure 5 shows how such an IP rated lens 10 can be placed over the front of a downlight 20. The downlight has its own optical lens 21 which serves to focus the light from one or more LED modules. This light is typically focused into a narrow beam of light or spot, say a 15° beam, or a flood of light, say a 60° beam, or various angles in between. These beam angles refer to the spread of light about an axis passing through the centre of the lens and substantially perpendicular to the light emitting face of the lens.

The downlight 20 has a body 26 with an outwardly extending flange 25 around the front perimeter and this flange would normally be concealed from view by a bezel. In order to give the downlight an IP rating, a lens or lens cover 10 is stretched over and around the flange 25, such that the flange 25 sits substantially inside the channel 16. The fit of the flange 25 inside channel 16 is tight enough to form a watertight seal to IP 65 standard.

The outer part of lens 10 may be concealed by a decorative bezel (not shown) if required.

From the foregoing description it will be appreciated that the term 'lens cover' is an appropriate term to describe item 10, in that it is designed to cover an existing optical lens in a downlight and to transmit any light emitted by the LED light source/optical lens combination.

Turning now to Figures 6 and 7 these show a different type of IP rated lens 30. In this embodiment the central region 31 comprises an optical lens. This optical lens has a substantially frustoconical body whose outer surface incorporates a plurality of densely distributed facets. Such solid lenses which operated by total internal reflection of light are known and are described, for example, in WO 2014/108575 (Aurora Limited) and WO 2014/108662 (Aurora Limited) the entire contents of which are hereby incorporated by reference. The centre of the light emitting face of lens region 38 is slightly dished or concave and the central region also incorporates a plurality of convex shaped dimples or pimples. These serve to scatter any light that would otherwise be emitted directly from an LED module located in a blind hole 39 on the rear face of the lens and adapted to accommodate an LED light engine.

In this example the corrugated or second region has three corrugations 32, 33 and 34. These serve to provide a great deal of flexibility such that the combination of a light source and lens 30 when installed in an adjustable down light can move significantly out of the plane of the front of the downlight without affecting the IP rating. An example of this angular movement is shown in Figure 8.

Figure 9 shows an IP rated lens of the type shown in Figures 6 and 7 attached to the front of a downlight 40. A further example of a lens of this type used in combination

with a downlight is shown in Figure 10. In Figure 10 downlight 50 has a body 56 and an outwardly extending flange 55 around the front perimeter of the downlight body. The lens 30 is secured or bonded to the perimeter flange 55 in a watertight fashion such as by way of an adhesive. The perimeter edge of the lens 30 may be covered by a bezel 60 as shown in Figure 10. If required the outer circumference of the lens 30 can incorporate an endless channel or groove similar to item 16 in the earlier example. The flange 55 would then sit in this channel.

An IP rated lens according to the present invention may be manufactured by any suitable process such as injection moulding, especially 2 shot or multiple shot injection moulding. This allows the first, central region to be manufactured from any type of plastics material which is optically very clear but not necessarily flexible, and the rest of the lens to be manufactured from a different more flexible plastics material. Depending on the materials of manufacture, a third plastic material may be required in order for the central region to adhere firmly to flexible outer region.

Alternatively the first and second regions of the IP rated lens can be manufactured separately in two parts and these two parts welded, bonded or glued together, such that the two parts become integral. A wide variety of methods are already known to the materials specialists whereby two plastic components can be bonded together including, but not limited to, ultrasonic welding.

In a further alternative the first and second regions may be manufactured from the same, optically substantially clear but flexibly deformable material by, for example, a one-shot injection moulding process. As described above, suitable materials will be selected by the materials specialist and such materials include highly transparent silicone polymers.

CLAIMS

1. An IP rated lens for a luminaire, said luminaire including a light source adapted to emit light from the front of the luminaire, said lens comprising:-
 - 5 (i) a first region through which light from the light source is emitted;
 - (ii) a second region which is resiliently deformable, thus allowing the light source in the luminaire to move with respect to the plane of the front of the luminaire, whilst retaining IP protection when the light source is out of the normal plane.
- 10 2. An IP rated downlight according to Claim 1 wherein the second region is integral with the first region.
3. An IP rated lens according to Claim 1 or Claim 2 wherein the first region and
15 the second region are formed from the same material.
4. An IP rated lens according to Claim 1 or Claim 2 wherein the first region and the second region are formed from different materials.
- 20 5. An IP rated lens according to Claim 4 wherein the first region and the second region are bonded together.
6. An IP rated lens according to Claim 4 wherein the first region and second region are formed by an injection moulding process.
- 25 7. An IP rated lens according to Claim 6 wherein the first region and the second region are formed by a multi-shot injection moulding process.
8. An IP rated lens according to any preceding claim wherein the second region
30 includes an engagement means adapted to enable the lens to attach to the front of the luminaire in order to achieve the required IP rating.
9. An IP rated lens according to any preceding claim wherein the first region comprises an optical lens.

10. An IP rated lens according to Claim 9 wherein the optical lens is adapted to focus light from the light source into a light cone having an angle between 15 degrees and 60 degrees about a central axis of the luminaire.

5 11. An IP rated lens according to Claim 9 or Claim 10 wherein the optical lens comprises a substantially conical body formed from a transparent or translucent material, said conical body having a first, narrow end and a second wider end and an outer surface designed to substantially totally reflect light towards the second end of the cone, said conical body having a primary axis extending from the first end to
10 the second end, wherein the outer surface of the conical body comprises a plurality of reflecting facets or reflecting surfaces.

12 An IP rated lens according to any preceding claim wherein the second region comprises one or more corrugations.

15

13. An IP rated lens according to any preceding claim wherein the IP rated lens is adapted to comprise a primary lens in the luminaire.

14. An IP rated lens according to any preceding Claim wherein the perimeter of
20 the IP rated lens is adapted to be covered by a bezel.

15. An IP rated lens according to any preceding claim wherein the IP rated lens is adapted to be held in place by the bezel.

25 16. An IP rated lens according to any preceding claim wherein a seal is provided between the luminaire and the IP rated lens.

17. An IP rated lens substantially as herein described with reference to and as illustrated in any combination of the accompanying drawings.

30

18. A luminaire incorporating an IP rated lens according to any of Claims 1 to 17 inclusive.

19. A luminaire incorporating an IP rated lens substantially as herein described
35 with reference to and as illustrated in any combination of the accompanying drawings.

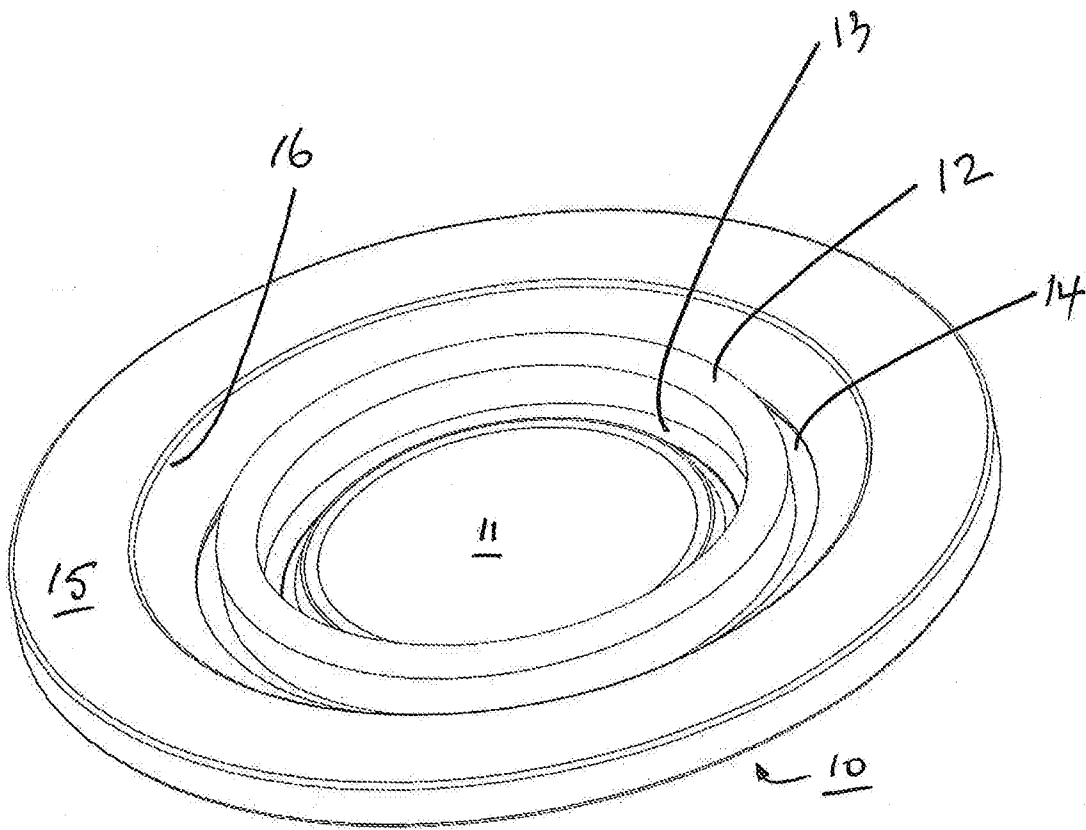
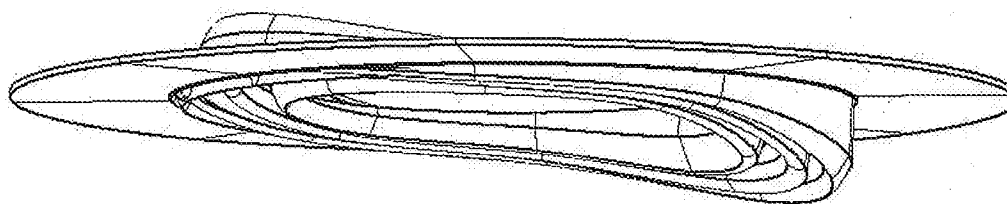
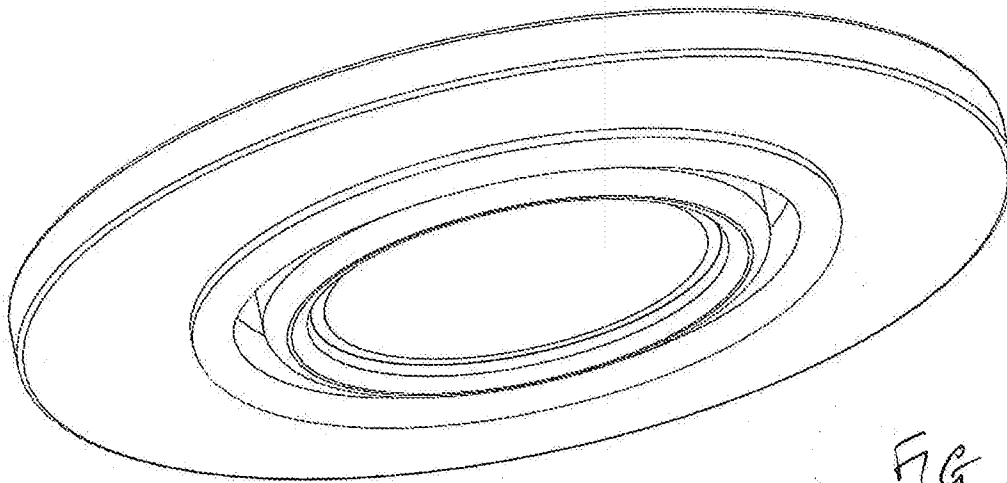
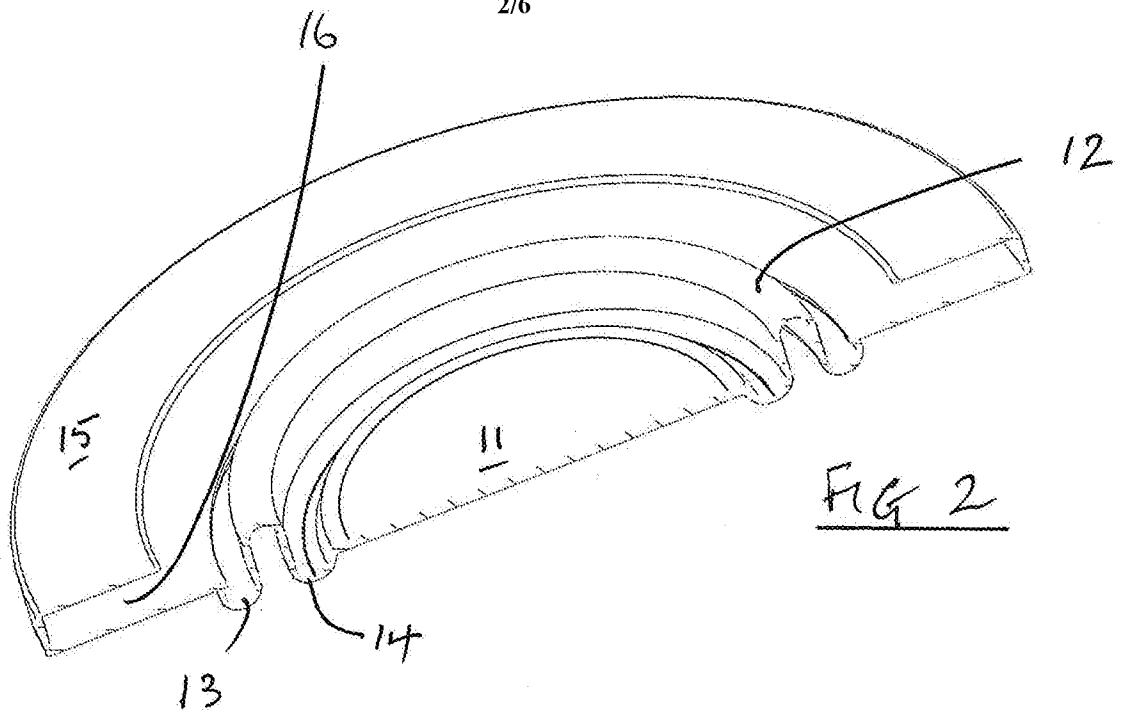


FIG 1



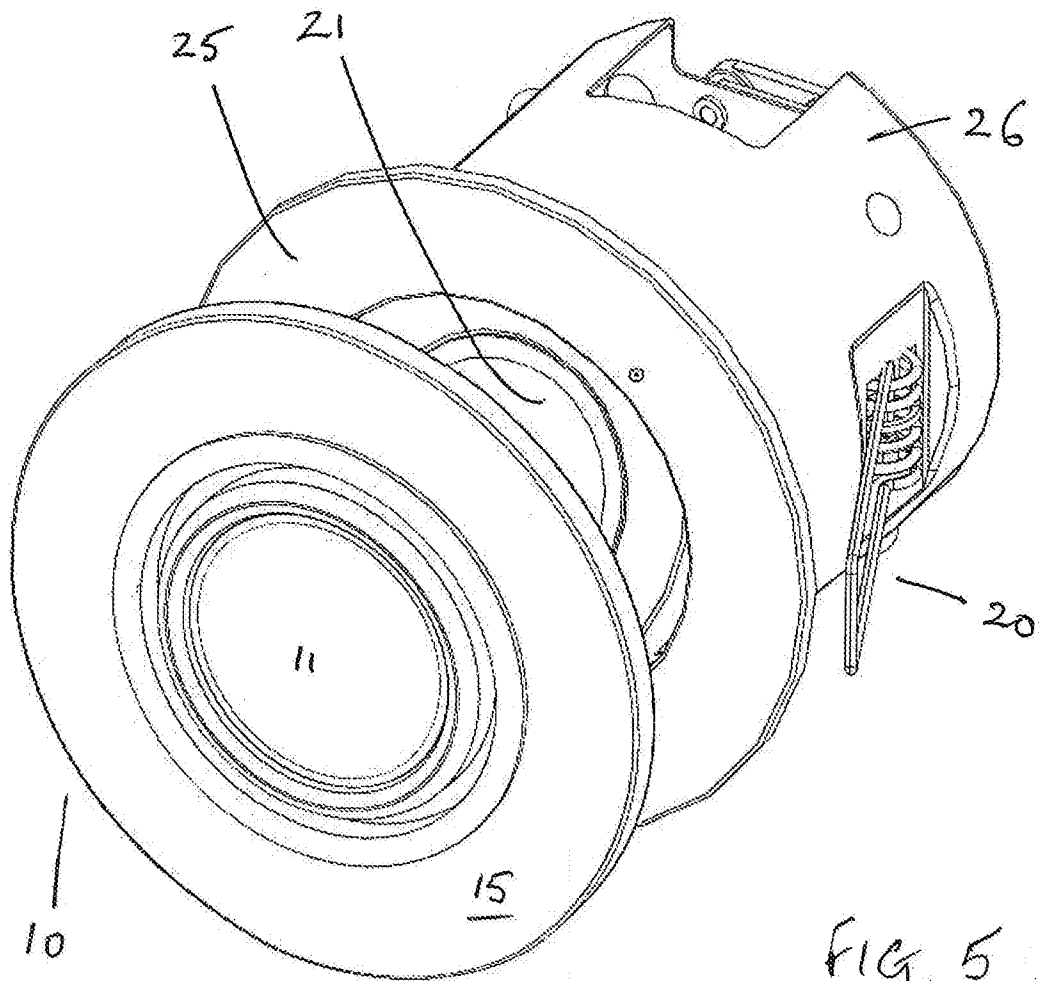


FIG 5

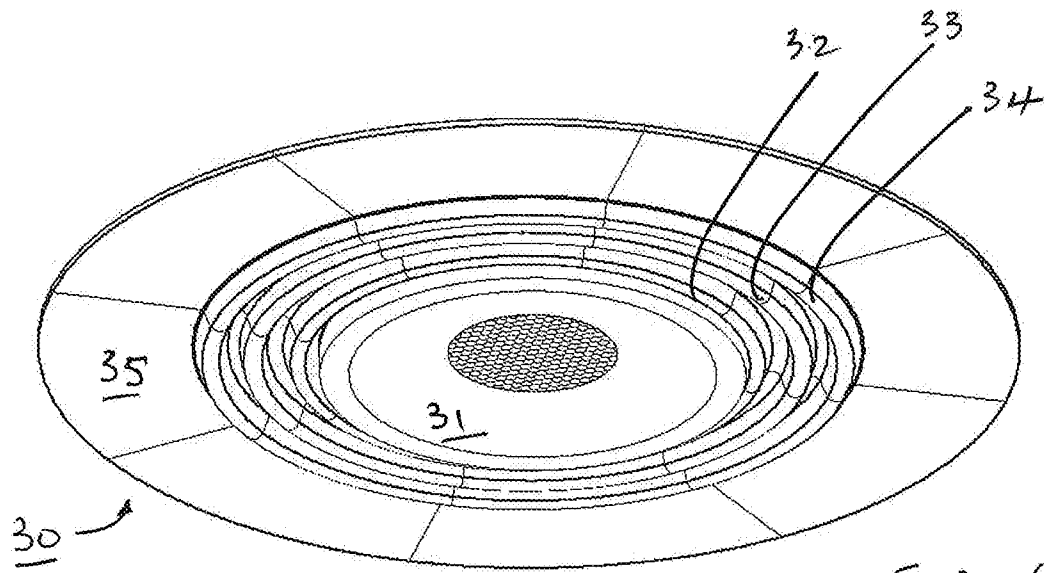


FIG 6

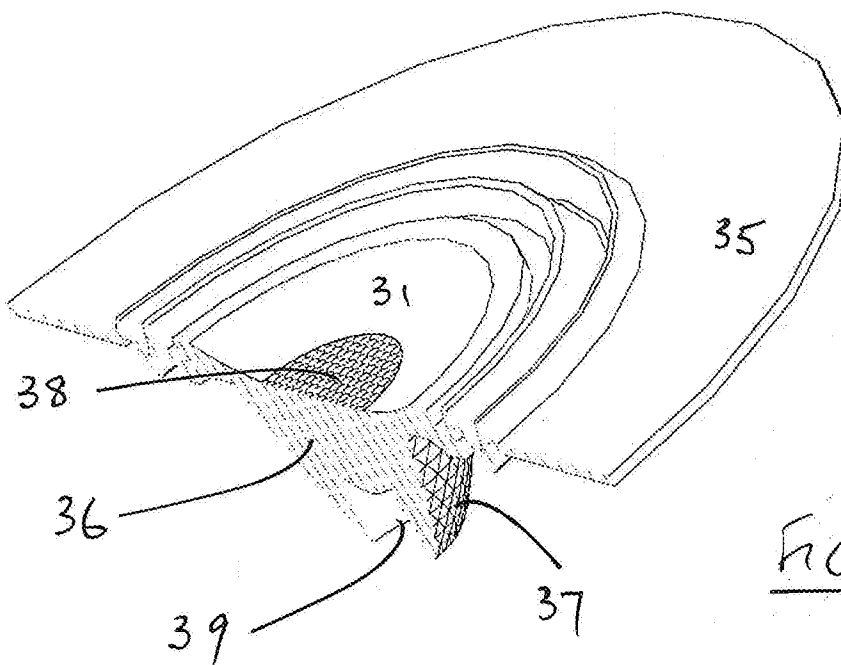
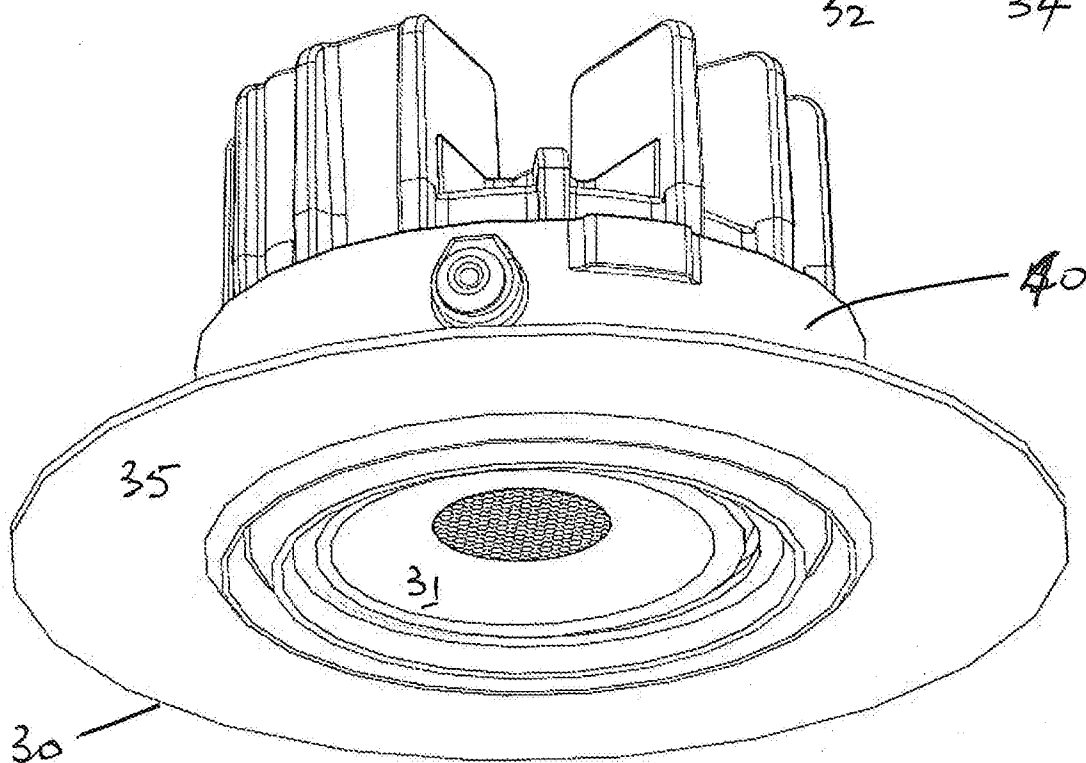
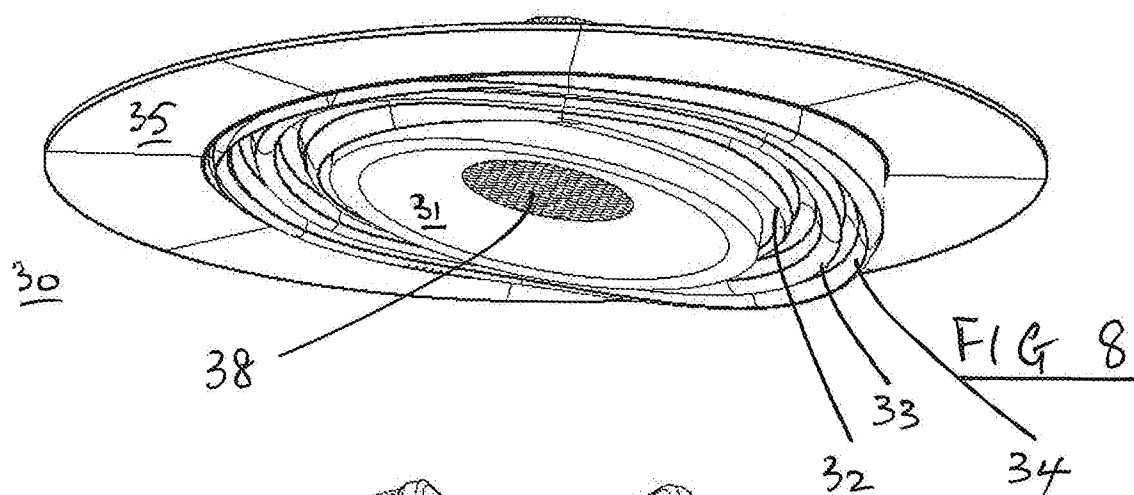


FIG 7



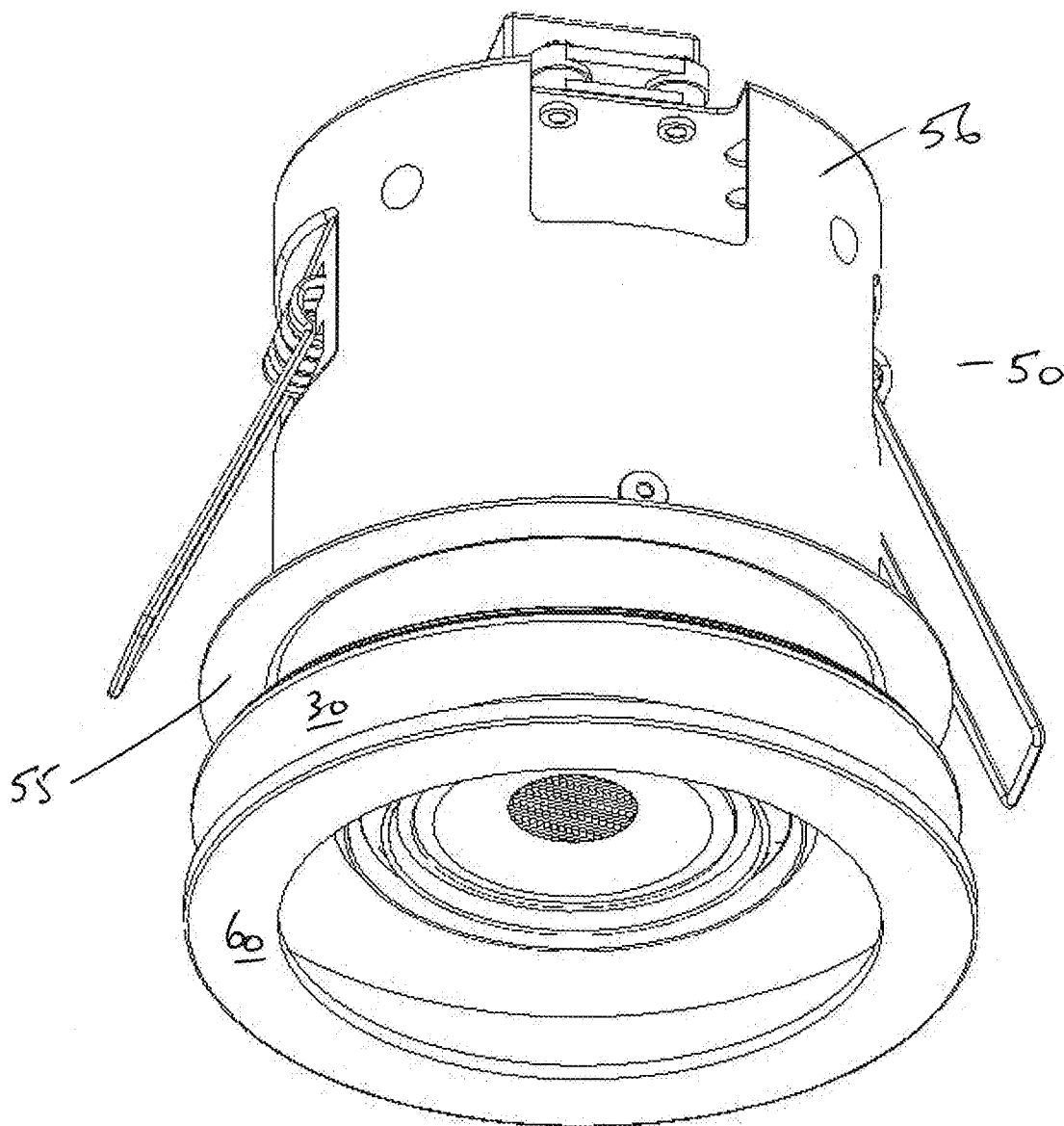


Fig 10

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2016/054108

A. CLASSIFICATION OF SUBJECT MATTER

INV. F21V31/00 F21S8/02 F21V7/00 F21V14/06 F21V21/30
ADD.

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 F21S G02B

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	WO 2014/190379 A1 (BRIGHTGREEN PTY LTD [AU]) 4 December 2014 (2014-12-04)	1-3, 6-11,13, 17-19
Y	figures 17a-21, 25-27, 38 paragraphs [0109] - [0120]	4,5,12, 14-16
Y	DE 10 2008 005697 A1 (ZUMTOBEL LIGHTING GMBH [AT]) 30 July 2009 (2009-07-30) figures 1, 4a-5b, 6 paragraphs [0028] - [0043]	4,5,12, 14-16

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search

10 August 2016

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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