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(54) **A DOWNLIGHTING SYSTEM AND A CARTRIDGE FOR USE IN THE SYSTEM**

(57) A downlighting system comprises a housing for recessed fitting into a mounting surface; and a cartridge housing a light source. The cartridge has an electrical screw fitting and the housing comprises a central electrical contact pin and a gripping device for gripping and electrically contacting the outside of the screw fitting. The electrical screw fitting is a push fit into and out of gripping engagement with the gripping device. The cartridge is removable from the housing, for replacement for example when the light source reaches its end of life. The two parts are physically and electrically connected to each other by a push fit. This means the connection and disconnection does not damage the mounting surface, since no twisting or rocking motion is needed.

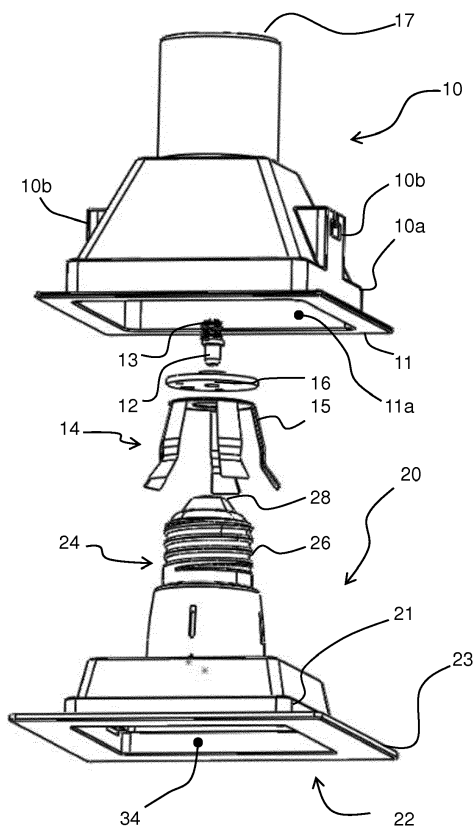


FIG. 2

Description

FIELD OF THE INVENTION

[0001] This invention relates to downlighters, in particular for recessed fitting into a mounting surface such as a ceiling.

BACKGROUND OF THE INVENTION

[0002] Downlighters are often designed to be recessed into a ceiling (or other surface). For this purpose, it is common for a downlighter to have a main housing which fits into an opening formed in the ceiling, and then remains in place using spring arms which push against the rear face of the ceiling, thereby lifting the main housing into position and holding it in place.

[0003] A bulb is then fitted in the main housing. For example, the bulb may be placed in a carrier, an electrical connection is made between the bulb and a terminal in the main housing, and the carrier is then fitted to the main housing by a twist and lock action.

[0004] The main housing thus remains in place when the bulb needs to be replaced, so that damage to the ceiling is prevented.

[0005] This typical design is not suitable for a non-circular bulb and housing because a twisting engagement is not then appropriate.

[0006] There is therefore a need for an alternative design of downlighter, which enables replacement of a bulb without disturbing the housing which is attached to the ceiling, and which does not require rotation during bulb replacement.

SUMMARY OF THE INVENTION

[0007] The invention is defined by the claims.

[0008] According to examples in accordance with an aspect of the invention, there is provided a downlighting system comprising:

a housing for recessed fitting into a mounting surface; and
 a cartridge housing a light source,
 wherein the cartridge comprises a light output window at a front side and an electrical screw fitting at a rear side, the electrical screw fitting comprising a threaded outer electrical contact area and a central electrical contact terminal,
 wherein the housing comprises an electrical contact pin for contacting the central electrical contact terminal and a gripping device for gripping and electrically contacting the outer contact area,
 and wherein the electrical screw fitting is a push fit into the gripping device of the housing during assembly and is a pull out of the gripping device of the housing for removal from the housing.

[0009] This lighting system (in particular a downlighter) has two parts. One part, the housing, is for fixing to a mounting surface such as a ceiling and is intended to remain installed. The other part, the cartridge, is removable from the housing, for replacement for example when the light source reaches its end of life. The two parts are physically/mechanically and electrically connected to each other by a push fit and are separated from each other by pulling. This the pushing of the push fit engages the electrical screw fitting with the gripping device and the pulling apart of the push fit disengages the electrical screw fitting from the gripping device. This means the connection and disconnection does not damage the mounting surface, since no twisting or rocking motion is needed. However, the push fit can be made remotely (i.e. without needing careful coupling of small connectors) by simply pushing a screw fitting into a gripping device. The ridges of the threads of the screw fitting are used as edges to be gripped, rather than being used as a rotational thread. The lighting system may thus be made with standard components so does not require a new design of push fit connector. The electrical screw fitting may thus be considered to have a push fit feature/function into the housing and a pull out feature/function for release from the gripping engagement with the gripping device.

[0010] The gripping device for example comprises an annular ring of inwardly biased fingers for gripping the outer electrical contact area.

[0011] These fingers grip over the thread ridges and into the thread valleys to resist longitudinal movement.

[0012] The system may further comprise a biasing spring for biasing the electrical contact pin towards the central electrical contact terminal. The biasing spring assists in making electrical contact with the central contact terminal for a range of possible relative positions.

[0013] The light output window is for example rectangular e.g. square.

[0014] The replacement of rectangular or square downlighters has been a problem, in that ceiling damage is often encountered. The push and pull fit system of the invention overcomes these problems.

[0015] The housing for example has a square opening for receiving the cartridge. The housing itself is received in a square opening in the mounting surface. It may be retained in place by a spring system, for example which urges down onto the back face (i.e. the non-visible face) of the mounting surface.

[0016] The cartridge may have a surround which overlaps a front rim of the housing. This provides a neat aesthetic outer appearance.

[0017] The surround is for example adapted, when the cartridge is received in the housing and the housing is fitted to the mounting surface, to be spaced from an exposed face of the mounting surface.

[0018] This spacing enables the cartridge to be gripped when it is to be removed from the housing, by pulling downwardly.

[0019] The system may further comprise a connection

plate mounted between the gripping device and a rear wall of the housing, wherein a first connection wire extends from the gripping device through a hole in the connection plate and through a hole in the rear wall.

[0020] A second connection wire for example extends from the electrical contact pin through a hole in the rear wall (which may be the same hole as for the first connection wire, or a second hole).

[0021] The connection plate is made of plastic and for isolating the two poles of the power supply, which connect to the electrical contacts of the housing.

[0022] The connection plate for example comprises an opening for the electrical contact pin, wherein the electrical contact pin has a shoulder for limiting the range of movement of the electrical contact pin through the opening. The connection plate thus retains the electrical contact pin in a defined location.

[0023] When a biasing spring is present for biasing the electrical contact pin towards the central electrical contact terminal (as explained above), the biasing spring is for example between the shoulder and the rear wall.

[0024] The electrical screw fitting is for example an E27 cap. This is a readily available lighting component, but which is not traditionally used for a push fit connection.

[0025] The light source is for example an LED arrangement, electrically connected to the electrical screw fitting.

[0026] The invention also provides a cartridge for use in the downlighting system defined above, comprising: a light source:

a light output window at a front side; and
an electrical screw fitting at a rear side, the electrical screw fitting comprising a threaded outer electrical contact area and a central electrical contact terminal, wherein the electrical screw fitting functions as a push fit feature into a gripping device of the housing of the downlighting system and functions as a pull out feature to release from gripping mechanical and electrical contact with the gripping device of the housing of the downlighting system.

[0027] This defines a replacement cartridge suitable for use in the system defined above.

[0028] These and other aspects of the invention will be apparent from and elucidated with reference to the embodiment(s) described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] For a better understanding of the invention, and to show more clearly how it may be carried into effect, reference will now be made, by way of example only, to the accompanying drawings, in which:

Fig. 1 shows a downlighting system in accordance with an example of the invention, in exploded form and in side view;

Fig. 2 shows the downlighting system of Figure 1 in

perspective exploded form;

Fig. 3 shows the cartridge more clearly in perspective view;

Fig. 4 shows the cartridge from beneath;

Fig. 5 shows the housing more clearly in perspective view;

Fig. 6 shows the housing more clearly in cut-away perspective view;

Fig. 7 shows the connection plate in more detail;

Fig. 8 shows another view of the connection plate;

Fig. 9 shows the contact pin in more detail;

Fig. 10 shows the biasing spring more clearly;

Fig. 11 shows the gripping device more clearly;

Fig. 12 shows the features at the inside of the rear wall more clearly in the assembled state; and

Fig. 13 shows the assembled system mounted to a ceiling.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0030] The invention will be described with reference to the Figures.

[0031] It should be understood that the detailed description and specific examples, while indicating exemplary embodiments of the apparatus, systems and methods, are intended for purposes of illustration only and are not intended to limit the scope of the invention. These and other features, aspects, and advantages of the apparatus, systems and methods of the present invention will become better understood from the following description, appended claims, and accompanying drawings. 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.

[0032] The invention provides a downlighting system which comprises a housing for recessed fitting into a mounting surface, and a cartridge housing a light source. The cartridge has an electrical screw fitting and the housing comprises a central electrical contact pin and a gripping device for gripping and electrically contacting the outside of the screw fitting. The electrical screw fitting has a push fit feature into the housing for assembly and a pull out feature for release from gripping engagement with the gripping device for disassembly. The cartridge is removable from the housing for replacement, for example when the light source reaches its end of life. The two parts are physically and electrically connected to each other by a push fit. This enables easy handling during assembly and disassembly (i.e. fitting the cartridge to the housing and removing the cartridge from the housing). By providing a separate cartridge, the removal of the cartridge does not damage the mounting surface, since the housing remains static.

[0033] Figure 1 shows a downlighting system in accordance with an example of the invention, in exploded form and in side view.

[0034] The system comprises a housing 10 for recessed fitting into a mounting surface such as a ceiling. The housing 10 has a side wall 10a which fits into an opening formed in the mounting surface. The housing and opening are for example square, but the invention may be applied to any shape of housing.

[0035] The housing 10 has a front rim 11 which extends radially outwardly beyond the side wall 10a sufficiently that it fits around the outside of the opening formed in the mounting surface. The front rim 11 has a square opening 11a (see Figure 2) for receiving a cartridge, described below. Thus, the front rim 11 has a square annular shape, giving a desired aesthetic appearance.

[0036] The housing 10 is received and then retained in the opening in the mounting surface. It may be retained in place by a spring system, for example which urges down onto an upper face (i.e. the non-visible face) of the mounting surface. The springs are not shown, but they attach to mounting points 10b. They are folded up to allow the housing to fit through the opening, then are released to push down on the back surface of the mounting surface. This is the conventional way in which a recessed housing is fitted to a ceiling.

[0037] The system further comprises a cartridge 20 housing a light source (not shown). The cartridge and its light source is a replaceable item.

[0038] The cartridge has an upstanding wall 21 which fits into internal opening formed by the side wall 10a. Thus, the cartridge and housing are aligned when assembled together.

[0039] The cartridge comprises a front face 22 at a front side and an electrical screw fitting 24 at a rear side. The front face defines a light output window 34 (visible in Figure 2). The front face is defined by a surround 23 which is square in this example (because it is the same shape as the front rim 11) and is slightly larger than the front rim 11. The surround 23 thus overlaps the front rim 11 of the housing 10 when the cartridge is installed. The surround 23 may sit flush over the front rim, or it may have a recessed portion in which the front rim sits, so that the surround overlaps and envelops the front rim.

[0040] The electrical screw fitting comprises a threaded outer electrical contact area 26 and a central electrical contact terminal 28. They are electrically conductive parts. It is for example an E27 cap.

[0041] The light source is for example an LED arrangement, and it is electrically connected internally to the contact area 26 and contact terminal 28.

[0042] The housing has an arrangement for making electrical and mechanical connection to the contact area and contact terminal. This comprises an electrically conductive contact pin 12 for contacting the central electrical contact terminal 28 and a gripping device 14 for gripping and electrically contacting the outer contact area 26. The contact pin 12 is biased downwardly by a biasing spring 13.

[0043] The gripping device 14 comprises an annular ring of inwardly biased fingers 15 for gripping the outer

electrical contact area 26. It is for example a metal component and is hence an electrically conductive part. It may be made of phosphor-bronze, beryllium copper or other materials with high Seebeck coefficients. As shown most clearly in Figure 2, this example has four gripping fingers 15 but there may be only three or indeed more than four. The fingers 15 grip over the thread ridges and into the thread valleys to resist longitudinal movement.

[0044] The electrical screw fitting 24 has a push-fit feature into the housing to implement gripping engagement with the gripping device, and a pull-out feature from gripping engagement with the gripping device 14. When this engagement is made, the central electrical contact terminal contacts the contact pin 12.

[0045] In this way, the screw fitting 24 is used as an electrical connection, but it is not used for making a screw connection, in other words, no rotation is used during connecting.

[0046] By using a push fit and pull out feature, the connection and disconnection does not damage the mounting surface, since the housing remains static. Thus, no twisting or rocking motion of the housing is needed and no such twisting or rocking is induced in the housing by the the insertion or removal of the cartridge. The push fit is made simply by pushing the cartridge into the housing, and in this way the screw fitting is pushed into the gripping device. The ridges of the threads of the screw fitting are used as edges to be gripped, rather than being used as a rotational thread.

[0047] Figure 1 also shows a connection plate 16 mounted between the gripping device 14 and a rear wall 17 of the housing 10. It is formed of plastic or other electrically insulation material.

[0048] A first connection wire 31 extends from the gripping device 14 through a hole in the connection plate 16 and through a hole in the rear wall 17. A second connection wire 32 extends from the contact pin 12 and through a hole in the connection plate 16 and through a hole (which may be the same as for the first connection wire) in the rear wall 17. The connection plate 16 is for isolating gripping device from the contact pin.

[0049] The connection wires are connected, e.g. via soldering, to the gripping device and the contact pin, respectively.

[0050] Figure 2 shows the same downlighting system in perspective exploded form. It shows the square opening 11a of the front rim 11 and also a square light output window 34 around which the surround 23 (a bezel panel) is formed.

[0051] When the lighting system is mounted to a mounting surface, the surround 23 is spaced from an exposed face of the mounting surface, so that a user can grip (by hand or with a tool) beneath the surround to pull the cartridge out. This space only needs to be greater than 1mm for example in the range 1mm to 5mm.

[0052] Figure 3 shows the cartridge 20 more clearly in perspective view, without the screw fitting.

[0053] Figure 4 shows the cartridge 20 from beneath

again without the screw fitting.

[0054] Figure 5 shows the housing 10 more clearly in perspective view.

[0055] It shows that the rear wall 17 has a first opening 50 for the first connection wire 31 and a second opening 52 for the second connection wire 32. Of course, this could be a single slot for both wires.

[0056] Figure 6 shows the housing 10 more clearly in cut-away perspective view.

[0057] It shows that the inside surface of the rear wall 17 has connection features. First, there are threaded up-standing bores 54. During assembly, the gripping device 14 is screwed to these threaded bores, thereby clamping the gripping device and connection plate 16 to the rear wall 17.

[0058] There is also a central cylinder 56. A top part of the contact pin 12 is received in the central cylinder (as will be seen more clearly in Figure 12).

[0059] Figure 7 shows the connection plate 16 in more detail, with the underside visible. The connection plate 16 comprises an opening 72 for the electrical contact pin 12 so that it can project through the connection plate to the central electrical contact terminal 28. The connection plate also has openings 74 (which may be threaded or not) for the screws as well as another opening 70 for the connection wire 31, which extends through the connection plate to the gripping device 14. On the upper face of the connection plate 16 there is a rim 76 around the opening 72.

[0060] Figure 8 shows another view of the connection plate 16 with the top side visible.

[0061] Figure 9 shows the contact pin 12 in more detail. It has a first end 12a for fitting in the central cylinder 56 and a second end 12b which functions as the contact terminal. A shoulder 18 is provided between the ends for limiting the range of movement of the electrical contact pin through the opening 72 in the connection plate. Thus, the contact pin shoulder 18 sits within the rim 76 when the contact pin 12 is at the end of its range of movement. The spring is provided around the first end 12a and pushes the contact pin down, to this end of its range of movement if there is no cartridge present, or else against the screw fitting when there is a cartridge present.

[0062] Figure 10 shows the biasing spring 13 more clearly. The biasing spring sits between the shoulder 18 and the rear wall 17, within the central cylinder 56.

[0063] Figure 11 shows the gripping device 14 more clearly. It shows that the fingers 15 have an inwardly projecting elbow 110, which is designed to engage between the screw threads of the electrical screw fitting 24. There is a central opening 112 through which the contact pin projects, and screw openings 114.

[0064] Figure 12 shows the features at the inside of the rear wall 17 more clearly in the assembled state (but without the gripping screws) in cross section. The biasing spring 13 is seen within the cylinder 56, extending between the rear wall 17 and the shoulder 18. The shoulder 18 sits within the rim 76, and in the position shown the

pin is near to its maximum downward extension, with the second end 12b projecting through the central opening 112 of the gripping device.

[0065] Figure 13 shows the assembled system mounted to a ceiling 130. The image is in cut away form, so that the various components can be seen most easily. The wires are not shown.

[0066] The ceiling has a square opening 132. The spring system for holding the housing 10 in the ceiling is shown schematically as 134.

[0067] The surround 23 covers the opening 132 in the ceiling. The gap 136, enabling the housing to be pulled down, is shown. The cartridge may have an extension inset from the outer edge by 1mm to 1.5mm, so as to cover the gap so that it is not visible to a user. Instead, the cartridge may contact the surface of the ceiling for a more flush aesthetic appearance, if it has an edge of sufficient thickness to be gripped to enable the cartridge to be pulled down.

[0068] The cartridge 10 remains in place (against the force of gravity) at least in part as a result of the engagement between the gripping device fingers 15 and the screw cap 26. The gripping force may be sufficient to hold the weight of the cartridge. Additionally, a frictional engagement between the upstanding wall 21 and side wall 10a may contribute to the retaining force of the cartridge.

[0069] The invention also relates to the cartridge alone, as it may be sold as a separate item. The cartridge may be a single unit, but it could have separable light source and electronics, so that for example only the light source or only the electronics could be replaced. Further, the cartridge with a standard E27 cap can be mounted to a socket with such standard interface.

[0070] The light source has not been described or shown in detail. Typically, the downlighting system is for connection to a mains AC supply with the wires 31, 32, and the necessary driver and LED circuitry is all housed in the cartridge 20. There may be optical elements such as lenses or diffusers within the cartridge. The housing parts can all be plastic - only the electrical contact parts and biasing spring are metal (and the spring system 134, not described in detail).

[0071] Variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. 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. If the term "adapted to" is used in the claims or description, it is noted the term "adapted to" is intended to be equivalent to the term "configured to". Any reference signs in the claims should not be construed as limiting the scope.

Claims**1.** A downlighting system comprising:

a housing (10) for recessed fitting into a mounting surface (132); and
 a cartridge (20) housing a light source, wherein the cartridge comprises a light output window (34) at a front side and an electrical screw fitting (24) at a rear side, the electrical screw fitting comprising a threaded outer electrical contact area (26) and a central electrical contact terminal (28), wherein the housing (10) comprises an electrical contact pin (12) for contacting the central electrical contact terminal (28) and a gripping device (14) for gripping and electrically contacting the outer contact area (26), and wherein the electrical screw fitting is a push fit into the gripping device of the housing during assembly and is a pull out of the gripping device of the housing for removal from the housing.

- 2.** A downlighting system as claimed in claim 1, wherein the gripping device (14) comprises an annular array of inwardly biased fingers (15) for gripping the outer electrical contact area (26). 25
- 3.** A downlighting system as claimed in claim 1 or 2, further comprising a biasing spring (13) for biasing the electrical contact pin (12) towards the central electrical contact terminal (28). 30
- 4.** A downlighting system as claimed in any one of claims 1 to 3, wherein the light output window (34) is non-circular. 35
- 5.** A downlighting system as claimed in claim 4, wherein the light output window (34) is rectangular. 40
- 6.** A downlighting system as claimed in claim 5, wherein the housing (10) has a rectangular opening (11a) for receiving the cartridge. 45
- 7.** A downlighting system as claimed in any one of claims 1 to 6, wherein the cartridge has a surround (23) which overlaps a front rim (11) of the housing (10). 50
- 8.** A downlighting system as claimed in claim 7, wherein the surround (23) is adapted, when the cartridge (20) is received in the housing (10) and the housing (10) is fitted to the mounting surface, to be spaced with a gap (136) from an exposed face of the mounting surface. 55
- 9.** A downlighting system as claimed in any one of claims 1 to 8, further comprising a connection plate

(16) mounted between the gripping device (14) and a rear wall (17) of the housing (10), wherein a first connection wire (31) extends from the gripping device (14) through a hole (70) in the connection plate (16) and through a hole (50) in the rear wall (17).

- 10.** A downlighting system as claimed in claim 9, wherein a second connection wire (32) extends from the electrical contact pin (12) through a hole (52) in the rear wall (17).
- 11.** A downlighting system as claimed in claim 9 or 10, wherein the connection plate (16) comprises an opening (72) for the electrical contact pin, wherein the electrical contact pin has a shoulder (18) for limiting the range of movement of the electrical contact pin through the opening.
- 12.** A downlighting system as claimed claim 11, wherein a biasing spring is between the shoulder (18) and the rear wall (17).
- 13.** A downlighting system as claimed in any one of claims 1 to 12, wherein the electrical screw fitting (24) is an E27 cap.
- 14.** A downlighting system as claimed in any one of claims 1 to 13, wherein the light source is an LED arrangement, electrically connected to the electrical screw fitting (24).
- 15.** A cartridge for use in the downlighting system of any of claims 1 to 14, comprising:
 a light source:
 a light output window (34) at a front side; and
 an electrical screw fitting (24) at a rear side, the electrical screw fitting comprising a threaded outer electrical contact area (26) and a central electrical contact terminal (28), wherein the electrical screw fitting (24) functions as a push fit feature into a gripping device of the housing of the downlighting system and functions as a pull out feature to release from gripping mechanical and electrical contact with the gripping device (14) of the housing of the downlighting system.

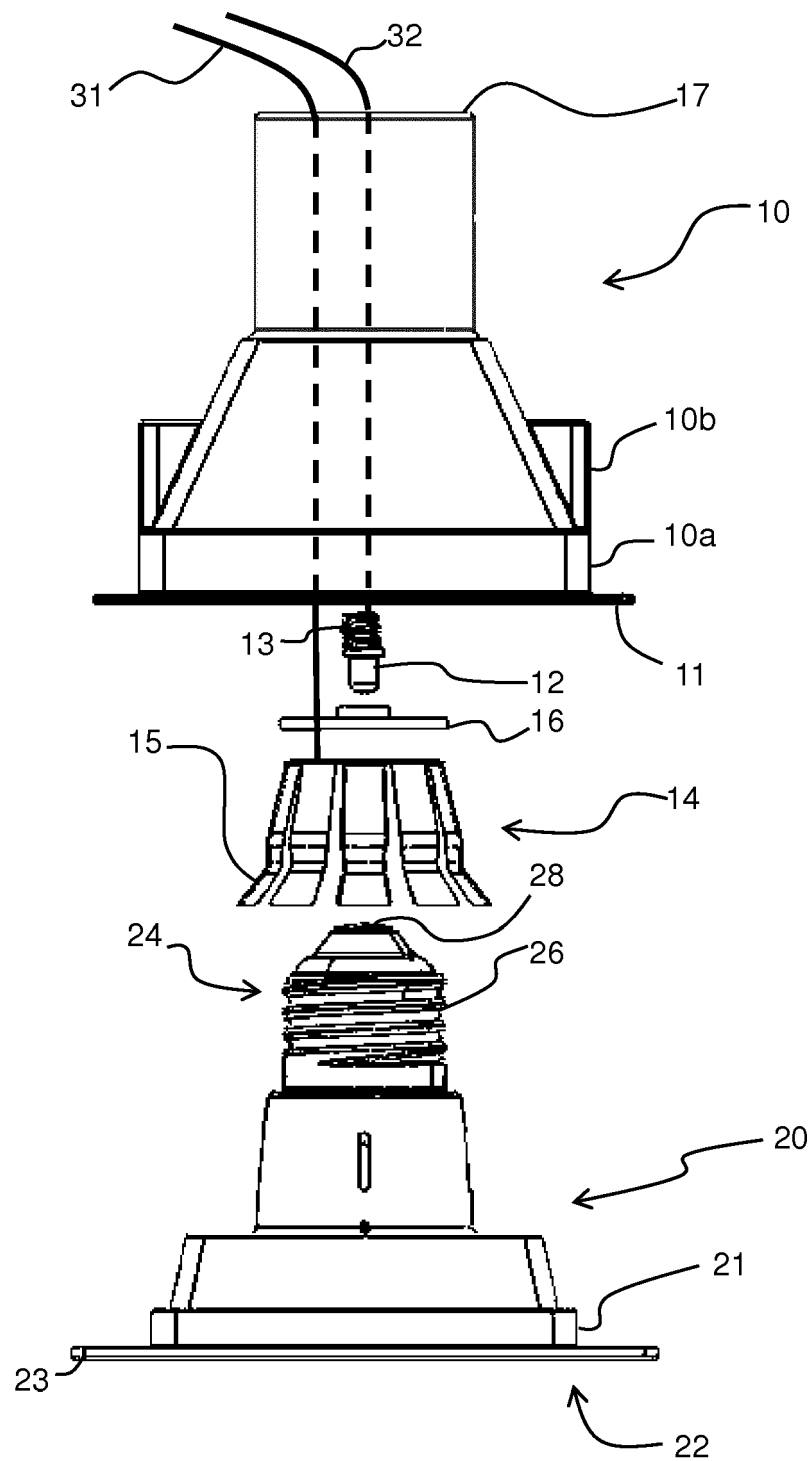


FIG. 1

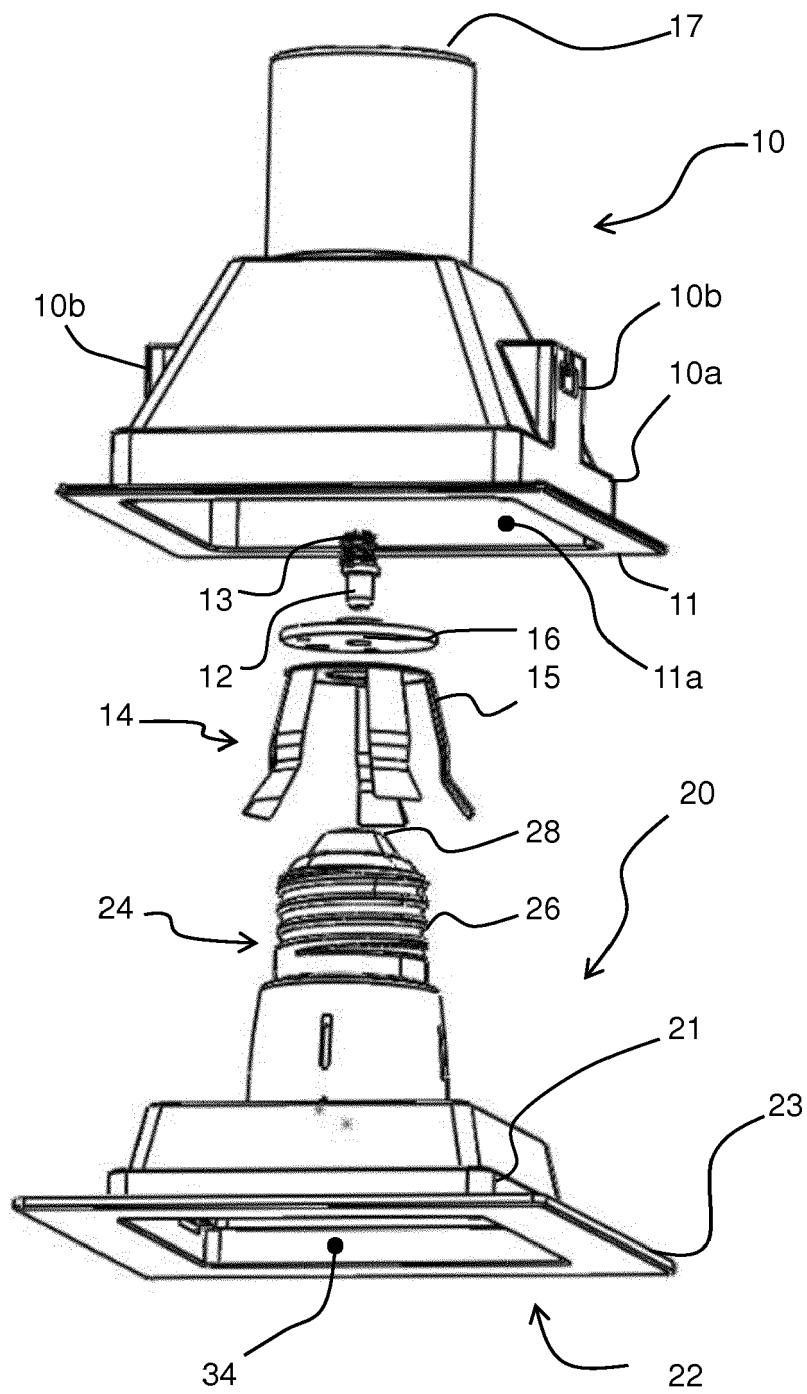


FIG. 2

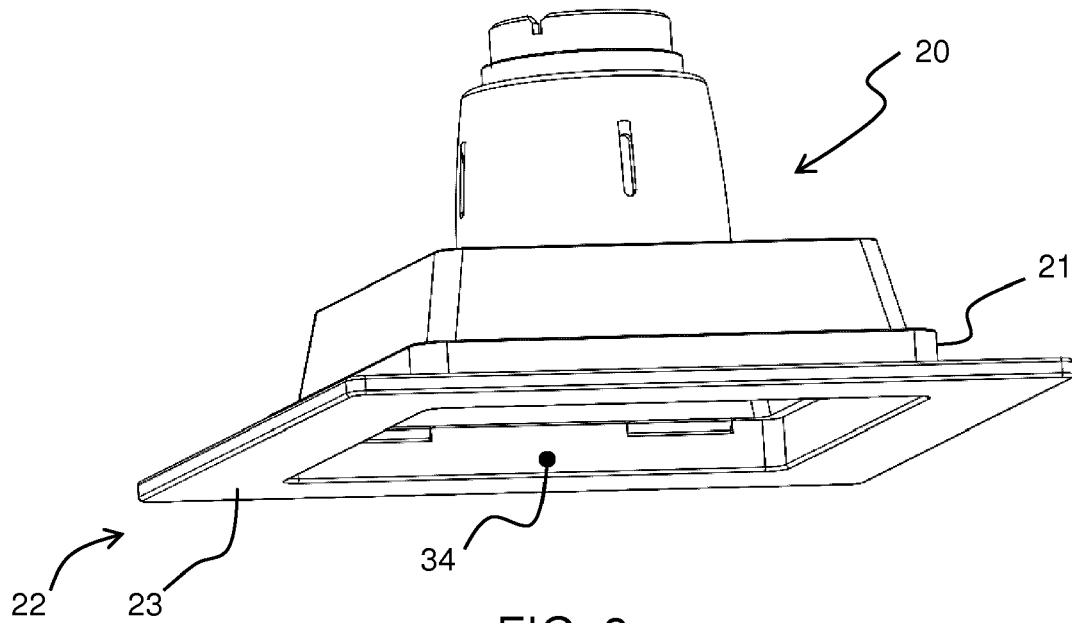


FIG. 3

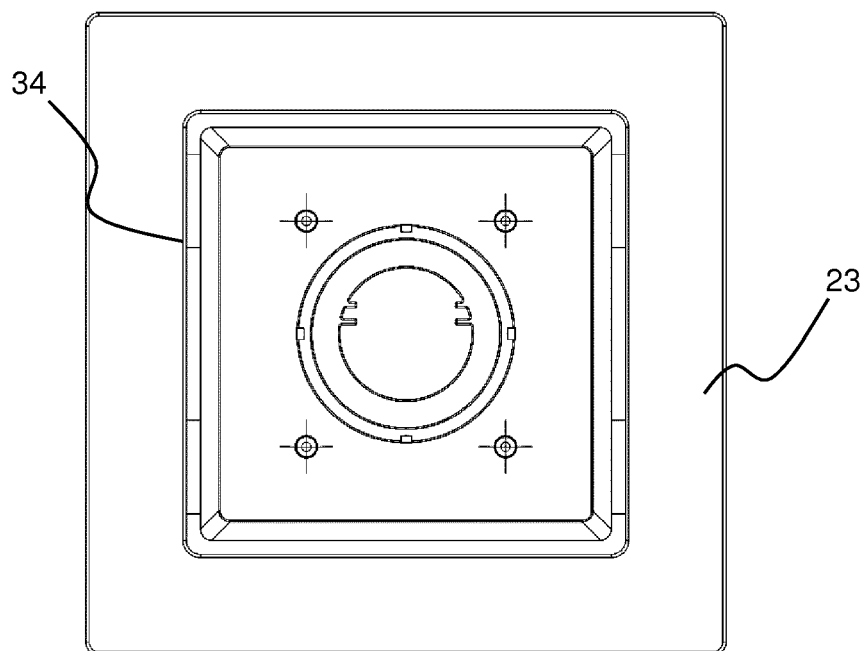


FIG. 4

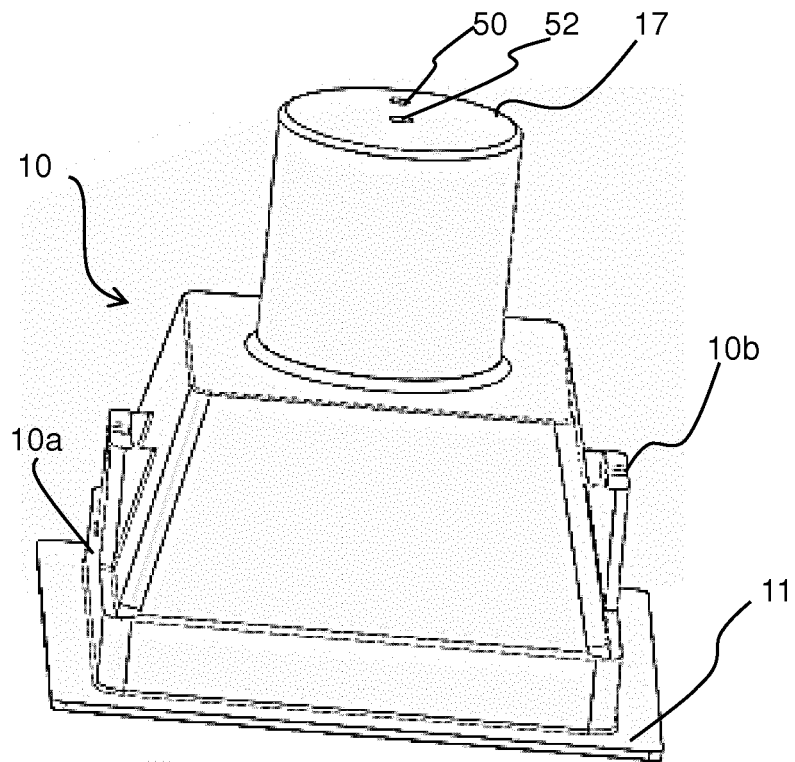


FIG. 5

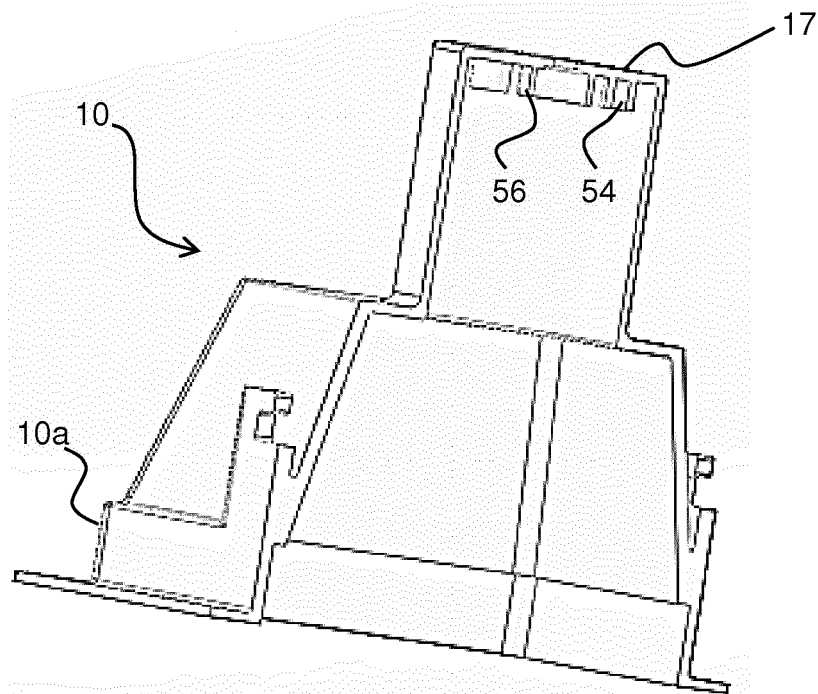


FIG. 6

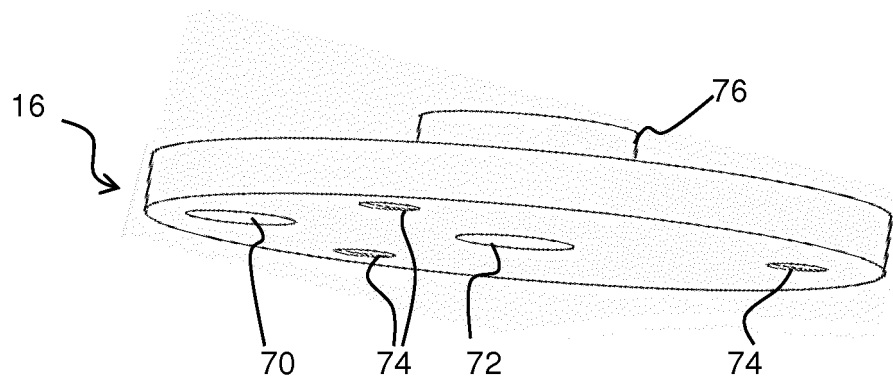


FIG. 7

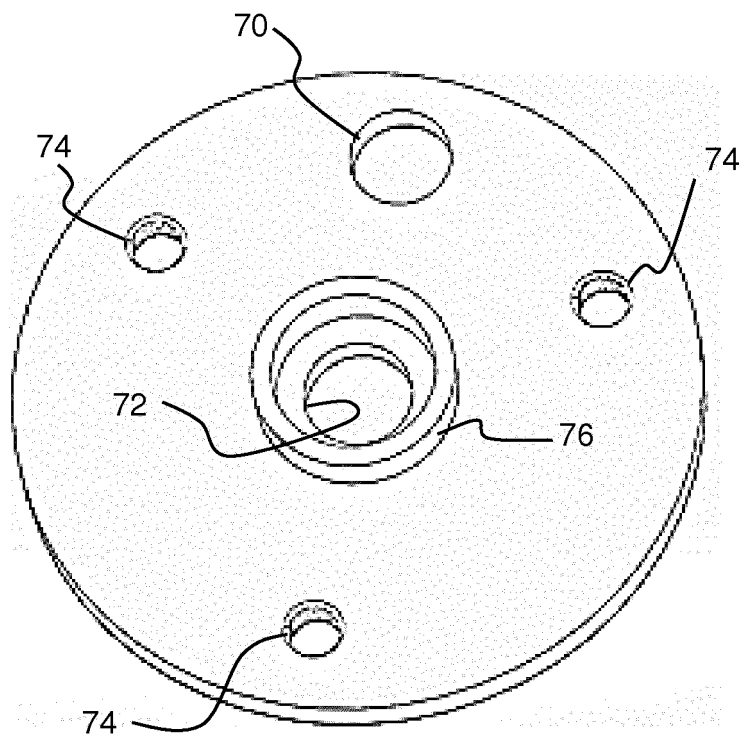


FIG. 8

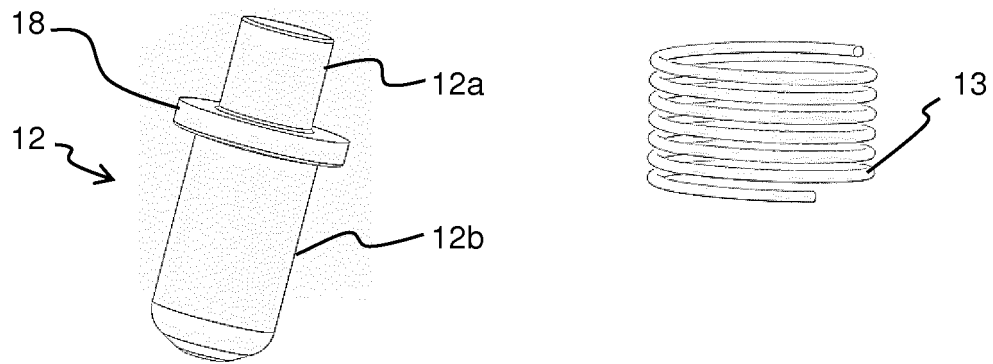


FIG. 10

FIG. 9

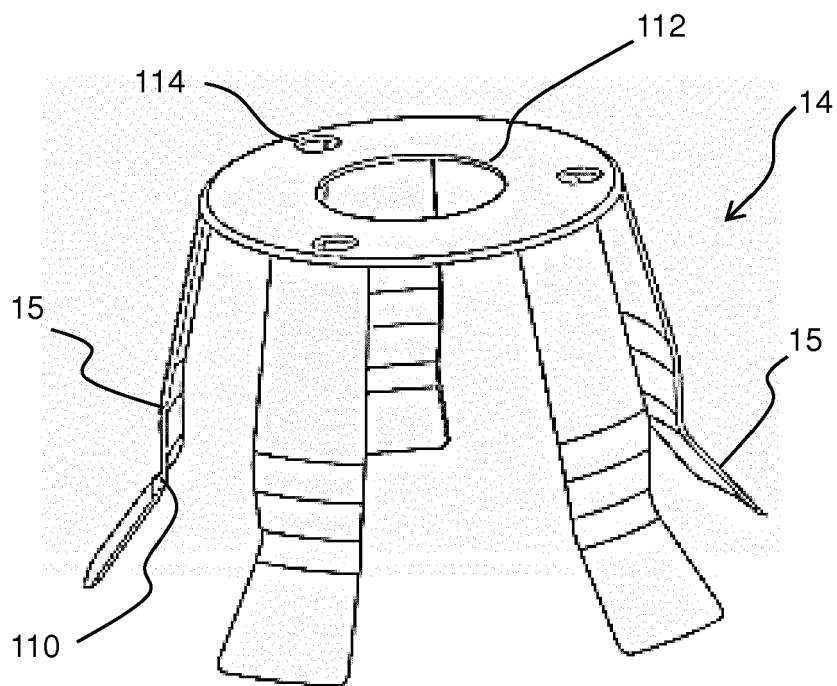


FIG. 11

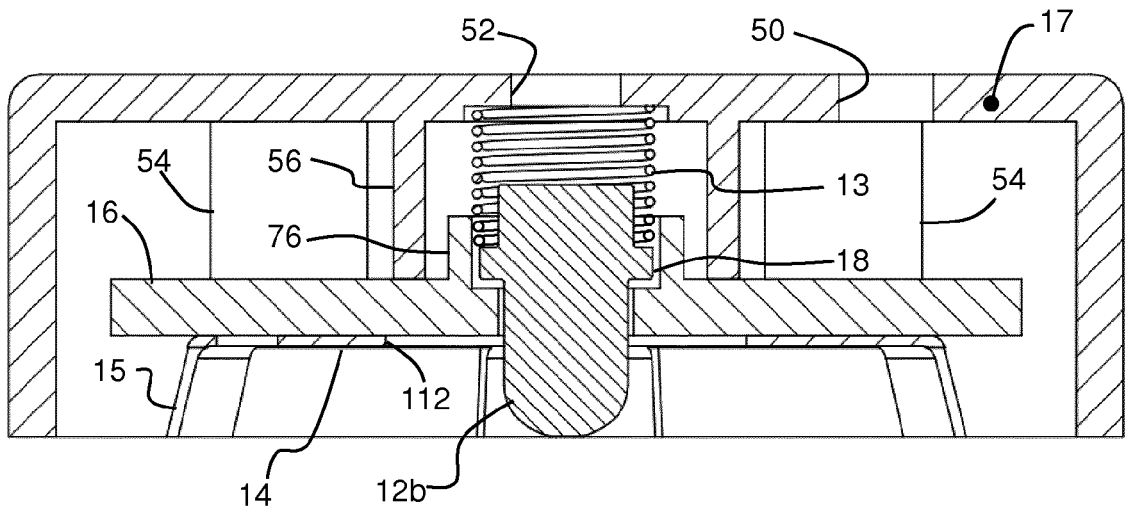


FIG. 12

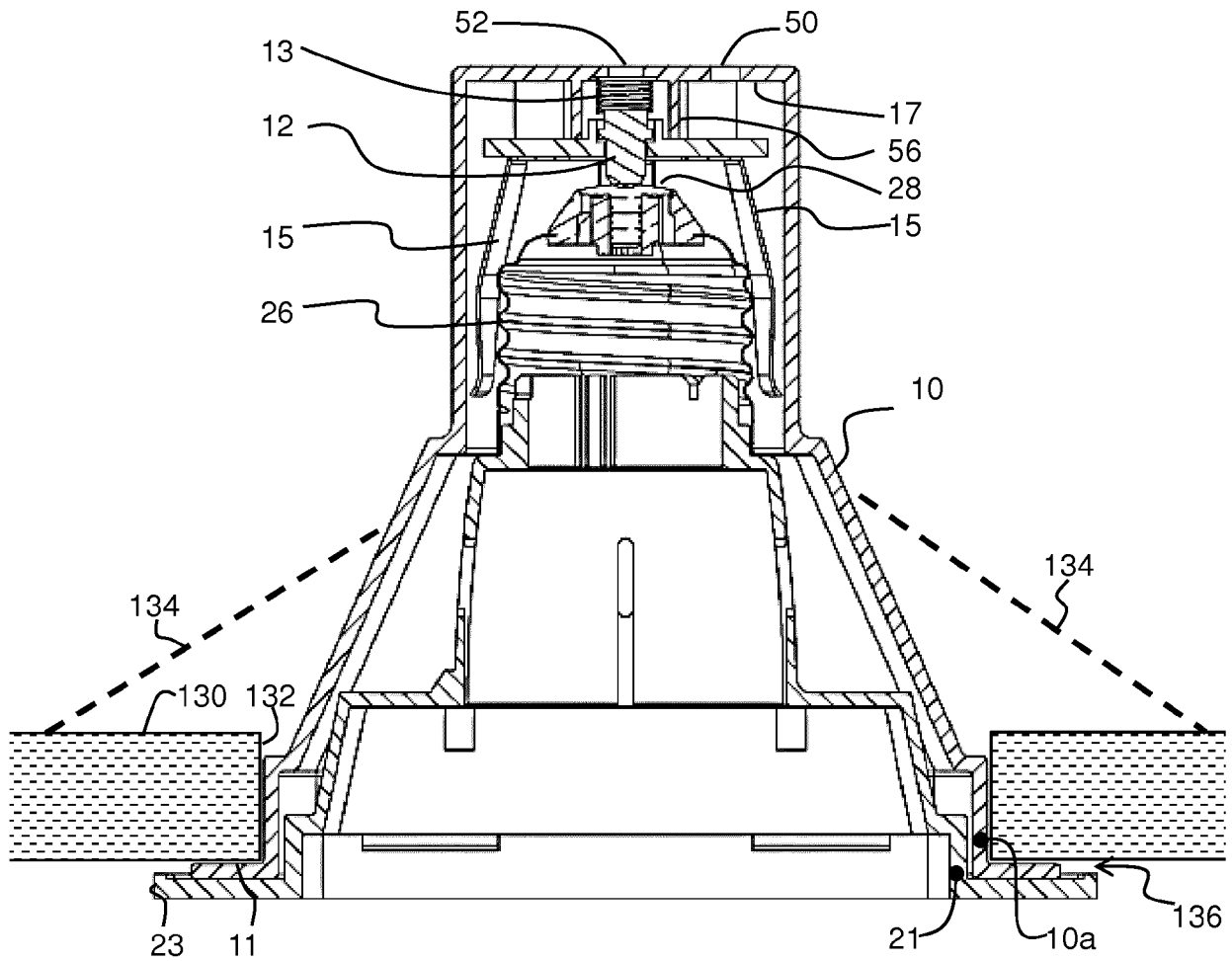


FIG. 13



EUROPEAN SEARCH REPORT

 Application Number
 EP 19 18 7577

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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)
X	JP 2016 021308 A (PANASONIC IP MAN CORP) 4 February 2016 (2016-02-04)	15	INV. F21K9/233 F21S8/02 F21V23/06 H01R13/24 H01R33/22
Y	* paragraphs [0010] - [0039]; figures 1-4 *	1-14	

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Y	* paragraphs [0060] - [0072]; figures 9-10 *	1-14	

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Y	* paragraphs [0012] - [0030]; figures 1-2 *	1-14	

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Y	* the whole document *	1-8,13,14	ADD. F21Y115/10

X	US 7 294 006 B1 (CHEN CHUAN-YING [TW]) 13 November 2007 (2007-11-13)	15	
Y	* column 3, line 34 - column 5, line 25; figures 1-6 *	1-14	

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Y	* the whole document *	1,2,4-8,13,14	

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Y	* the whole document *	1,2,4-8,13,14	

The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 26 November 2019	Examiner Thibaut, Arthur
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 18 7577

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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