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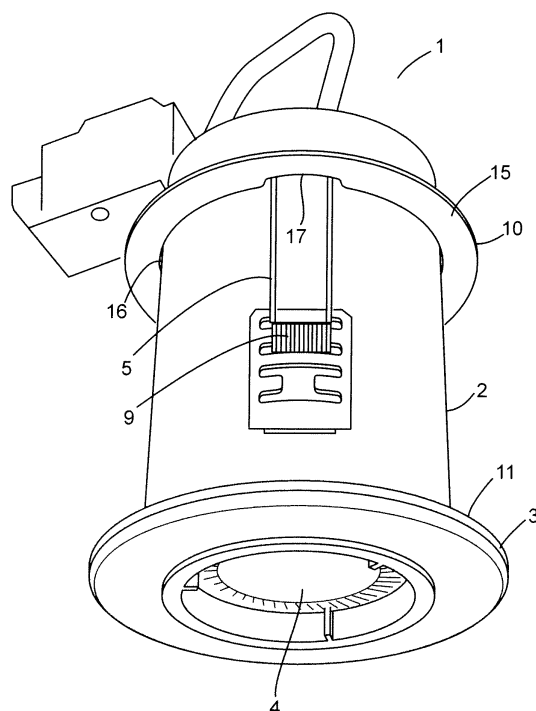
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(54) **A lamp assembly**

(57) A Lamp assembly for mounting in an associated opening in a ceiling panel has a lamp housing (2) with a flanged outer end (3). A pair of spring loaded clamp arms (5) are mounted on the housing (2). The clamp arms (5) are movable between a folded disengaged position against the lamp housing (2) and an outwardly extended engaged position to retain the lamp assembly (1) on the ceiling panel. Springs (9) on each clamp arm (5) urge the clamp arms (5) towards the engaged position. A retaining ring (10) fits about the clamp arms (5) to hold them in the folded position to facilitate insertion of the lamp assembly (1) into the opening of the ceiling panel, this retaining ring (10) being engagable with the periphery of the opening as the lamp assembly (1) is inserted into the opening to disengage the retaining ring (10), sliding the retaining ring (10) downwardly off the clamp arms (5) thus releasing the clamp arms (5) which can then move into the engaged position under spring bias.



**Fig. 1**

## Description

### Introduction

[0001] This invention relates to a lamp assembly.

[0002] The invention is particularly concerned with lamps such as downlights for mounting in an opening in a ceiling panel. Such downlights essentially comprise a lamp body having a flanged outer end and spring-loaded clamp arms on the lamp body which engage an inside face of the ceiling panel to clamp the flanged outer end against an outer face of the ceiling panel, thus securing the downlight on the ceiling panel. A typical downlight of this type is disclosed in GB 2486498. When fitting such downlights on the ceiling panel, the spring-loaded clamp arms have to be folded into a stored position and held there as the downlight is inserted through the opening in the ceiling panel. This typically requires both hands of the person fitting the downlight and it can be somewhat tricky to manoeuvre the downlight through the opening, particularly as the person is usually standing on a ladder to gain access to the ceiling into which the downlight is to be fitted. This is also not ideal from a safety point of view as the person does not have any hand free to hold on to the ladder whilst fitting the downlight. EP 2463578 discloses a lighting fixture having means for securing the lighting fixture in an opening in a panel. The securing means comprises a pair of elastic members at opposite sides of the lighting fixture which deform to allow insertion of the lighting fixture into the opening in the panel and when fully inserted retain the lighting fixture in the opening on the panel.

[0003] The present invention is directed towards overcoming the above-mentioned problems.

### Summary of the Invention

[0004] According to the invention, there is provided a lamp assembly for mounting in an associated opening in a cladding panel, the lamp assembly including:

a lamp housing with a flanged outer end;

two or more clamp arms mounted on the lamp housing;

each clamp arm being movable on the lamp housing between a disengaged position alongside the lamp housing and an outwardly extended engaged position to retain a periphery of the opening in the cladding panel between said clamp arm and said flanged outer end of the lamp housing;

bias means to urge each clamp arm towards the engaged position;

characterised in that there is provided retaining means which is engagable with the clamp arms to

retain the clamp arms in the disengaged position;

said retaining means being engagable with the periphery of the opening in the cladding panel upon insertion of the lamp housing through said opening for disengagement of the retaining means from the clamp arms.

[0005] Conveniently the retaining means holds the clamp arms in the disengaged position facilitating single-handed fitting of the lamp assembly on the cladding panel and as the lamp housing is inserted into the opening in the cladding panel, the retaining ring will disengage from the clamp arms to allow the clamp arms to secure the lamp assembly on the cladding panel.

[0006] In another embodiment of the invention, the retaining means comprises a single retaining element which is engagable with all the clamp arms.

[0007] In a further embodiment the retaining means is slidably engagable with the clamp arms.

[0008] In a further embodiment the retaining means is engagable about an exterior of the lamp housing. The retaining means may be slidably engagable with the exterior of the lamp housing.

[0009] In another embodiment the retaining means is a ring.

[0010] In another embodiment the ring has a plurality of slots at an inner edge of the ring for reception of the clamp arms.

[0011] In another embodiment each clamp arm is U-shaped having a pair of side members interconnected at their outer ends by a cross-member, an associated pair of slots being provided at an inner edge of the ring for each clamp arm, said slots for reception of the side members with a tongue between said slots engaging with the cross-member to hold the ring in engagement with an outer end of the clamp arms.

[0012] In a further embodiment the ring comprises a flat annular flange having an inner opening sized to receive the lamp housing which is movable through said inner opening, at least a portion of an outer periphery of the flange being wider than the opening in the cladding panel.

[0013] In another embodiment a number of spaced-apart clamp arm receiving slots are provided at a periphery of said inner opening to receive the clamp arms.

[0014] In another embodiment two or more pairs of associated clamp arm receiving slots are provided in which the spacing between clamp arm engaging portions of associated clamp arm receiving slots in each pair of clamp arm receiving slots is different.

[0015] In another embodiment the ring is a stainless steel ring having a thickness in the range 0.4 - 0.8 mm, and preferably is about 0.5 mm thick.

[0016] In another embodiment the ring has an inner diameter of between 58 mm and 62 mm and an outer diameter of between 85 mm and 90 mm, and preferably the outer diameter is about 89mm.

[0017] In another aspect the invention provides a retaining ring for the lamp assembly of the type herein described. Preferably the retaining ring comprising a flat annular flange having an inner opening sized to receive the lamp housing which is movable through said inner opening, at least a portion of an outer periphery of the flange being wider than the opening in the cladding panel in which the lamp housing is to be mounted.

[0018] In another embodiment a number of spaced-apart clamp arm receiving slots are provided at a periphery of said inner opening to receive the clamp arms.

[0019] In another embodiment the retaining ring is an annular stainless steel ring of 0.5mm thickness and having an inner diameter of between 58mm and 62mm and an outer diameter of 89mm.

### **Brief Description of the Drawings**

[0020] The invention will be more clearly understood by the following description of some embodiments thereof, given by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a lamp assembly according to the invention;

Fig. 2 is a plan view of a retaining ring of the lamp assembly;

Fig. 3 is a perspective view showing the lamp assembly positioned immediately below an opening in a ceiling panel to which the lamp assembly is to be mounted;

Fig. 4 is a view similar to Fig. 3 showing the lamp assembly partially engaged with the opening in the ceiling panel;

Fig. 5 is a perspective view similar to Fig. 3 showing the lamp assembly fully engaged in the opening of the ceiling panel;

Fig. 6 is a perspective view of another lamp assembly according to a second embodiment of the invention;

Fig. 7 is a plan view of a retaining ring of the lamp assembly of Fig. 6; and

Figs. 8 to 10 are perspective views illustrating the mounting of the lamp assembly of Fig. 6 in a ceiling opening.

### **Detailed Description of the Invention**

[0021] Referring to the drawings and initially to Figs. 1 to 5 thereof, there is illustrated a lamp assembly according to the invention indicated generally by the reference numeral 1. The lamp assembly 1 has a lamp housing 2

with a flanged outer end 3. Any suitable lamp 4, such as an LED lamp may be mounted within the lamp housing 2 for projection of light outwardly at the flanged outer end 3 of the lamp housing 2. Two clamp arms 5 are mounted on opposite sides of the lamp housing 2. Each clamp arm 5 is pivotally movable on the lamp housing 2 between a disengaged position alongside the lamp housing 2 as shown in Fig. 1 and an outwardly extending engaged position, as shown in Fig. 5, for mounting the lamp assembly 1 in an associated opening 7 in a ceiling panel 8. A spring 9 at an inner end of each clamp arm 5 urges the clamp arm 5 towards the engaged position. Lamps of this type are well known and need no further description. In accordance with the present invention, the lamp assembly 1 includes a retaining ring 10 which is engageable with the clamp arms 5 as shown in Fig. 1 to retain the clamp arms 5 in a folded disengaged position alongside the lamp housing 2 to facilitate single handed insertion of the lamp housing 2 into the opening 7 in the ceiling panel 8.

[0022] As shown in the sequence of Figs. 3 to 5, upon insertion of the lamp housing 2 into the opening 7, the retaining ring 10 engages an outer periphery 12 of the opening 7 at an outer face 13 of the ceiling panel 8 and as the lamp housing 2 is inserted the retaining ring 10 is pushed downwardly on the lamp housing 2 until it nests against an inside face 11 of the flanged outer end 3, thus releasing the clamp arms 5 which pivot outwardly and downwardly to engage against an inner face 14 of the ceiling panel 8 keeping the flanged outer end 3 securely clamped against the outer face 13 of the ceiling panel 8 and mounting the lamp assembly 1 on the ceiling panel 8, retaining the periphery 12 of the opening 7 in the ceiling panel 8, that is the portion of the ceiling panel 8 surrounding the opening 7, between the clamp arms 5 and the flanged outer end 3 of the lamp housing 2.

[0023] The retaining ring 10 comprises a flat annular flange 15 having an inner opening 16 sized to receive the lamp housing 2 which is movable through said inner opening 16. Two clamp arm receiving slots 17 are provided at opposite sides of a periphery of the inner opening 16 to receive the clamp arms 5. It will be noted that the outside diameter of the flange 15 is greater than the diameter of the opening 7 through which the lamp assembly 1 is inserted. Additional slots 18 may be provided at the periphery of the inner opening 16 to accommodate and fit around fittings on an exterior of the lamp housing 2.

[0024] The distance between clamp arm engaging portions 19 of the associated pair of clamp arm engaging slots 17 may be varied to apply different restraining forces to the springs 9, for example to avoid over tensioning of the springs 9 associated with the clamp arms 5 when the lamp assembly 1, 30 requires a longer storage duration prior to installation.

[0025] It is also envisaged that two or more spaced-apart pairs of clamp arm receiving slots 17 may be provided at the periphery of the inner opening 16. It may in some cases be desirable to have different spacings be-

tween associated clamp engaging portions 19 of different associated pairs of clamp arm receiving slots 17, for example to accommodate different lamp constructions or in order to permit selective application of different restraining forces to the springs as mentioned above.

**[0026]** In use, typically the lamp assembly 1 is supplied with the retaining ring 10 in the position shown in Fig. 1 retaining the clamp arms 5 in the retracted folded position. Alternatively, the retaining ring could be fitted just prior to insertion of the lamp into the ceiling panel 8. To fit the lamp assembly 1 into the opening 7 in the ceiling panel 8, it is only necessary to position the lamp housing 2 at the opening 7 and push the lamp housing 2 upwardly through the opening 7 as shown in the sequence of Figs. 3 to 5. The retaining ring 10 will engage the periphery 12 of the opening 7 on the outer face 13 of the ceiling panel 8 as the lamp housing 2 is pushed upwardly through the opening 7. This slides the retaining ring 10 downwardly on the lamp housing 2 and clamp arms 5, releasing the clamp arms 5 which pivot outwardly under the action of the springs 9 until they engage the inner face 14 of the ceiling panel 8 as shown in Fig. 5 to securely clamp the flanged lower end 3 of the lamp assembly 1 against the outer face 13 of the ceiling panel 8.

**[0027]** Referring now to Figs. 6 to 10, there is shown another lamp assembly according to a second embodiment of the invention indicated generally by the reference numeral 30. Parts similar to those described previously are assigned the same reference numerals. In this case the clamp arms 5 project upwardly of the lamp housing 2 when in the folded disengaged position shown in Fig. 6. The clamp arm receiving slots at a periphery of the inner opening 16 in this case are provided by a pair of notches 31 associated with each clamp arm 5. Side elements 32, 33 of each arm 5 engage with the notches 31. A tongue 34 between each pair of notches 31 projects inwardly under a cross-member forming a looped outer end 35 of the side elements 32, 33 to secure the retaining ring 10 at the outer ends of the clamp arms 5 prior to insertion of the lamp assembly 30 into the opening 7 in the ceiling panel 8.

**[0028]** In use, the lamp assembly 30 is fitted to the ceiling panel 8 in similar fashion to the lamp assembly previously described. The fitting sequence is shown in Figs. 8 to 10. As the lamp assembly 30 is inserted into the opening 7, a periphery 12 of the opening 7 at the outer face 13 of the ceiling panel 8 engages the retaining ring 10 and slides it downwardly over the clamp arms 5 and about the lamp body 2 until it reaches the inner face 11 of the flanged lower end 3 of the lamp body 2. As the retaining ring 10 moves downwardly, the clamp arms 5 are released for outward movement under the action of the spring 9 to engage the inner face 14 of the ceiling panel 8 and clamp the lower flanged end 3 against the outer face 13 of the ceiling panel 8.

## **Example of the Invention**

**[0029]** In an example of the invention, a stainless steel annular retaining ring 10 of inner diameter 59 mm and outer diameter 89 mm, and of thickness 0.5 mm, was made by means of laser cutting of a 316 stainless steel plate. The retaining ring 10 was made from stainless steel so that it would survive the temperatures encountered during a typical fire, for up to 90 minutes as required to maintain the integrity of ceilings with a 90 minute fire rating duration.

**[0030]** This retaining ring 10 was fitted over the clamp arms 5 of a ROBUS TRILED RF9 type downlight housing 2 supplied by LED Group (Western Retail Park, Nangor Road, Dublin 12, Ireland), and the downlight housing 2 was inserted into a 60 mm clearance aperture 7 cut-out in a ceiling 8. On contact with the ceiling 8, the retaining ring 10 dropped onto the bezel 3 of the downlight housing 2, releasing the clamp arms 5 which under the action of the springs 9 pulled the downlight housing 2 upward into the ceiling aperture 7 until the stainless steel annular retaining ring 10 contacted the ceiling 8 and the bezel 3 of the downlight housing 2, anchoring the downlight housing 2 securely in place. The insertion and securing of the downlight housing 2 in the ceiling aperture 7 was completed within 2 seconds.

**[0031]** If the retaining ring 10 is used with a downlight fitting having an enclosure or housing 2 of diameter 57.5 mm and a flange 3 of outer diameter 90 mm the retaining ring 10 may have an inner diameter of between 58 mm and 60 mm and an outer diameter of between 85mm and 90 mm.

**[0032]** In other examples of the invention, retaining rings 10 of different inner diameters between 61 mm and 85 mm were fabricated with an outer diameter of 89 mm to apply different restraining forces to the springs 9, to avoid over tensioning of the springs 9 when the product requires a longer storage duration prior to installation.

**[0033]** The retaining ring 10 may be of any suitable material provided it meets the functional and regulatory requirements. Typically, the retaining ring 10 will be metal, and in this regard steel is preferred. Stainless steel is particularly preferred as it aids the fire rating of the light fitting and is resistant to corrosion and oxidation. Galvanised steel could alternatively be used and would be cheaper to produce.

**[0034]** Ideally, the retaining ring 10 should be as thin as possible to ensure the light fitting does not protrude too far from the ceiling so that the retaining ring 10 is hidden and essentially not visible. In this regard, a retaining ring thickness of about 0.5mm has been found to be particularly suitable.

**[0035]** The inner and outer diameters of the annular flange 15 forming the retaining ring 10 will generally be determined by the particular light fitting it is to be used with, and in particular the diameter of the lamp housing 2, the diameter of the flanged outer end 3 and the diameter of the opening 7 in the ceiling panel 8 into which the

lamp assembly is to be inserted. What is essential is that the inner diameter, or inner opening 16, is such that the retaining ring 10 will slide over the lamp housing 2 and the outer diameter, or at least a portion of an outer edge of the retaining ring 10, is such that the retaining ring 10 will engage against a periphery of the opening 7 in the ceiling 8 upon insertion of the lamp housing 2 into the opening 7 to release the clamp arms 5. Preferably the outer diameter of the retaining ring 10 is slightly less (say 1-2 mm) than the diameter of the flanged outer end 3 of the lamp housing 2 so the retaining ring 10 is hidden from view when the lamp assembly 1, 30 is mounted on the ceiling panel 8.

**[0036]** The inner diameter of the retaining ring 10 may be varied depending upon the desirable tension to be applied to the springs 9, and in this regard may be somewhat larger than the diameter of the lamp housing 2 to tension the springs 9 less in order to have a longer shelf life without unacceptably adversely affecting the spring 9 performance before use. Alternatively, where clamp arm receiving slots 17 are provided the depth of the clamp arm receiving slots 17 may be varied for the same purpose.

**[0037]** While the lamp assembly of the invention is described as being fitted on a ceiling panel, it will be appreciated that it could be fitted to other cladding panels, such as wall panels, or even floor panels if desired, in a similar fashion. The retaining ring secures the clamp arms in a collapsed stored position until the lamp assembly is inserted into the opening in the cladding panel. As already stated, this facilitates single-handed insertion of the lamp assembly into the cladding panel. Thus, the fitting of the lamp assembly to a cladding panel is made easier, quicker and safer.

**[0038]** In this specification the terms "comprise, comprises, comprised and comprising" or any variation thereof and the terms "include, includes, included and including" or any variation thereof are considered to be totally interchangeable and they should all be afforded the widest possible interpretation.

**[0039]** The invention is not limited to the embodiments hereinbefore described which may be varied in both construction and detail with the scope of the appended claims.

## Claims

1. A lamp assembly (1, 30) for mounting in an associated opening (7) in a cladding panel (8), the lamp assembly (1, 30) including:

a lamp housing (2) with a flanged outer end (3);  
two or more clamp arms (5) mounted on the lamp housing (2);  
each clamp arm (5) being movable on the lamp housing (2) between a disengaged position alongside the lamp housing (2) and an outwardly

extended engaged position to retain a periphery (12) of the opening (7) in the cladding panel (8) between said clamp arm (5) and said flanged outer end (3) of the lamp housing (2);

bias means (9) to urge each clamp arm (5) towards the engaged position;

**characterised in that** there is provided retaining means (10) which is engagable with the clamp arms (5) to retain the clamp arms (5) in the disengaged position;

said retaining means (10) being engagable with the periphery (12) of the opening (7) in the cladding panel (8) upon insertion of the lamp housing (2) through said opening (7) for disengagement of the retaining means (10) from the clamp arms (5).

2. The lamp assembly (1, 30) as claimed in claim 1 wherein the retaining means (10) comprises a single retaining element which is engagable with all the clamp arms (5).
3. The lamp assembly (1, 30) as claimed in claim 1 or claim 2 wherein the retaining means (10) is slidably engagable with the clamp arms (5).
4. The lamp assembly (1, 30) as claimed in any one of the preceding claims wherein the retaining means is engagable about an exterior of the lamp housing (2).
5. The lamp assembly (1, 30) as claimed in any one of the preceding claims wherein the retaining means is a ring (10).
6. The lamp assembly (1, 30) as claimed in claim 5 wherein the ring (10) has a plurality of slots (17) at an inner edge of the ring (10) for reception of the clamp arms (5).
7. The lamp assembly (1, 30) as claimed in claim 6 wherein each clamp arm (5) is U-shaped having a pair of side members (32, 33) interconnected at their outer ends by a cross-member (35), an associated pair of slots (31) being provided at an inner edge of the ring (10) for each clamp arm (5), said slots (31) for reception of the side members (32, 33) with a tongue (34) between said slots (31) engaging with the cross-member (35) to hold the ring (10) in engagement with an outer end of the clamp arms (5).
8. The lamp assembly (1, 30) as claimed in any one of claims 5 to 7 wherein the ring (10) comprises a flat annular flange (15) having an inner opening (16) sized to receive the lamp housing (2) which is movable through said inner opening (16), at least a portion of an outer periphery of the flange (15) being wider than the opening (7) in the cladding panel (8).

9. The lamp assembly (1, 30) as claimed in claim 8 wherein a number of spaced-apart clamp arm receiving slots (17) are provided at a periphery of said inner opening (16) to receive the clamp arms (5). 5
10. The lamp assembly (1, 30) as claimed in claim 9 where two or more pairs of associated clamp arm receiving slots (17) are provided in which the spacing between clamp arm engaging portions (19) of associated clamp arm receiving slots (17) in each pair of clamp arm receiving slots (17) is different. 10
11. The lamp assembly (1, 30) as claimed in any one of claims 5 to 10 wherein the ring (10) is a stainless steel ring of 0.5 mm thickness. 15
12. The lamp assembly (1, 30) as claimed in any one of claims 5 to 11 wherein the ring (10) has an inner diameter of between 58 mm and 62 mm and an outer diameter of 89 mm. 20
13. A retaining ring (10) for the lamp assembly (1, 30) as claimed in any one of the preceding claims comprising a flat annular flange (15) having an inner opening (16) sized to receive the lamp housing (2) which is movable through said inner opening (16), at least a portion of an outer periphery of the flange (15) being wider than the opening (7) in the cladding panel (8) in which the lamp housing (2) is to be mounted. 25 30
14. A retaining ring (10) as claimed in claim 13, wherein a number of spaced-apart clamp arm receiving slots (17) are provided at a periphery of said inner opening (16) to receive the clamp arms (5). 35
15. A retaining ring (10) as claimed in claim 13 or claim 14, wherein the retaining ring (10) is an annular stainless steel ring of 0.5mm thickness and having an inner diameter of between 58mm and 62mm and an outer diameter of 89mm. 40

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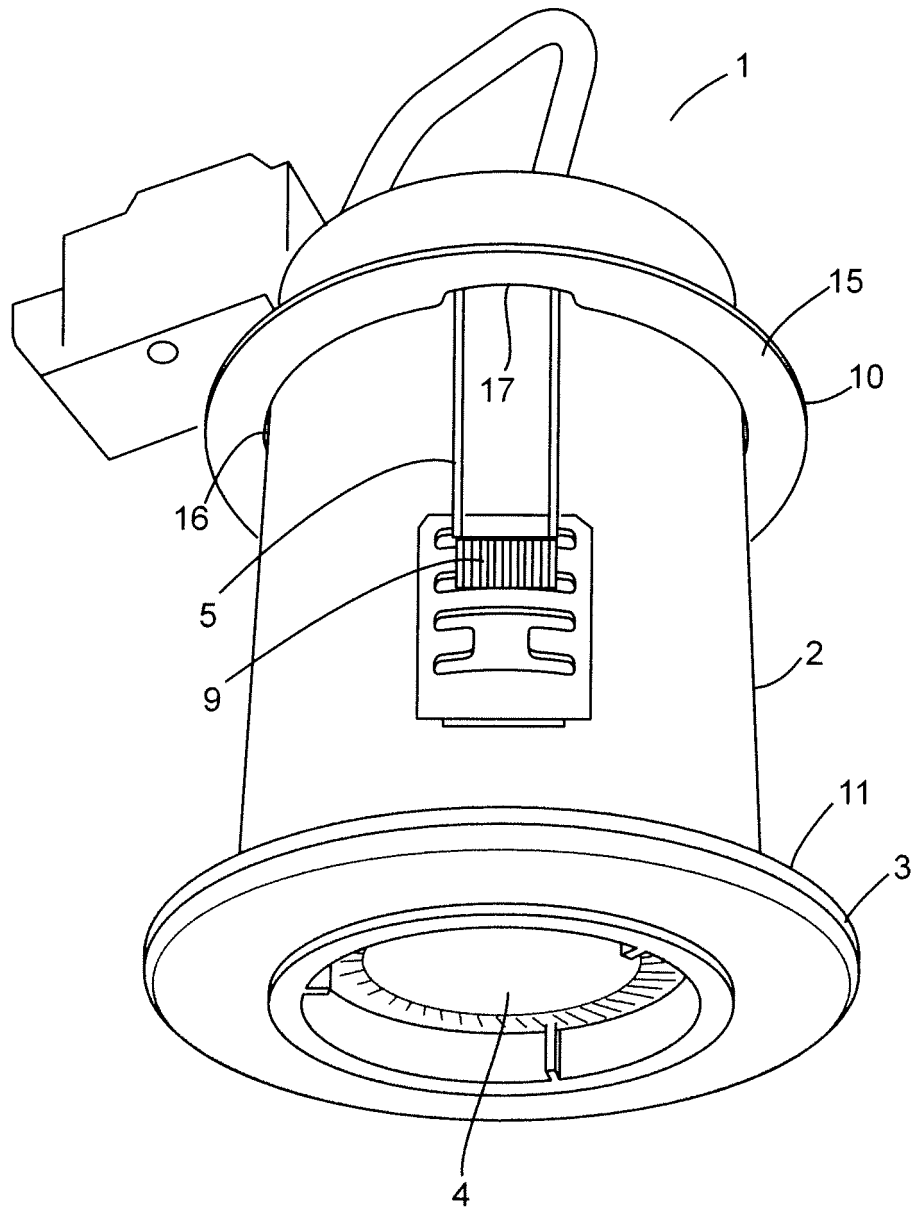


Fig. 1

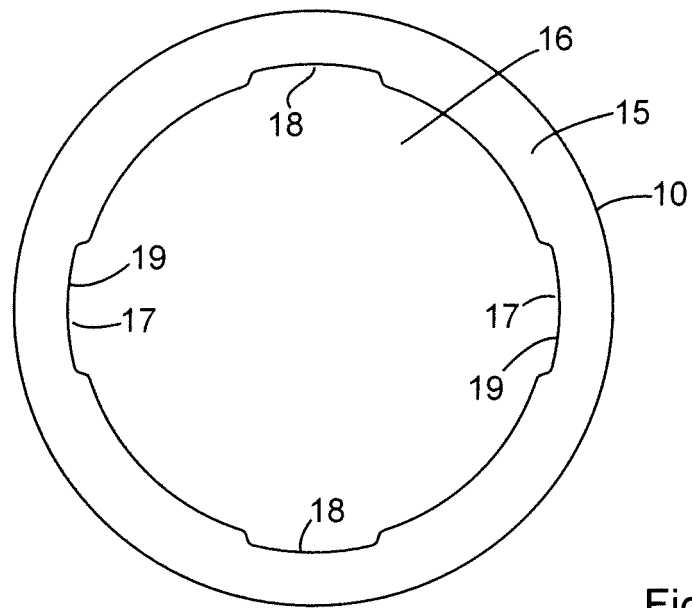


Fig. 2

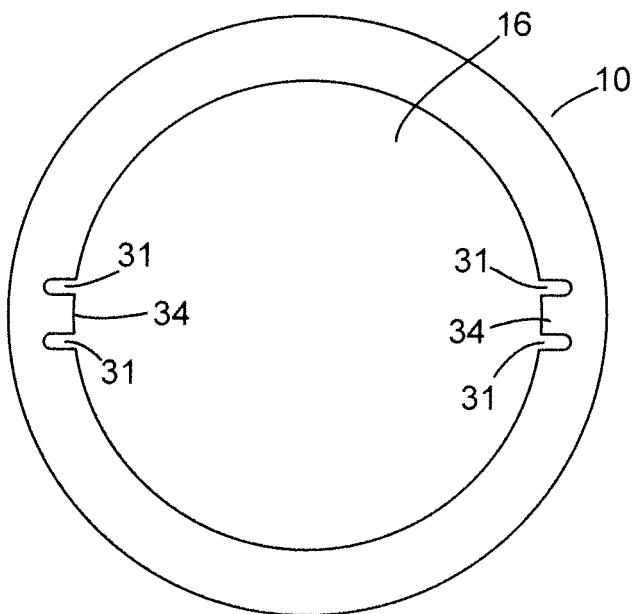
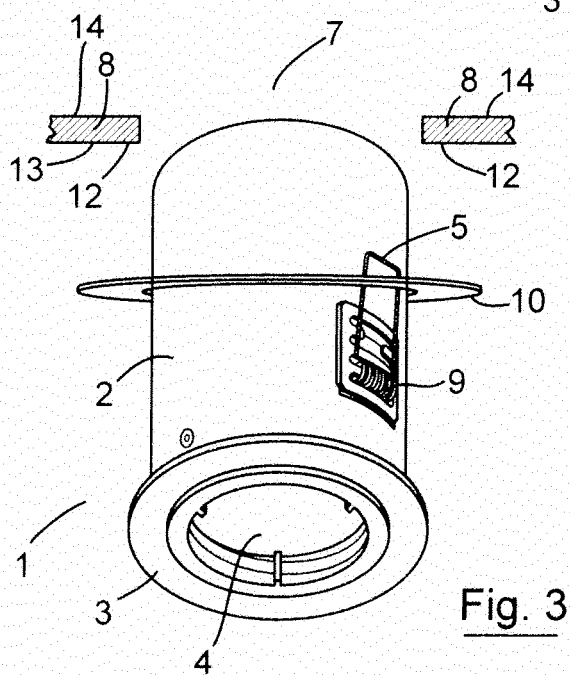
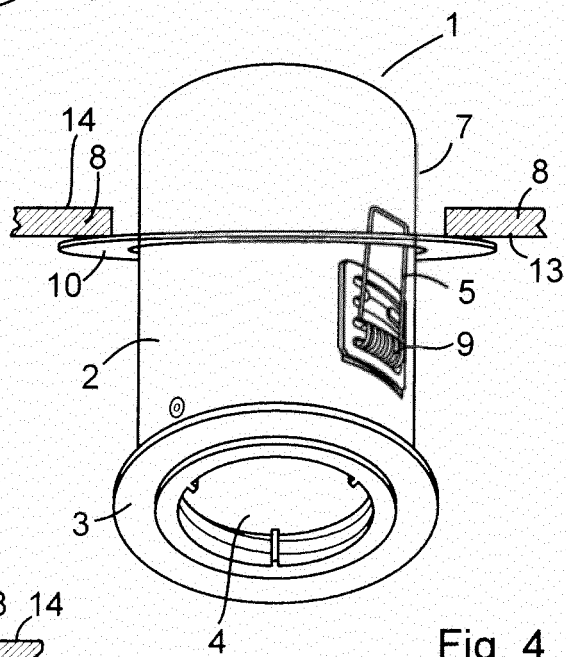
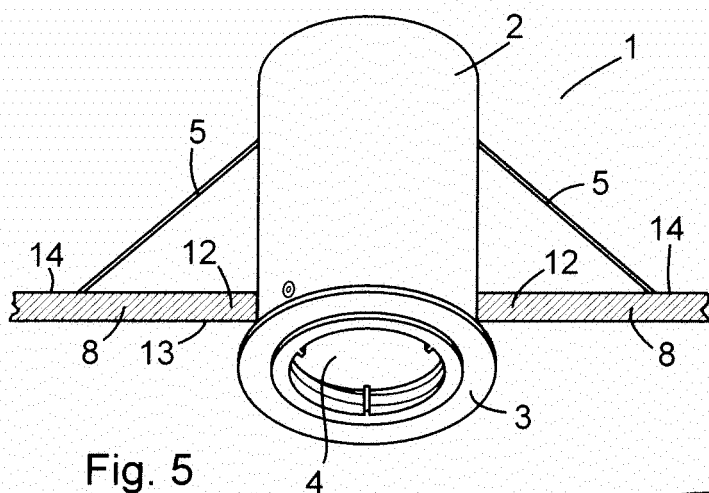
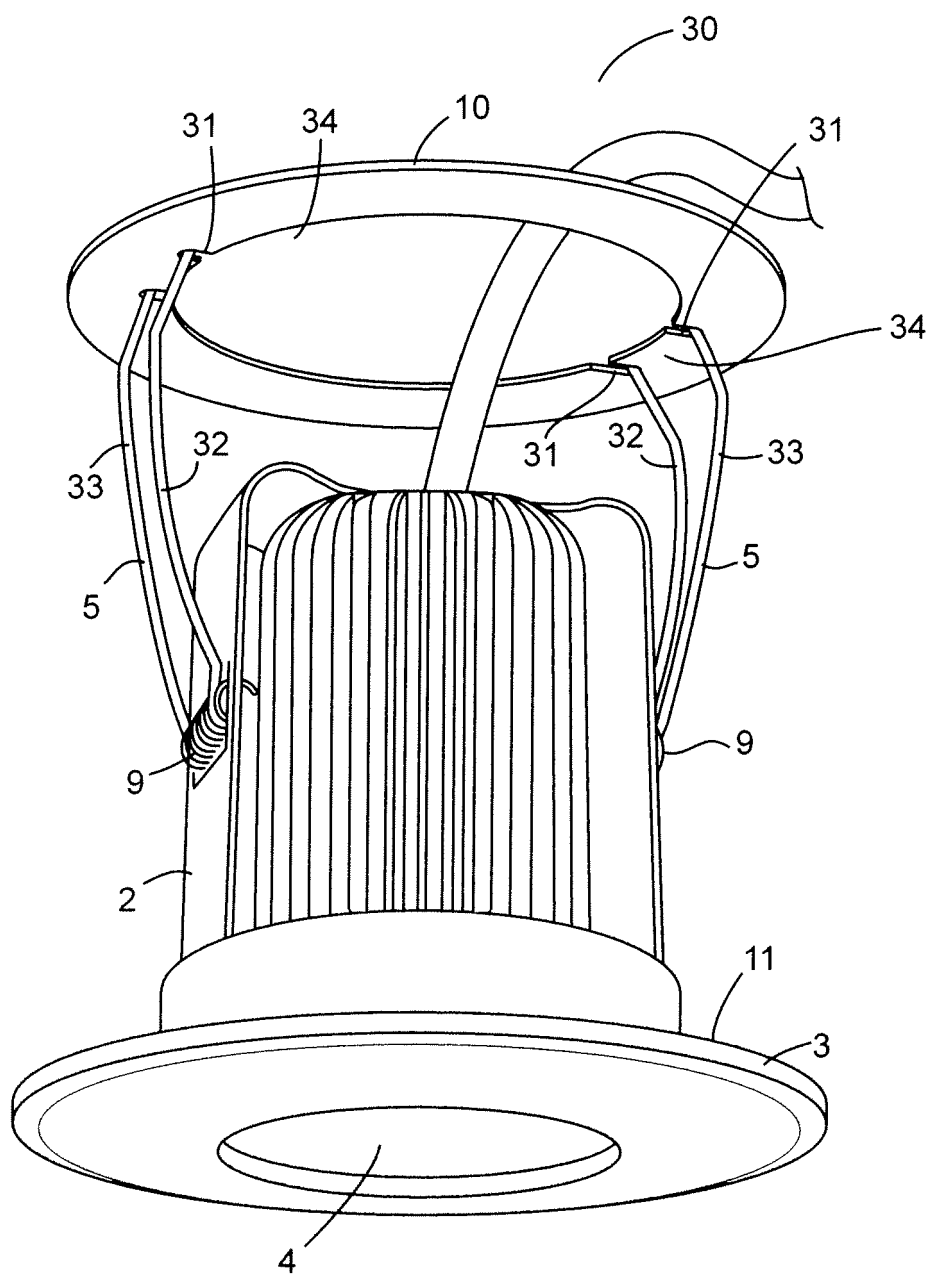


Fig. 7







**Fig. 6**

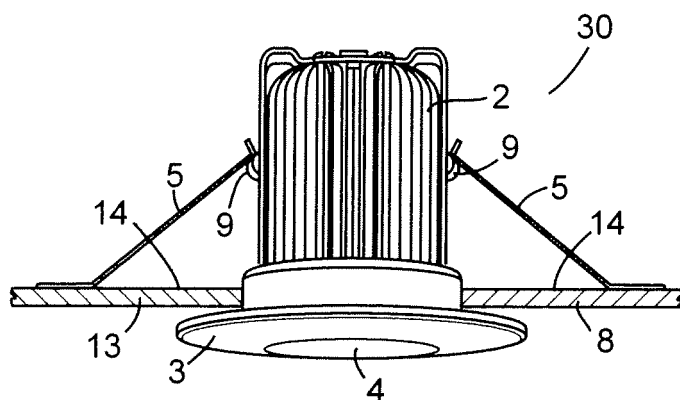


Fig. 10

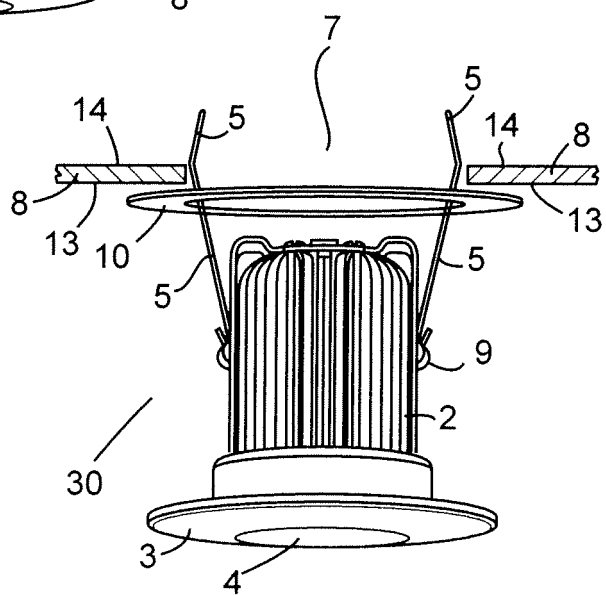


Fig. 9

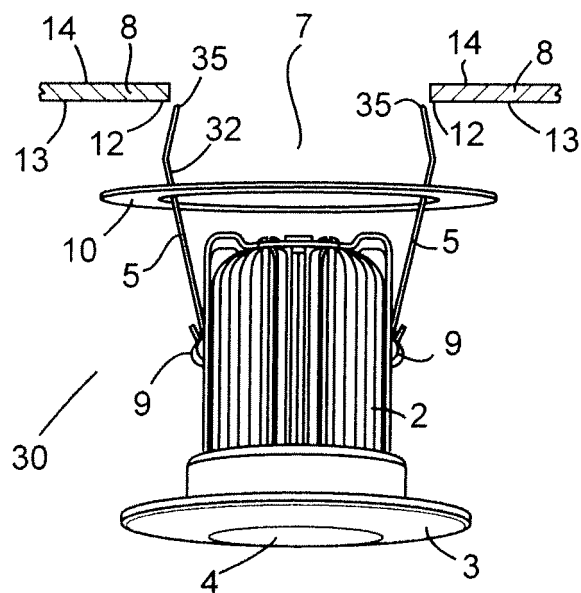


Fig. 8



## EUROPEAN SEARCH REPORT

Application Number  
EP 14 16 5264

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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                     |                                                                                                      |                                                                                                                                                                                                                                                                              |                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| Category                                                                                                                                                                                                                | Citation of document with indication, where appropriate, of relevant passages                        | Relevant to claim                                                                                                                                                                                                                                                            | CLASSIFICATION OF THE APPLICATION (IPC) |
| A                                                                                                                                                                                                                       | JP H07 296623 A (MATSUSHITA ELECTRIC WORKS LTD) 10 November 1995 (1995-11-10)<br>* figures 1, 2, 3 * | 1                                                                                                                                                                                                                                                                            | INV.<br>F21S8/00<br>F21V21/00           |
| A                                                                                                                                                                                                                       | WO 2010/135928 A1 (WU LIANGJU [CN])<br>2 December 2010 (2010-12-02)<br>* figures 1a, 2a *            | 1                                                                                                                                                                                                                                                                            |                                         |
|                                                                                                                                                                                                                         |                                                                                                      |                                                                                                                                                                                                                                                                              | TECHNICAL FIELDS SEARCHED (IPC)         |
|                                                                                                                                                                                                                         |                                                                                                      |                                                                                                                                                                                                                                                                              | F21S<br>F21V                            |
| The present search report has been drawn up for all claims                                                                                                                                                              |                                                                                                      |                                                                                                                                                                                                                                                                              |                                         |
| Place of search<br><b>The Hague</b>                                                                                                                                                                                     |                                                                                                      | Date of completion of the search<br><b>2 June 2014</b>                                                                                                                                                                                                                       | Examiner<br><b>Sacepe, Nicolas</b>      |
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ON EUROPEAN PATENT APPLICATION NO.

EP 14 16 5264

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| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)         | Publication<br>date      |
|-------------------------------------------|---------------------|------------------------------------|--------------------------|
| JP H07296623 A                            | 10-11-1995          | NONE                               |                          |
| WO 2010135928 A1                          | 02-12-2010          | CN 101629706 A<br>WO 2010135928 A1 | 20-01-2010<br>02-12-2010 |

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- GB 2486498 A [0002]
- EP 2463578 A [0002]