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(54) **LED lighting device**

(57) The present invention concerns a LED lighting device comprising a LED (4), a support body (2) for the LED (4), power supply means (17) for supplying power to said LED (4), a securing device (3) comprising a support element (18) for supporting said power supply means (17), said support element (18) comprising a first support element (18A) and a second support element (18B), which are mutually associated to allow rotation of said first support element (18A) relative to said second support element (18B) about a preset axis of rotation (7); The device is characterized in that the power supply means (17) include first power supply means (17A) in rotatably joined relation to said first support element (18A), second power supply means (17B) secured to said second support element (18B), said first power supply means (17A) and said second power supply means (17B) being in electrical communication with each other, to supply power to said LED (4) even when there is a seamless rotary movement of said first support element (18A) relative to said second support element (18B).

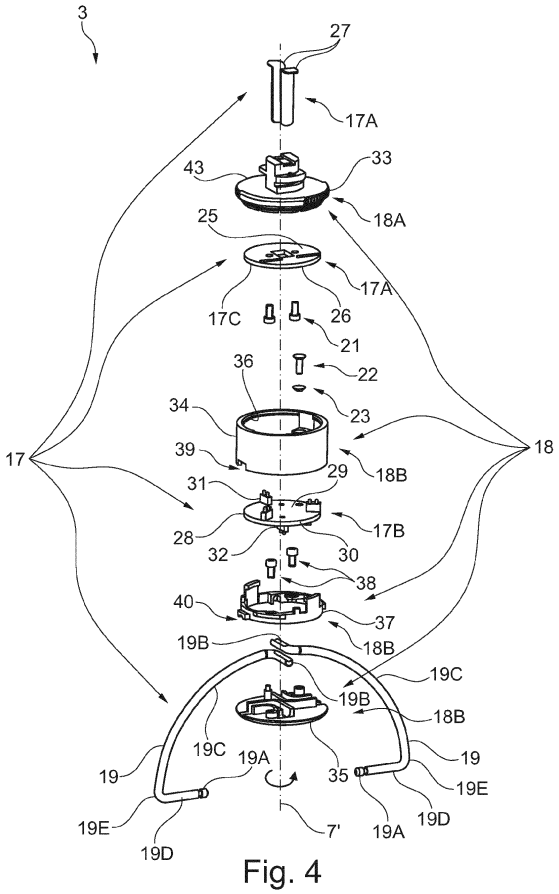


Fig. 4

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Description

Field of the Invention

[0001] The present invention relates to a LED lighting device, particularly but without limitation to a low voltage supply LED lighting device as defined in the preamble of claim 1.

Background art

[0002] LED lighting devices are known in the art, which comprise a concave reflector designed to reflect the light emitted by the LED along one axis of the reflector.

[0003] LED lighting devices are also known, which are mounted to a support secured via more or less articulated systems to additional supports, to be coupled to an electrified track. Such articulated systems allow the light beam generated by the LED lighting device to be oriented as needed by the user.

[0004] For example, CN 201697073U discloses a LED lighting device mounted to a support which is in turn secured via an articulated system to a ceiling or a vertical wall to be coupled to an electrified track from which it receives supply voltage.

[0005] Nevertheless, while these articulated systems provide advantages in many respects, they still suffer from certain drawbacks, including the one of not allowing the LED lighting device to rotate about an axis of rotation (e.g. extending transverse, preferably orthogonal to said ceiling or said vertical wall) beyond a given rotation angle.

[0006] For example, in prior art LED lighting devices, the maximum admitted rotation is limited due to the obstacle created by the LED power cords. This occurs regardless of whether these cords are external or internal to the LED support and/or the articulated system. The short length of the power cord usually only affords constrained rotation of the lighting device about said axis of rotation.

[0007] Therefore, to orient the LED lighting device, the user must remove the LED lighting device from the articulated system and mount it thereto again in a new position, fulfilling his/her needs.

[0008] This constraint is an apparent limit whenever the LED lighting device should be oriented to define an appropriate light beam direction.

Object of the Invention

[0009] In the light of the above described prior art, the present invention has the object of providing a LED lighting device that can allow seamless rotation relative to the articulated coupling system, while ensuring power supply to the device.

[0010] According to the present invention, this object is fulfilled by a LED lighting device having the features as defined in claim 1.

[0011] The present invention provides a LED lighting device that can rotate relative to the articulated coupling system even through an angle greater than a round angle.

[0012] Also, the present invention provides a device that can adequately dissipate the heat generated by the LED, even when a high-power LED is used.

[0013] Finally, the present invention provides an easy-to-handle LED lighting device, having a simple and compact construction.

Brief description of the drawings

[0014] The characteristics and advantages of the invention will appear from the following detailed description of one practical embodiment, which is illustrated without limitation in the annexed drawings, in which:

- Figure 1 shows a perspective view of a lighting device of the invention, mounted to a support and adapted to be secured, via a securing device, to a wall, according to the present invention;
- Figure 2 shows a perspective exploded view of a few elements of the lighting device of Figure 1;
- Figure 3 shows another perspective exploded view of additional elements of the lighting device of Figure 1;
- Figure 4 shows another perspective exploded view of additional elements of the lighting device of Figure 1;
- Figures 5A to 5D show partially broken-away or enlarged perspective views of the elements as shown in Figure 4;
- Figure 6 shows a sectional view of some of the elements shown in Figure 4.

Detailed description

[0015] Referring to the accompanying figures, numeral 1 generally designates a LED lighting device having a support 2 secured by a more or less articulated securing device 3 to a wall, such as the ceiling or a vertical wall of a room, or a walkway surface; in the example of Figure 1, the securing device is adapted to be mechanically and electrically coupled, via the securing device 3, to an electrified track (not shown).

[0016] The support 2 of the lighting device 1 comprises a LED 4 and a reflector 5 having a preferably concave reflecting surface 6, which is adapted to reflect the light emitted by the LED 4.

[0017] As used herein, the term "LED" is intended to designate any light source comprising one or more light-emitting diodes connected together in various manners, e.g. in parallel and/or series arrangements.

[0018] The LED 4 is supported in facing relation to the reflector 5, and spaced from the reflecting surface 6 thereof.

[0019] The reflecting surface 6 has an axis 7, which may be the axis of symmetry of the surface 6 or, more

generally, an axis that generally defines the direction of the light emitted by the reflecting surface 6.

[0020] The light beams emitted by the LED 4 may have an aperture angle ranging from 0° to 45° with respect to the axis 7 of the reflecting surface 6.

[0021] The reflecting surface 6 of the reflector 5 advantageously has a substantially circular periphery.

[0022] The support 2 of the lighting device 1 comprises a heat sink 8, located at the periphery of said reflecting surface 6 and a support body 9 for the LED 4, which is connected to the heat sink 9 via at least one connecting element 10, e.g. in the form of a connecting fin.

[0023] Preferably, the heat sink 8 is an annular body associated with the periphery of the reflecting surface 6 in encircling relation thereto.

[0024] Preferably, the support body 9 is connected to the heat sink 8 via two fins 10, 11.

[0025] Preferably, the support body 9 consists of an annular body.

[0026] Advantageously, the two fins 10, 11 and the support body 9 lie along a diameter of the periphery of the reflecting surface 6.

[0027] It shall be noted that the heat sink 8, the two fins 10, 11 and the support body 9 are symmetric with respect to the axis of symmetry 7 of the reflecting surface 6.

[0028] The fins 10, 11 and said support body 9 are made from high thermal conductivity materials, to conduct the heat generated by the LED 4 to the ring-shaped heat sink.

[0029] Preferably, the LED support body 9, the connecting fins 10, 11 and the heat sink 8 associated with the periphery of the reflecting surface are formed into one piece.

[0030] Preferably, the LED support body 9, the connecting fins 10, 11 and the heat sink 8 are made of metal, or another high thermal conductivity material.

[0031] The connecting fins 10, 11 and the ring-shaped heat sink 8 dissipate the heat generated by the LED to the outside.

[0032] Advantageously, the connecting fins 10, 11 have a flat shape and are oriented over a plane that contains the axis 7 of the reflecting surface 6.

[0033] As shown in Figure 2, the reflector 5 is adapted to be joined by snap fit engagement with the heat sink 8 through a coupling tooth 5A on the annular edge of the reflector 5 and a corresponding seat 8A on the body of the heat sink 8. Such coupling arrangement affords two advantages: assembly is quicker during manufacture and the final user can replace the reflector with other reflectors of different optical shapes (alternative reflectors being referenced 5', 5", 5"' and respective coupling teeth being referenced SA', 5A", SA"' in Figure 2) to obtain a light beam as close as possible to his/her needs, without having to replace the entire device or the optical LED-supporting part.

[0034] Referring to Figure 3, the support 2 of the lighting device 1 is shown to comprise a closure element 12 having anchor means 13 configured to be coupled to respective mating anchor means 14 for sandwiching the reflecting surface 6 of the reflector 5 between the heat sink 8 and the closure element 12 itself.

[0035] Particularly, the anchor means 13 are configured to couple to respective mating anchor means 14 to secure the support body 9 for the LED 4, the connecting fins 10, 11 and the heat sink 8 to the support 2.

[0036] The anchor means 13 are designed to be engaged with and released from the mating anchor means 14 manually, without using tools. For this purpose, appropriate engagement means 15 are provided on the anchor means 13 for engagement into appropriate mating engagement means 16 on the mating anchor means 14.

[0037] Particularly, both anchor means 13 and mating anchor means 15 consist of a coupling ring; whereas the engagement means 15 consist of a pair of pins 15A, 15B having a head and a shank, with the head having a larger cross section than the shank. Therefore, the pins form an undercut that can establish an axial securing arrangement, as the mating engagement means 16 include a pair of seats 16A and 16B.

[0038] For this purpose, still referring to Figure 3, the seats 16A, 16B that receive the corresponding pins 15A, 15B include a section that allows axial of the pin head there through, and an undercut portion in which the pin head is engaged in the assembled state.

[0039] Figure 3 also shows that the anchor means 13 include a boss 20 that prevents reversed assembly of the anchor means 13 and the mating anchor means 14.

[0040] This boss 20 is designed to engage with one of the two seats 16A and 16B only. For example, such one seat 16A is designed to be appropriately shaped at a portion 16C thereof, preferably its end portion, for unique coupling of the boss 20 and the portion 16C.

[0041] Once the rings 13, 14 are coupled together, also referring to Figure 2, clamp means 42 (e.g. consisting of a plurality of screws) are provided to hold the reflector 5 against the heat sink 8 by clamping the reflector 5 between the rings 13, 14 and the heat sink 8.

[0042] Preferably, the lighting device 1 may include two screens 41, lying over the plane of the periphery of the reflecting surface 6 to close the concavity formed by the reflector 5. This improves protection against introduction of solid bodies, and provides a more uniform light beam emitted from the reflector.

[0043] Referring now to Figure 4, the securing device 3 of the lighting device 1 comprises power supply means 17 for supplying power to the LED 4 and a support element 18 for supporting the power supply means 17.

[0044] The support element 18 comprises a first support element 18A and a second support element 18B, which are mutually associated to allow rotation of the first support element 18A relative to the second support element 18B about an axis of rotation 7', which may coincide with the axis of symmetry 7 of the reflecting surface 6.

[0045] Particularly, the axis of rotation 7' is an axis extending transverse to the walkway surface, the ceiling or

the vertical wall of a room upon which the device 1 may be mounted.

[0046] In other words, the axis of rotation 7' is an axis that may be, for instance, orthogonal to the walkway surface, the ceiling or the vertical wall.

[0047] In a preferred embodiment, the power supply means 17 and the support element 18 consist of devices whose shape is symmetric with respect to the axis of rotation 7'.

[0048] It should be noted that the first support element 18A and the second support element 18B may rotate about the axis of rotation 7' through an angle equal to or greater than a round angle.

[0049] The power supply means 17 are designed to be supplied with low voltage during normal operation of the lighting device with the LED on.

[0050] As used herein, the term "low voltage" is intended to designate a voltage falling in the SELV range.

[0051] Advantageously, the power supply means 17 are designed to be powered during normal operation of the lighting device with the LED supplied with low voltage.

[0052] In other words, the power supply means 17 receive a voltage falling in the SELV range, which is generated by AC-DC transformers (not shown), with such transformed voltage being transferred through the electrified track to the LED 4.

[0053] Alternatively, the LED 4 may be also supplied with the mains voltage, by appropriately modifying the power supply means 17.

[0054] The lighting device 1 is **characterized in that** the power supply means 17 comprise:

- first power supply means 17A rotatably joined to the first support element 18A;
- second power supply means 17B joined to the second support element 18B;
- the first power supply means 17A and the second power supply means 17B are in electrical communication with each other, to supply power to the LED 4 even when there is a rotary movement about the axis of rotation 7' of the first support element 18A relative to the second support element 18B through an angle equal to or greater than a round angle.

[0055] In other words, the first power supply means 17A and the second power supply means 17B can supply power to the LED 4 even when the first support element 18A rotates relative to the second support element 18B through an angle smaller than, equal to or greater than a round angle (i.e. for rotation values smaller than, equal to or greater than 360°).

[0056] It shall be noted that the first power supply means 17A are configured to receive a supply voltage, i.e. either the mains voltage or a transformed voltage (e.g. transformed by transformers designed to ensure compatibility with SELV values), whereas the second power supply means 17B are configured to receive such power voltage and to generate the voltage required for powering the LED 4.

[0057] In order to secure the first power supply means 17A, in rotatably joined relation to the first support element 18A, clamping means 21 are provided (consisting, for instance, of a pair of screws); likewise, further clamping means 22, 23, e.g. consisting of a clamping screw 22 and a corresponding insulating washer, are provided for securing the second power supply means 17B to the second support element 18B

[0058] In a peculiar aspect, the first and second power supply means 17A and 17B are external to the support 2 of the LED device 1 and are preferably accommodated in the securing device 3.

[0059] In order to supply power to the LED 4, the power supply means 17 include electric contacts 19, which are electrically connected to the LED 4 for powering it.

[0060] Particularly, the electric contacts 19 are in signal communication on the one hand with the second power supply means 17B and on the other with the engagement means 15 (i.e. the pins of the ring 13, see Figure 2).

[0061] As shown in Figure 4, the electric contacts 19 consist of a pair of arms made of an electrically conductive material and is preferably formed with a first curved section 19C (e.g. as an arc of a circle) and with a second straight section 19D, seamlessly connected together by an elbow 19E.

[0062] Particularly, one end 19A of the arms is in electrical communication with the second power supply means 17B and the other end 19B is in electrical communication with the engagement means 15 (i.e. the pins of the ring 13).

[0063] It shall be noted that the ends 19B of the electric contacts 19 are mechanically connected to the mating anchor means 14, to allow the assembly composed of the support 2, the anchor means 13 and the mating anchor means 14, as well as the heat sink 8, to rotate about an axis of rotation 7".

[0064] Such coupling arrangement is embodied by a seat designed to create a form fit with the ends 19B of the electric contacts 19 and allow the assembly composed of the support 2, the anchor means 13 and the mating anchor means 14 as well as the heat sink 18, to rotate about the axis 7".

[0065] It shall be noted that the assembly composed of the support 2, the anchor means 13 and the mating anchor means 14 as well as the heat sink 8 is free to rotate about the axis of rotation 7".

[0066] It shall be noted that, according to a preferred embodiment of the present invention, the first power supply means 17A are in electrical communication with the second power supply means 17B through a wiping contact 24.

[0067] Namely, as shown by the particular embodiment of Figures 4 to 6, the first power supply means 17A comprise:

- a first electric board 17C defining first and second larger surfaces 25, 26, the second surface 26 having

at least one wiping contact track 24;

- power supply lugs 27 (or possibly electric cables) for supplying power to the wiping contact track 24, as the power supply lugs 27 contact the second surface 26 proximate to such wiping contact track 24.

[0068] It shall be noted that the power supply lugs 27 are tightly connected to the first electric board 17C.

[0069] Such first electric board 17C consists of a disk-shaped printed circuit board, with two wiping contact tracks 24 being preferably formed on its second surface 26; the two wiping contact tracks 24 are preferably formed into mutually concentric circular shapes. Each track 24 acts as positive/negative pole or phase/neutral, according to the electronic solution in use, respectively.

[0070] Still referring to the particular embodiment of Figures 4 to 6, the second power supply means 17B comprise:

- a second electric board 28, defining first and second opposite surfaces 29, 30, the first surface 29 having at least one first electric connector 31 for electrically connecting the at least one wiping contact track 24, and the second surface 30 having at least one second electric connector 32 for electrically connecting the end 19B of the electric contacts 19 to supply power to the LED 4.

[0071] In a preferred embodiment, the second electric board 28 consists of a disk-shaped printed circuit board, which actually forms the driver of the LED 4.

[0072] It shall be noted, also referring to Figure 5D, that the first electric connector 31 on the first surface 29 of the second electric board 28 comprises a base 31A having a pin 31B projecting therefrom, and movable in an axial direction of the pin itself, to fit back into the base 31A under the load generated by the first support element 18A in operation.

[0073] For this purpose, elastic means (not show) are provided, which are configured with a predetermined elastic load, i.e. sufficient to cause the first electric connector 31 to abut against the at least one wiping contact track 24, thereby ensuring safe mechanical and electric contact between the two elements.

[0074] Particularly, in the preferred embodiment, three electric connectors 31 are provided, to ensure mutual planar abutment of the two boards 17C and 28, while also allowing power supply to be transferred, through the wiping contact 24, between the boards 17C and 28, to ensure that they can rotate relative to each other about the axis of rotation 7' in a substantially smooth manner even through angles greater than a round angle.

[0075] It shall be noted that rotation of the first support element 18A relative to the second support element 18B, i.e. of the board 17C relative to the driver board 28, is ensured by forming such support element 18A as a disk-shaped element 43 having a coupling cam 33 on its free peripheral edge.

[0076] It should be noted that the second support element 18B comprises a container 34, a bottom 35 and a support element 37.

[0077] In a particularly preferred embodiment, the container 34, the bottom 35 and the support 37 are symmetric with respect to the axis of rotation 7'.

[0078] The following is preferably provided:

- the container 34 is formed of a heat dissipating material and consists, for instance, of a cylindrical element;
- the bottom 35 acts as an insulating plate for the second electric board 28 and consists, for instance, of a disk-shaped element;
- the support element 37 supports the second electric board 28 and consists, for instance, of a cylindrical element.

[0079] Particularly, the second electric board 28 is clamped to the bottom 35 by the support element 37 which is secured to the bottom 35 via appropriate clamping means 38 (e.g. consisting in clamping screws) and coupling teeth 38A which engage the top surface of the second electric board 28.

[0080] The container 34 creates a form fit with the cam 33 and the support element 37; for instance, the container 34 has an annular ridge 36 at a free end thereof, which couples to the coupling cam 33, and a recess 39 at the opposite end, which couples with a tooth 40 that radially projects out of the support element 37.

[0081] The container 34 preferably has a cylindrical symmetry.

[0082] This clearly shows that the objects of the invention have been fulfilled.

[0083] Particularly, the invention provides a lighting device that has relatively small dimensions in the direction of its optical axis and a light weight.

[0084] Also, the invention provides a LED lighting device that can adequately dissipate the heat generated by the LED, even when a high-power LED is used.

[0085] Furthermore, the device achieves a very high optical performance, as well as controlled lighting, as all the light emitted thereby is reflected by the reflector.

[0086] The device also has a compact shape, with no sharp protrusion.

[0087] Finally, the device affords seamless rotation relative to the articulated coupling system, while ensuring power supply to the device.

[0088] A number of changes and variants may be obviously made to LED lighting device of the invention as described hereinbefore, without departure from the scope of the invention, as defined in the following claims.

Claims

1. A LED lighting device, comprising:

- a LED (4);
- a support body (2) for the LED (4);
- power supply means (17) for supplying power to said LED (4);
- a securing device (3) comprising a support element (18) for supporting said power supply means (17), said support element (18) comprising a first support element (18A) and a second support element (18B), which are mutually associated to allow rotation of said first support element (18A) relative to said second support element (18B) about a preset axis of rotation (7");

characterized in that said power supply means (17) comprise:

- first power supply means (17A) rotatably joined to said first support element (18A);
- second power supply means (17B) joined to said second support element (18B);
- said first power supply means (17A) and said second power supply means (17B) being in electrical communication with each other, to supply power to said LED (4) even when there is a rotary movement of said first support element (18A) relative to said second support element (18B) through an angle equal to or greater than a round angle.

2. A LED lighting device as claimed in claim 1, wherein said first power supply means (17A) are in electrical communication with said second power supply means (17B) through at least one electric wiping contact (24).

3. A LED lighting device as claimed in claim 1 or 2, wherein said first power supply means (17A) are configured to receive a supply voltage, either the mains voltage or a transformed voltage, whereas the second power supply means (17B) are configured to receive such power voltage and to generate the voltage required for powering the LED (4).

4. A LED lighting device as claimed in any preceding claim, wherein said first power supply means (17A) comprise a first electric board (17C) defining a first (25) and a second opposite surface (26), said second surface (26) having said at least one wiping contact (24).

5. A LED lighting device as claimed in claim 2, wherein said first power supply means (17A) comprise power supply lugs (27) for supplying power to said at least one wiping contact (24), said power supply lugs (27) contacting said second surface (26) of the first electric board (17C).

6. A LED lighting device as claimed in claim 2, wherein said second power supply means (17B) comprise a second electric board (28) defining a first (29) and a second opposite surface (30), said first surface (29) having at least one first electric connector (31) for electrically connecting said at least one wiping contact (24).

7. A LED lighting device as claimed in claim 6, wherein said second surface (30) of said second electric board (28) has at least one second electric connector (32) for electrically connecting said electric contacts (19) to supply power to said LED (4).

8. A LED lighting device as claimed in claim 6, wherein said at least one first electric connector (31) on said first surface (29) of said second electric board (28) comprises a base (31A) having a stem (31B) projecting therefrom, and movable in an axial direction of said stem and elastic means interposed between said base (31A) and said stem (31B), the stem (31B) abutting against said at least one wiping contact (24) through said elastic means.

9. A LED lighting device as claimed in claim 1, wherein said first support element (18A) comprises a disk-shaped element (43) having a coupling cam (33) defined on its free peripheral edge.

10. A LED lighting device as claimed in any preceding claim, wherein said second support element (18B) comprises a bottom (35), a container (34) and a support element (37), which is secured to said bottom (35) via clamping means (38), said container (34) creating a form fit with said cam (33) at one free end thereof, and a form fit with said support element (37) at the opposite end.

11. A LED lighting device as claimed in claim 1, comprising a reflector (5) which has a reflecting surface (6) adapted to reflect the light from the LED (4), wherein said LED is fixed to said support body in facing relation to said reflecting surface (6).

12. A LED lighting device as claimed in claim 1, wherein said support (2) of the lighting device (1) comprises a closure element (12) having anchor means (13) configured to be coupled to respective mating anchor means (14) for sandwiching the reflecting surface (6) of the reflector (5) between a heat sink (8) and said closure element (12).

13. A LED lighting device as claimed in claim 12, wherein said anchor means (13) include a boss (20) that prevents reversed assembly of the anchor means (13) and the mating anchor means (14).

14. A LED lighting device as claimed in any preceding claim, wherein said reflector (5) is adapted to be joined by snap fit engagement with said heat sink (8)

through a coupling tooth (5A) on the annular edge of the reflector (5) and a corresponding seat (8A) on the body of the heat sink (8).

15. A LED lighting device as claimed in claim 1 wherein said power supply means (17) include electric contacts (19) which are electrically connected to the LED (4) for powering it, said electric contacts (19) being in signal communication with said second power supply means (17B).

16. A LED lighting device as claimed in claim 14, wherein said electric contacts (19) are arms that support said support body (2) for the LED (4).

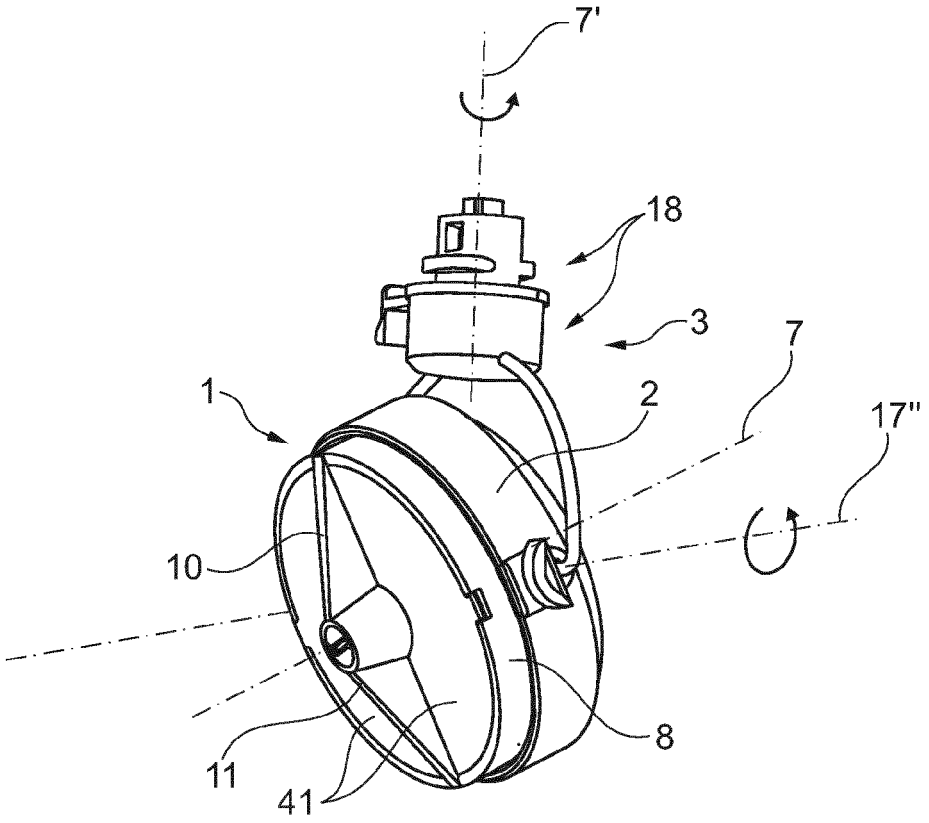


Fig. 1

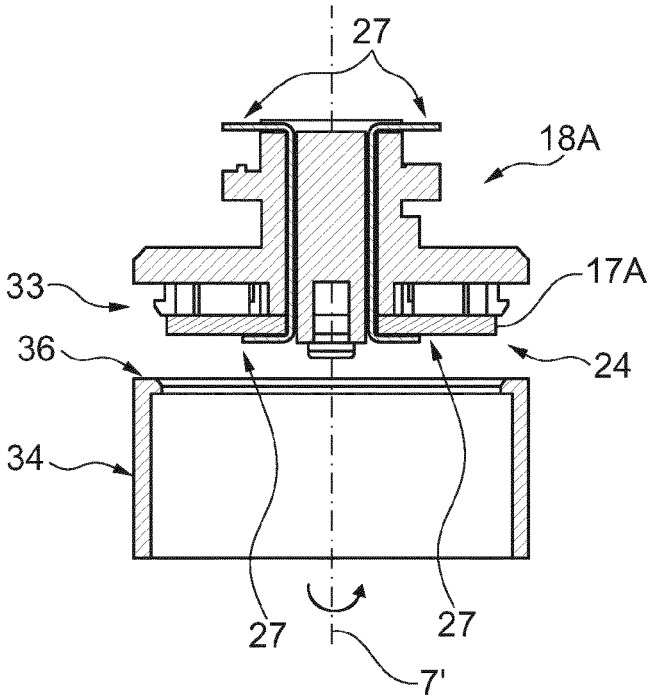


Fig. 6

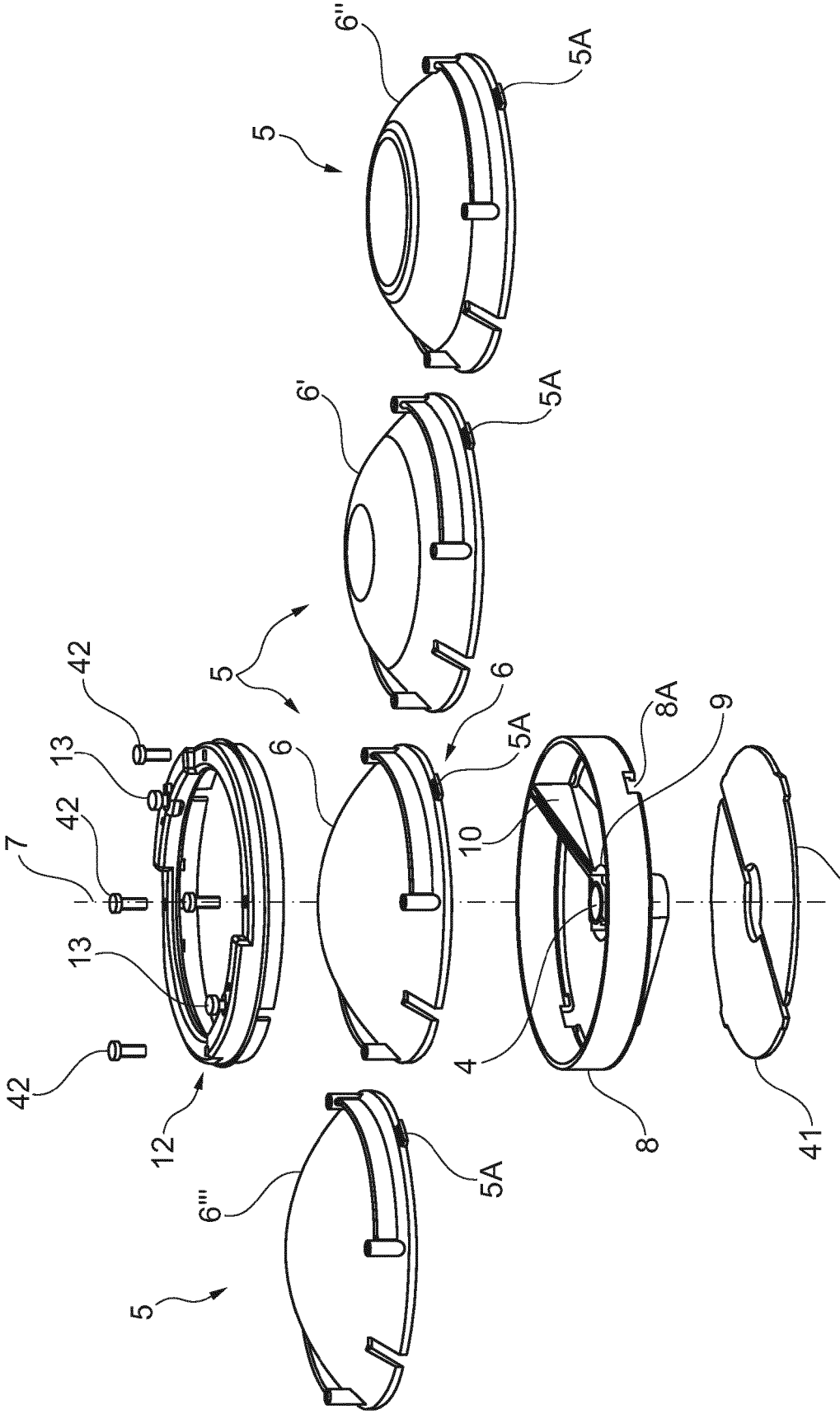


Fig. 2

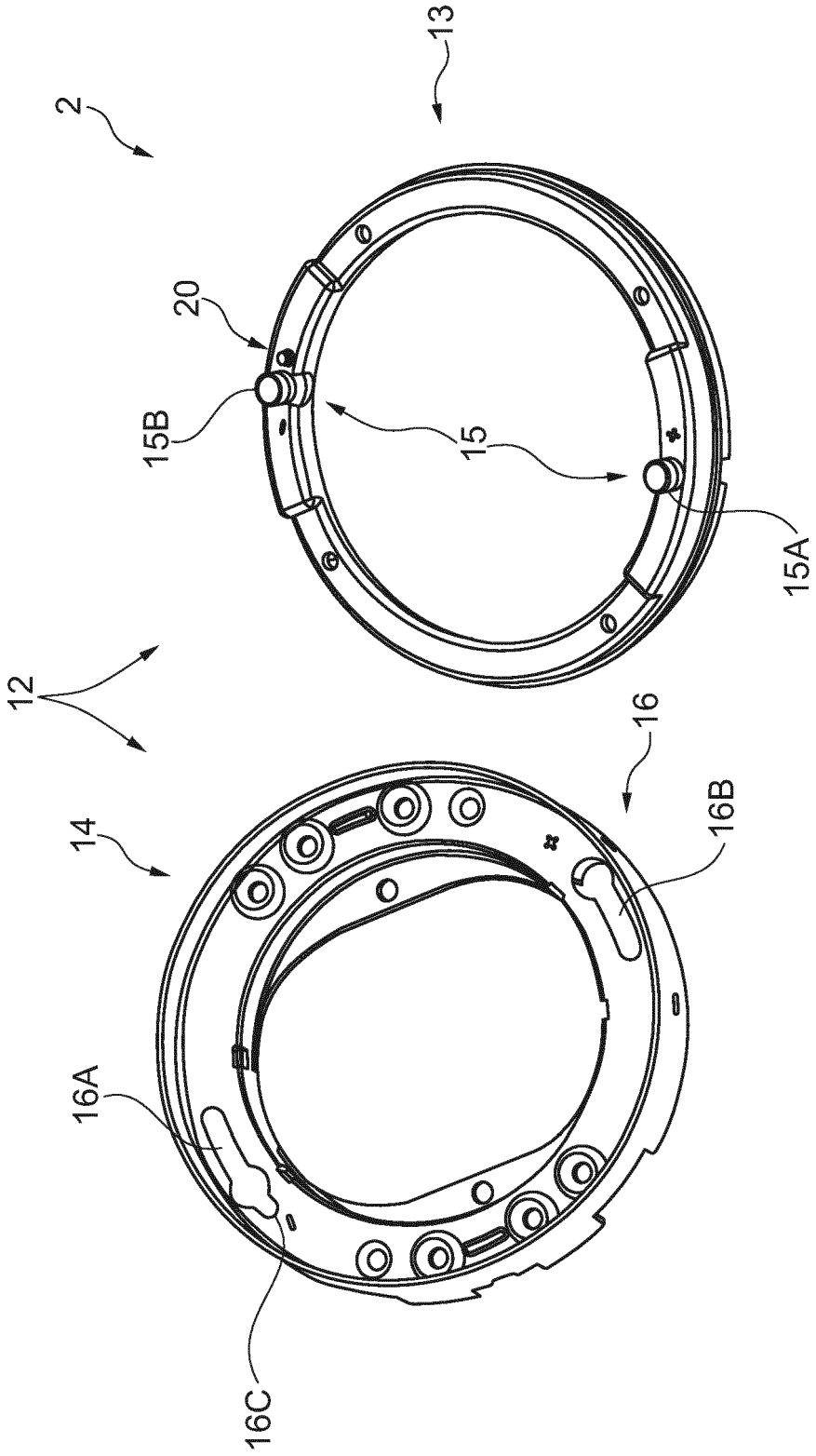


Fig. 3

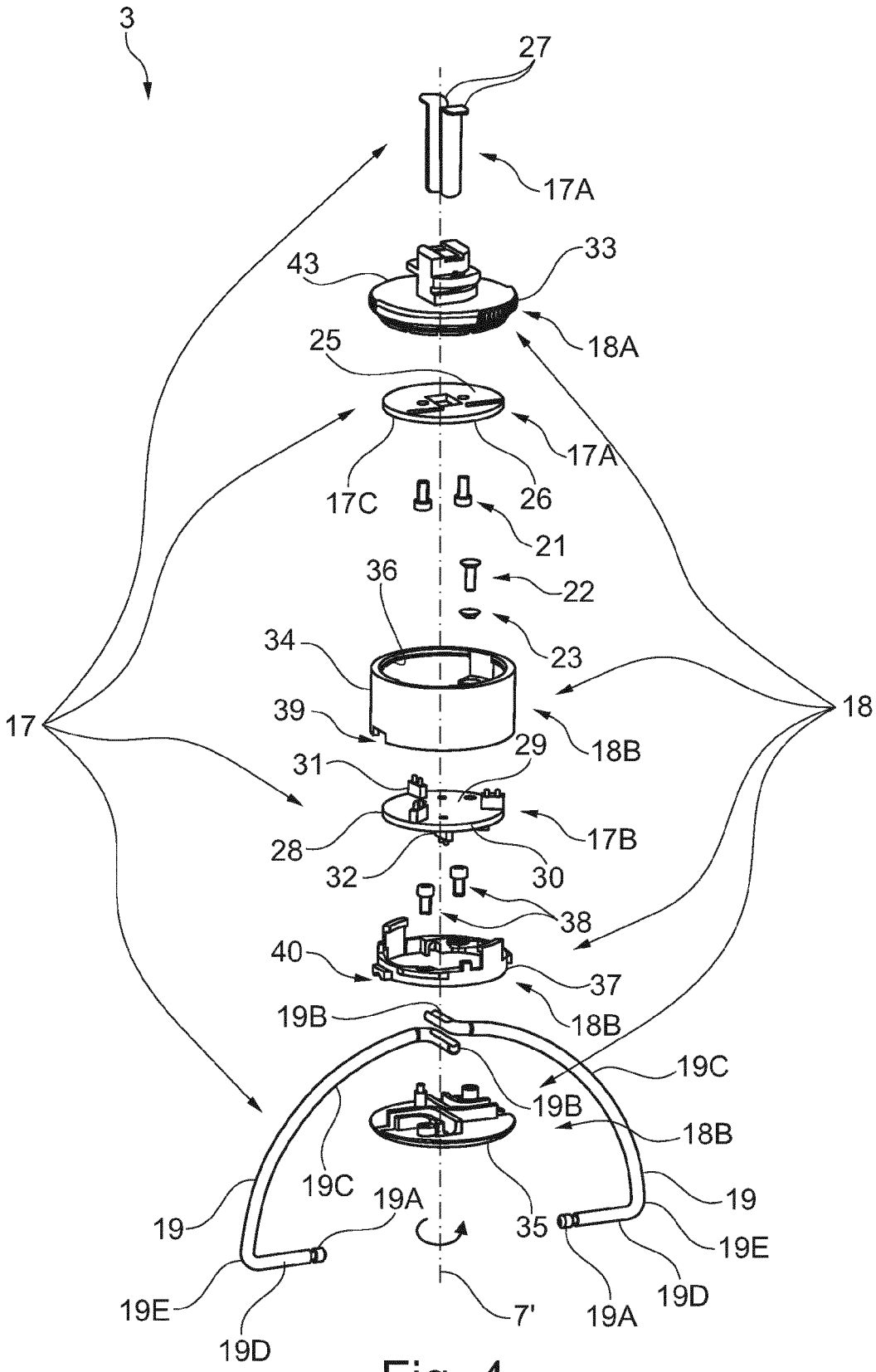

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Fig. 4

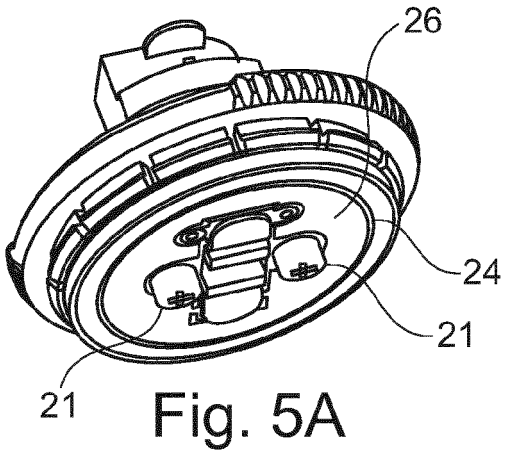


Fig. 5A

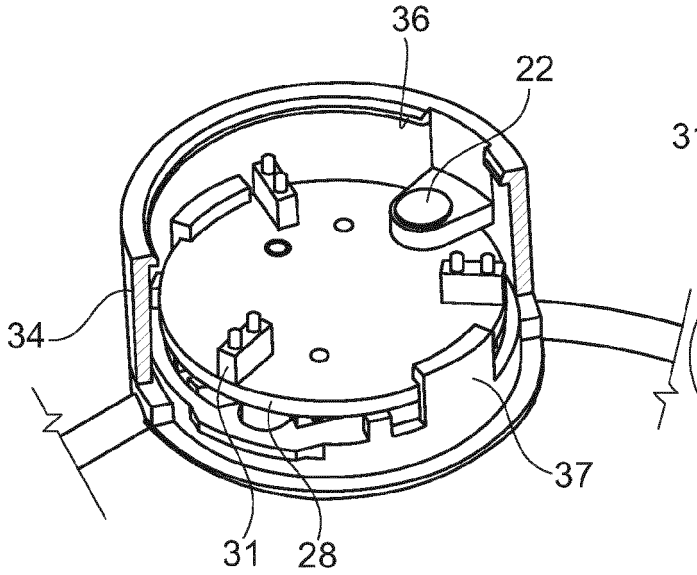


Fig. 5B

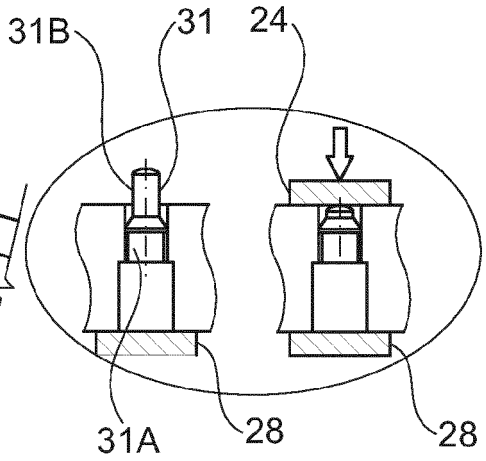


Fig. 5D

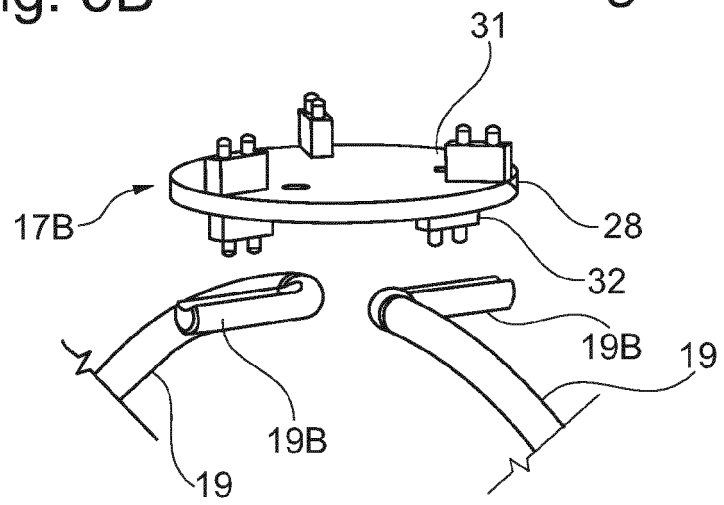


Fig. 5C

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EUROPEAN SEARCH REPORT

Application Number
EP 12 42 5039

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 Y	DE 44 06 042 A1 (WHITAKER CORP [US]) 25 August 1994 (1994-08-25) * column 3, line 45 - column 11, line 12 * * figures 1-13 *	1-3,9, 10,14-16 11-13	INV. F21V7/00 F21V17/16 F21V21/30 H01R33/00
Y A	WO 2011/037876 A1 (CREE INC [US]; VAN DE VEN ANTONY PAUL [CN]; COLEMAN THOMAS G [US]; NEG) 31 March 2011 (2011-03-31) * figures 1-5 * * page 28, line 4 - page 30, line 18 *	11-13 1	H01R35/04 ADD. F21Y101/02
X	US 2 673 966 A (FRANCIS LARKIN JAMES) 30 March 1954 (1954-03-30) * column 2, line 39 - column 4, line 58 * * figures 1-3,10 *	1-8	
X	WO 03/044906 A1 (SAFETY QUICK LIGHT LTD [IL]; KOHEN RAN [IL]) 30 May 2003 (2003-05-30) * page 6, line 7 - page 9, line 18 * * figures 2,6 *	1-5,9, 10,14-16	
A	DE 35 43 087 A1 (STIERS UNTERHALTUNGSELEKTRONIK [DE]) 19 June 1987 (1987-06-19) * column 7, line 52 - column 10, line 50 * * figures 1,2,4 *	1	TECHNICAL FIELDS SEARCHED (IPC) F21V H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19 July 2012	Blokland, Russell

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 12 42 5039

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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19-07-2012

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

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