



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
19.11.2014 Bulletin 2014/47

(51) Int Cl.:
F21V 33/00 ^(2006.01) **F21S 8/08** ^(2006.01)
F21W 111/02 ^(2006.01) **F21W 131/10** ^(2006.01)
F21Y 101/02 ^(2006.01) **F21W 131/103** ^(2006.01)

(21) Application number: **14167797.1**

(22) Date of filing: **09.05.2014**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(71) Applicant: **Fivep S.P.A.**
23875 Osnago (Lecco) (IT)

(72) Inventor: **Cariboni, Dante**
23875 Osnago (Lecco) (IT)

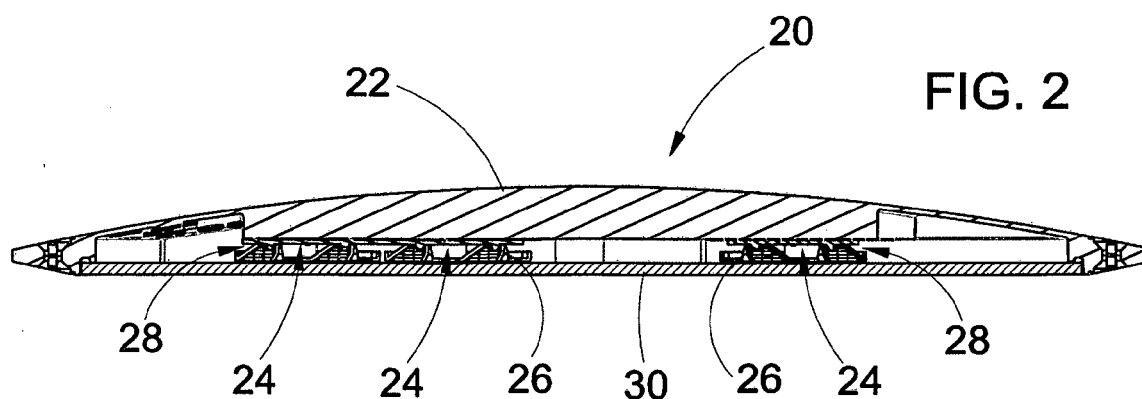
(74) Representative: **Petruzzello, Aldo**
Racheli S.r.l.
Viale San Michele del Carso, 4
20144 Milano (IT)

(30) Priority: **15.05.2013 IT MI20130798**

(54) **Led lighting device with improved light distribution**

(57) An LED (Light Emitting Diode) lighting device (10) particularly suitable for being used for public lighting functions of urban and suburban roads and/or motorways, for the lighting of parking lots, parks and gardens and/or pedestrian areas, for the lighting of street furniture elements such as façades of public and/or private build-

ings or the like, connected to a support pole (12) with a "post-top" or "suspension" connection and comprising modular means suitable for allowing the single lighting device to orientate the distribution of the light beam emitted by LEDs (26) simultaneously according to a bidirectional distribution with respect to the support pole (12).



Description

[0001] The object of the present invention is an LED (Light Emitting Diode) lighting device with improved light distribution.

[0002] More particularly the present invention refers to a lighting device of the LED type particularly suitable for being used for functions of public lighting of urban and suburban roads and/or motorways, for the lighting of parking lots, parks and gardens and/or pedestrian areas. Moreover the same device can be used for the lighting of elements of street furniture such as, for example, façades of public and/or private buildings or the like with poor visibility and which, consequently, require lighting and enhancement by means of special lamps or spot-lights or other known means of lighting.

[0003] Currently the safety laws on pedestrian, vehicle and cycling traffic require the guarantee of correct and optimal lighting not only of the main or vehicle roadways but also of so-called "neighbouring" areas which require safety lighting for possible pedestrians or cyclists or for the vehicles which intend to enter the main roadway.

[0004] The development of lighting devices with LED technology has allowed some typical disadvantages of incandescent or discharge lamps linked to a dispersion of part of the luminous flux to be overcome. This thanks to specific optics suitable for "marginating" the distribution of the beam of light emitted by the LEDs creating a greater benefit in terms of visual comfort and uniformity for users transiting on roads.

[0005] However these lighting devices also have disadvantages linked to poor lighting of the peripheral areas.

[0006] In order to resolve these disadvantages separate lighting devices are typically used, specifically dedicated to the lighting of the main road and the secondary and adjacent routes. More particularly said lighting devices are, generally, mounted on the same support poles or on coupled poles and orientated in such a way as to emit the light beam in the direction of the main road and of the secondary adjacent one, mounted at the same height or at different heights as a function of the specific lighting technology parameters.

[0007] However this traditional solution of lighting has some major disadvantages linked to the need of having to mount, on each support pole or on two coupled poles, two separate lighting appliances optionally provided with features of different light emission as a function of the lighting technology needs of the routes or spaces to be lit.

[0008] This entails an increase in terms of cost linked to the fact that for every pole it is necessary to consider two lighting devices and, consequently, a greater consumption of electrical energy is seen.

[0009] A further disadvantage of traditional lighting devices and technologies is represented by the fact that the use of two lighting devices mounted on a same support pole or on two adjacent poles entails the formation of a "forest" of lighting points which may not be particularly pleasing or suitable from an aesthetic standpoint.

[0010] A further disadvantage linked to the use of several lighting devices mounted on a same support pole is represented by an increase in the costs of maintenance, taking account of the fact that as the number of lighting appliances increases the risk of faults, outages and/or breakages tends to grow.

[0011] A further unfortunate disadvantage is represented by the fact that the installation of a considerable number of support poles, lighting devices, etc. corresponds to a greater causal accidentality dependent on traffic.

[0012] A known solution developed to obviate the above disadvantages is described in the document WO2012/142447 in which reference is made to a lighting appliance comprising a plurality of lighting sources circumferentially arranged so as to be able to produce a distribution of the light beam in all the directions of interest and with said sources of lighting which are, likewise, provided with one or more controls suitable for controlling said sources of lighting in an independent manner.

[0013] This solution, albeit effective in solving the problems relating to the use of several devices mounted on a same support pole, does not solve the problems linked to the variation of the light distribution as a function of the specific lighting technology needs, containing and/or lowering the maintenance and systems engineering costs. This solution in fact cannot easily be configured/reconfigured except by replacing the lighting devices or acting, for example, through electrical inputs.

[0014] Moreover this solution requires considerable structural modifications, not only with reference to the number of lighting sources but also to the components and to the features of the components functional to the functioning of the same lighting sources in order to be able to vary the type of light distribution, for example, from symmetrical to rotosymmetrical or the like with considerable correlated costs.

[0015] These disadvantages can be found in other known solutions of lighting devices such as, for example, those described in the documents DE102011082454 or US2008/0080178 which are designed for specific distributions of lighting and which require considerable and substantial structural modifications in order to vary these features, with a constant increase in the correlated costs.

[0016] The object of the present invention is that of avoiding the disadvantages mentioned above.

[0017] More particularly the object of the present invention is that of providing an LED lighting device which allows simultaneous lighting of main roadways and of the adjacent and secondary ones using a single lighting appliance.

[0018] A further object of the present invention is that of providing a lighting device which allows the lighting distribution to be varied as a function of the specific needs of lighting.

[0019] A further object of the present invention is that of providing a lighting device suitable for allowing a reduction in the costs of systems engineering, of maintenance

nance, of energy consumption, of environmental impact as well for guaranteeing the observance of the aesthetic parameters.

[0020] A further object of the present invention is that of making available to users an LED lighting device suitable for guaranteeing a high level of resistance and reliability in time and such, moreover, as to be able to be easily and economically manufactured.

[0021] These and other objects are achieved by the present invention which has the features as claimed in the independent claim 1.

[0022] According to the invention an LED (Light Emitting Diode) lighting device is provided, connected to a support pole with a "post-top" or "suspension" connection and comprising modular means suitable for allowing the single lighting device to orientate the distribution of the light beam emitted by LEDs simultaneously according to a bidirectional distribution with respect to the support pole.

[0023] Advantageous embodiments of the invention are disclosed by the dependent claims.

[0024] The constructional and functional features of the LED lighting device with improved light distribution of the present invention will be made clearer by the following detailed description, in which reference is made to a preferred and non-limiting embodiment thereof, in which:

Figure 1 shows schematically a front view of an LED lighting device with light distribution of the present invention;

Figure 2 shows a sectioned schematic view of a component of the lighting device of the present invention;

Figure 3 shows schematically different configurations of arrangement of the LED lighting sources for the lighting device of the invention;

Figure 4 shows schematically different configurations of arrangement of the reflecting optics of the lighting device of the invention;

Figure 5 shows a schematic view of the lines of luminous flux emitted by the lighting sources in the case of a bidirectional distribution;

Figure 6 shows at schematic level a diagram of the distribution of the luminous flux or photometric distribution of the lighting device in the case of a bidirectional distribution.

[0025] Referring to the aforementioned drawings, the LED lighting device with improved light distribution of the present invention, denoted overall by 10, is shown in Figure 1 arranged in connection with respect to a support pole 12 by means of an accessory arm 14 in a configuration typically defined as "suspension". However the same lighting device can be arranged directly on the top of the support pole 12 in a configuration typically defined as "post-top".

[0026] The LED lighting device, in the preferred embodiment as per the drawings, is substantially constituted

by three portions defined by a first portion 16 suitable for allowing the connection with respect to the support pole 12 or to the accessory arm 14 and in which all the electrical and electronic components are housed necessary for the functioning of the lighting device, a second portion 18 placed in connection with the first portion on the opposite side with respect to that of connection with the support pole or with the accessory arm and suitable for supporting, on the side opposite to that of connection with the first portion, a third portion 20 defining a lighting body of the lighting device.

[0027] The lighting body defined by the third portion 20, with particular reference to the preferred embodiment as per the drawings, has a substantially disk-shaped configuration and is defined by the container body 22 suitable for housing the PCB (Printed Circuit Board) electronic plates or boards 24 whereon the lighting sources provided with LEDs 26 are positioned and with optics or reflectors 28 (defining secondary optics in addition to the primary optics typically integrated with the LEDs) placed above the electronic plates 24 and suitable for intercepting the beam of light emitted by the LEDs 26 and for reflecting it in the directions required as detailed here below.

[0028] The container body 22 of the lighting body is moreover closed by means of a screen or cover 30 in coloured or transparent plastic material tendentially but not exclusively plate-shaped and to which lenses can be integrated (for example Fresnel lenses) having the function of increasing the luminosity of the beam of light emitted by the LEDs.

[0029] Referring to Figure 3 different configurations of arrangement of one or more electronic plates or boards 24 in the container body 22 are schematised, with said boards defined by modules preferably, but not exclusively, provided with ten, twenty or thirty LEDs and secured inside said container body 22 singly or in groups as a function of the specific lighting needs. For example combinations are possible defined by two modules with ten LEDs, two modules with twenty LEDs, one module with ten and one module with thirty LEDs or, again, a configuration is possible in which a single module with twenty LEDs is used.

[0030] Multiple and different configurations are therefore possible, using different LED boards, in terms of number and/or geometric distribution of the LEDs on the board, arranged singly or in combination one with the other as a function of the specific lighting needs.

[0031] Figure 4 represents a schematisation of different embodiment configurations relative to the arrangement of the optics or reflectors 28 for the management of the light beam emitted by the LEDs as a function of the arrangement of the electronic plates or boards 24, with said optics arranged with reflecting elements orientated in the same direction or opposite as a function of the specific lighting needs.

[0032] The optics 28 are of the type with rotosymmetrical distribution of the luminous flux with photometry

passing on the axis of the lighting device and of the road distribution type in which the distribution of the light beam is directed along the road axis in such a way as to be able to make best use of the photometric emission without dispersing light where it is not needed and without creating points of darkness.

[0033] The optics or reflectors 28 used in the lighting device define modules provided with reflecting elements, preferably but not exclusively ten, such as to allow different distributions of the light beam and, as mentioned previously, are arranged relatively to the electronic plates 24 singly or can be coupled and grouped one in relation to the other in a number of two or more and placed adjacent or distanced one from the other as a function of the specific lighting needs and the arrangement of the electronic plates provided with LEDs.

[0034] For example, with particular reference to what is schematised in Figure 4, a configuration is possible with two assemblies each one constituted by two optics or reflectors 28 coupled and adjacent one in relation to the other or with said two pairs of reflectors distanced one in relation to the other or, again, a configuration defined by a single optic or reflector 28 and by a group of three reflectors distanced with respect to the single reflector or optic, etc.

[0035] As further example Figure 2 shows a sectioned view of the lighting body of the lighting device of the invention, in which two optics or reflectors 28 are present, coupled adjacent one to the other, and a third optic or reflector 28 arranged singly or distanced from the aforesaid pair of reflectors.

[0036] Referring to Figure 5 the condition of a bidirectional distribution of the light beam emitted by the lighting device according to the invention is schematised.

[0037] Figure 6 schematises the photometric diagrams relating to the distribution of the light beam emitted by the lighting device of the invention in the case of a bidirectional distribution as per Figure 5.

[0038] As can be seen from the above the advantages that the device of the invention achieves are clear.

[0039] The LED lighting device with improved light distribution allows advantageously a simultaneous illumination of the zones frontal to the support pole and of the rear ones, i.e. of the main roadways and of the adjacent and secondary ones using a single lighting appliance. This in that it combines optics with rotosymmetrical distribution and optics with road distribution, installed on the axis of the roadway and on the opposite axis, in such a way as to be able to make best use of the photometric distribution without dispersing the light where it is not needed.

[0040] Further advantageous is the fact that the lighting device having the electronic plates or boards with the LEDs and optics of modular type is highly flexible and can be reconfigured as a function of the specific lighting needs and, likewise, allows different levels of lighting to be fulfilled both of roadways and of pavements simply by varying the composition/arrangement of the LED mod-

ules and of the modules of reflecting elements or optics in the manner which best complies with regulations.

[0041] A further advantage is represented by the fact that the lighting device of the invention allows the obtaining, by combining in a different way in terms of number and position, the electronic plates and/or the optics or reflectors, multiple configurations without structural modifications of the lighting appliance.

[0042] A further advantage is represented by the fact that the lighting device of the invention allows advantageously the reduction in the plant costs and energy waste, in that the number of lighting appliances per single support pole is reduced.

[0043] Further advantageous is the fact that the lighting device of the invention does not generate a "forest" of support poles and lighting devices and, consequently, does not impair possible aesthetic or environmental impact parameters.

[0044] Although the invention has been defined above with particular reference to one of its embodiments given solely by way of a non-limiting example, numerous changes and variations will appear clear to a person skilled in the art in light of the description given above. The present invention intends, therefore, to embrace all the modifications and the variations that fall within the scope of the following claims.

Claims

1. An LED (Light Emitting Diode) lighting device (10) particularly suitable for being used for public lighting functions of urban and suburban roads and/or motorways, for the lighting of parking lots, parks and gardens and/or pedestrian areas, for the lighting of street furniture elements such as façades of public and/or private buildings or the like, connected to a support pole (12) with a "post-top" or "suspension" connection and **characterised in that** it comprises modular means defined by one or more electronic plates or boards (24) provided with LEDs (26) and one or more optics or reflectors (28) defining secondary optics provided with reflecting elements which can be combined singly or in groups with number of LEDs (26) equal or different for different configurations suitable for allowing the single lighting device to orientate the distribution of the light beam emitted by LEDs (26) simultaneously according to a bidirectional distribution with respect to the support pole (12).
2. The lighting device according to the preceding claims, **characterised in that** the modules of electronic plates (24) with LEDs are secured internally to a container body (22) of a lighting body of the lighting device.
3. The lighting device according to claim 2 or 3, **char-**

acterised in that the electronic boards or plates (26) comprise ten, twenty or thirty LEDs.

4. The lighting device according to the preceding claims, **characterised in that** the optics or reflectors (28) are arranged above the electronic plates (24) individually or in groups of two or more modules in a manner corresponding to said electronic plates. 5
5. The lighting device according to one or more of the preceding claims, **characterised in that** the optics or reflectors (28) are arranged above the electronic plates (24) with the reflecting elements orientated in the same direction or opposite. 10
15
6. The lighting device according to one or more of the preceding claims, **characterised in that** the optics or reflectors (28) define a rotosymmetrical or road distribution of the luminous flux emitted by the LEDs. 20
7. The lighting device according to any one of claims 5 to 7, **characterised in that** the optics or reflectors (28) are defined by modules comprising ten reflecting elements. 25
8. Method for bidirectional lighting by means of a light beam emitted by LEDs (26) of a single lighting device according to one or more of the preceding claims, **characterised in that** it uses modular elements defined by electronic boards or plates (24) provided with LEDs and superimposed modular elements defined by optics or reflectors (28), said modular elements arranged inside the container body of the lighting body, combined singly or in a group, in order to obtain different configurations suitable for a simultaneous rotosymmetrical and road distribution of the light beam. 30
35
40
45
50
55

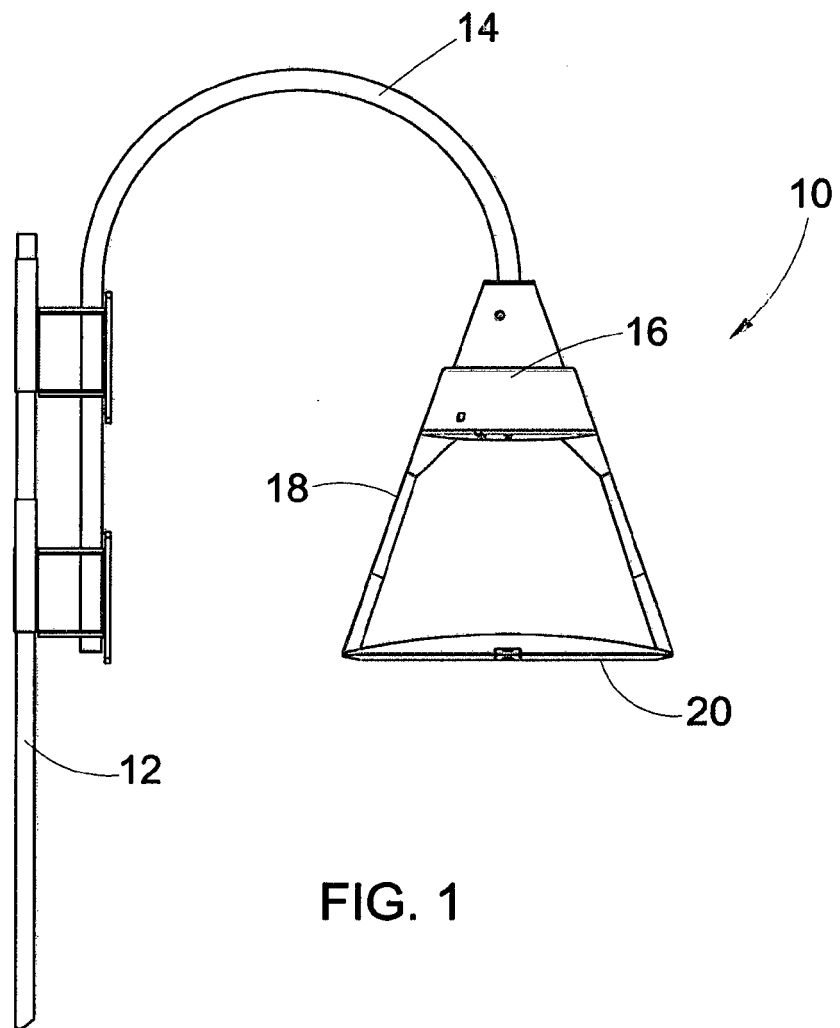


FIG. 1

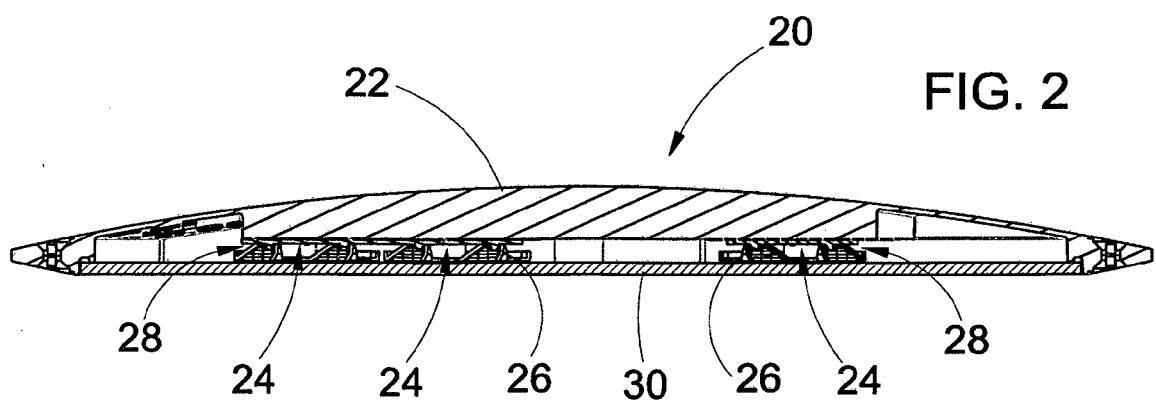


FIG. 2

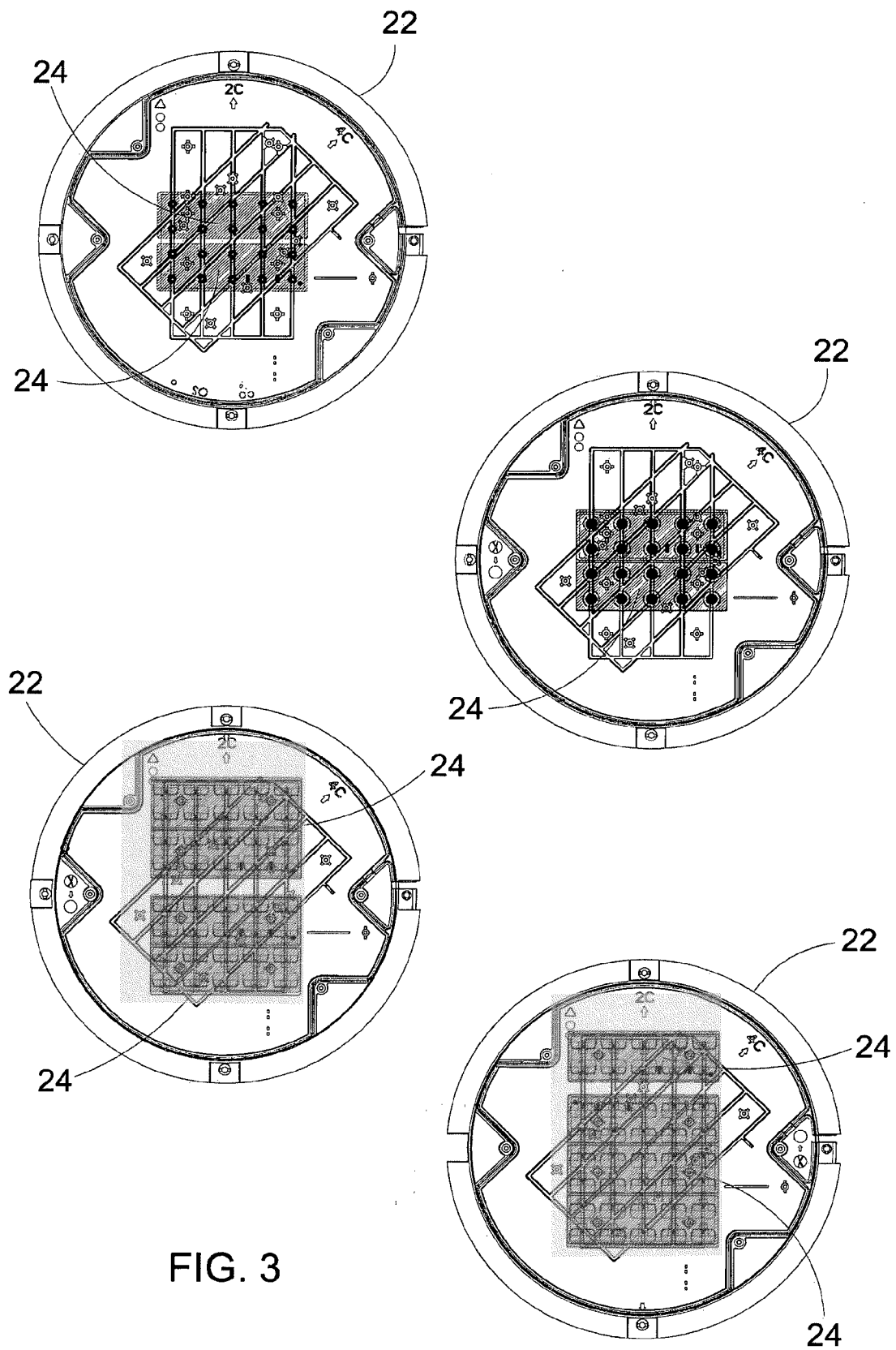


FIG. 3

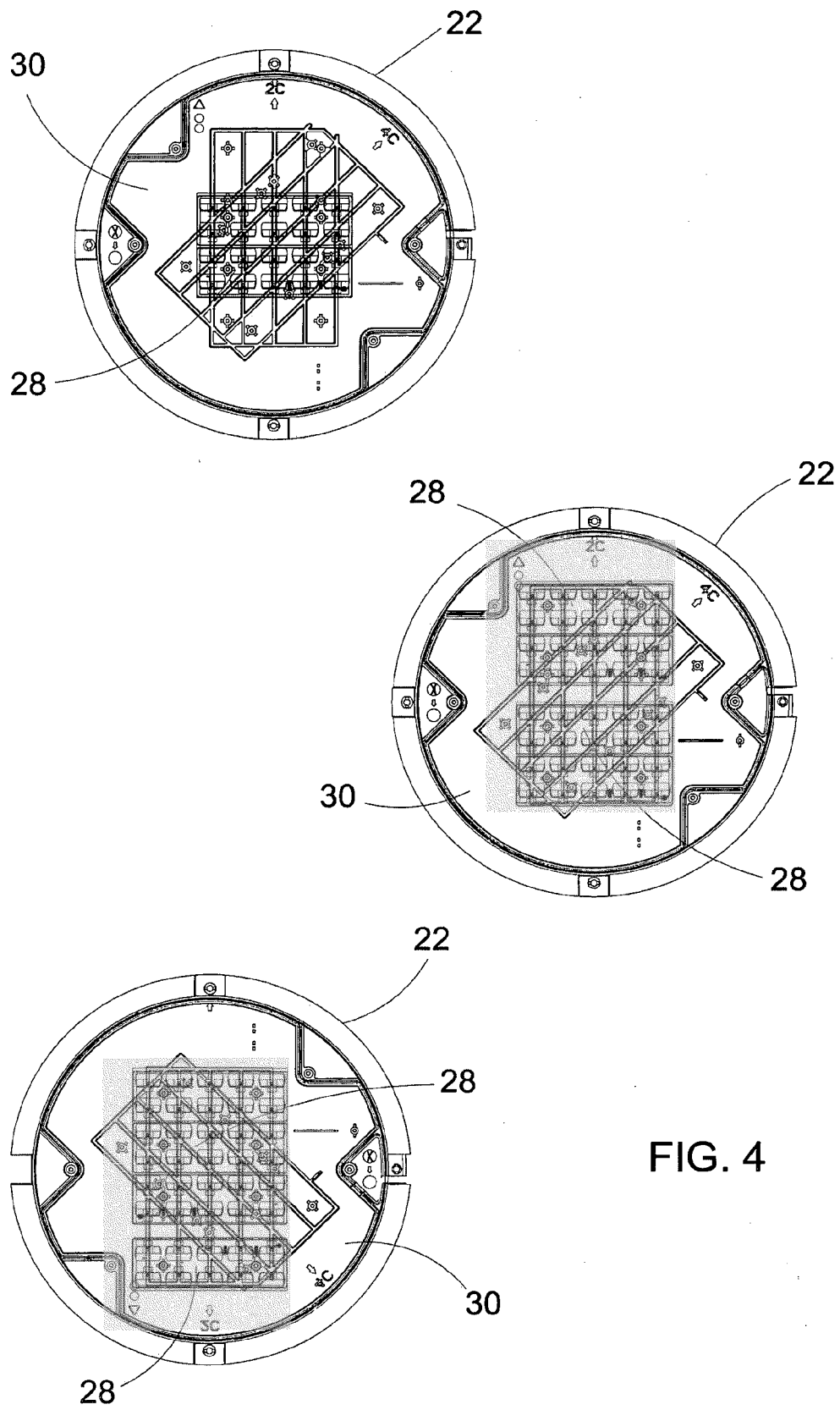
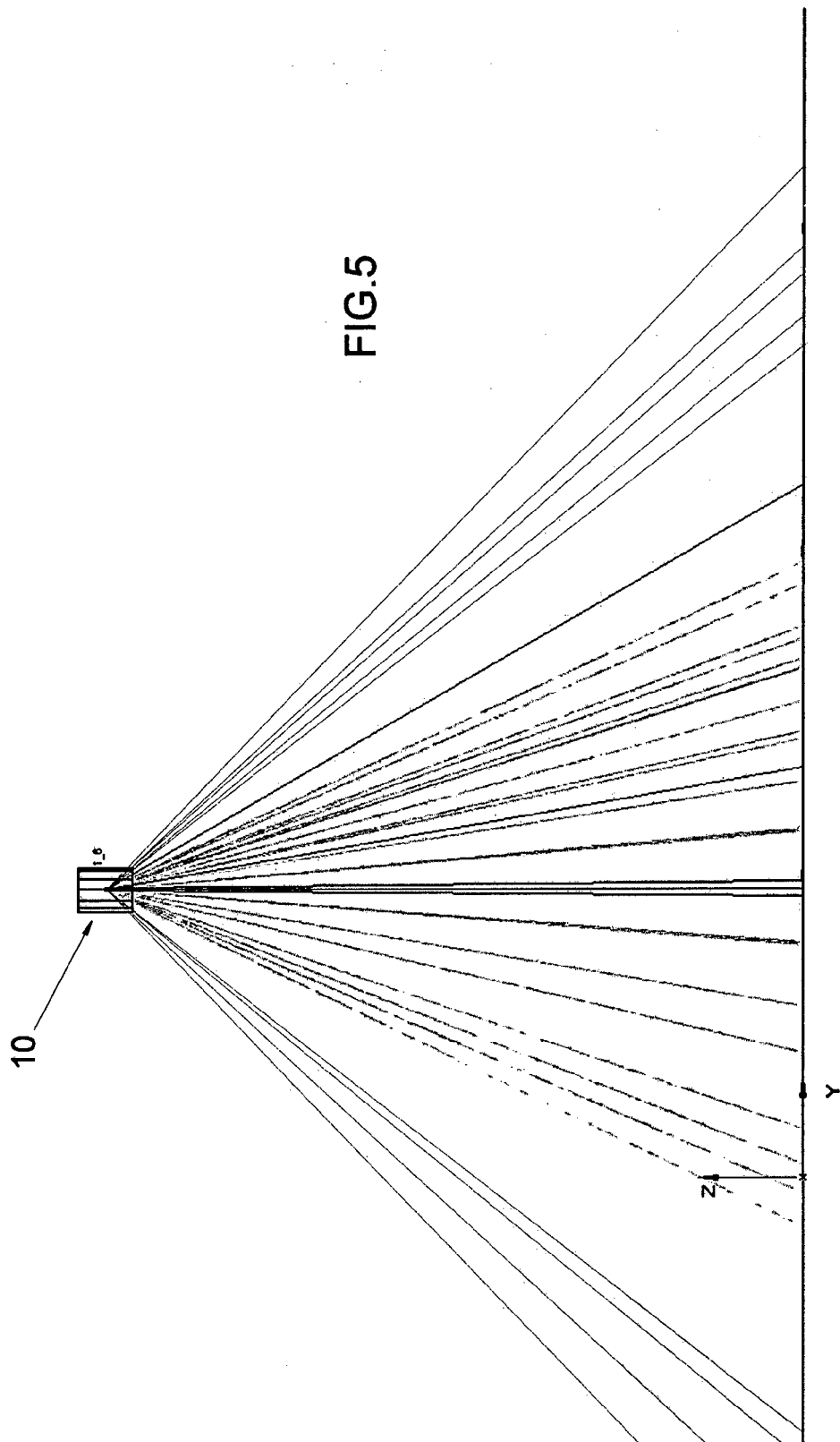


FIG. 4



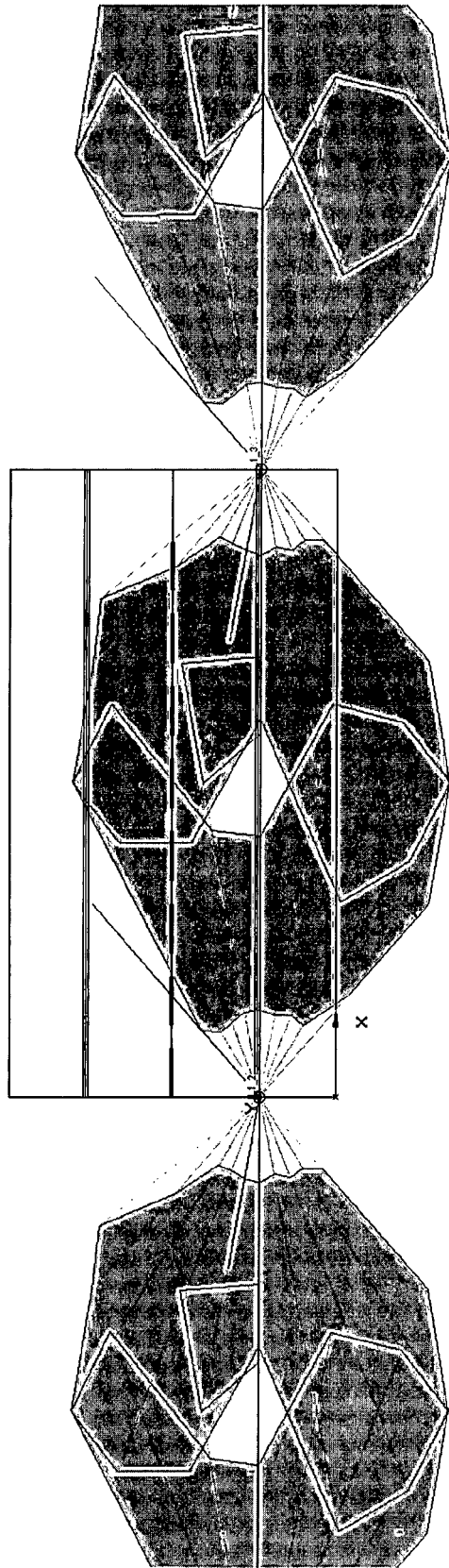


FIG. 6



EUROPEAN SEARCH REPORT

 Application Number
EP 14 16 7797

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	WO 2012/142447 A1 (AMERLUX LLC [US]; LESHNIAK ITAI [US]) 18 October 2012 (2012-10-18) * paragraph [0015] - paragraph [0030]; figures 1-6 *	1-8	INV. F21V33/00 F21S8/08
X	DE 10 2011 082454 A1 (OSRAM AG [DE]) 20 December 2012 (2012-12-20) * paragraph [0027] - paragraph [0038]; figures 1-3 *	1-8	ADD. F21W111/02 F21W131/10 F21Y101/02 F21W131/103
X	US 2008/080178 A1 (KITA YASUSHI [JP] ET AL) 3 April 2008 (2008-04-03) * paragraph [0033] - paragraph [0035]; figures 1,2 *	1,3,4,8	
X	US 2012/287618 A1 (SAITO TAKASHI [JP]) 15 November 2012 (2012-11-15) * paragraph [0034] - paragraph [0047]; figures 1-3 *	1,3,4,8	
X	WO 2010/010494 A1 (KONINKL PHILIPS ELECTRONICS NV [NL]; MOURLHOU SEBASTIEN [FR]) 28 January 2010 (2010-01-28) * page 5, line 18 - page 13, line 18; figures 1-3 *	1-8	TECHNICAL FIELDS SEARCHED (IPC) F21W F21V F21S F21Y
X	WO 2006/132533 A2 (LEMMIS LIGHTING IP GMBH [CH]; ROOYMANS JOHANNES OTTO [NL]) 14 December 2006 (2006-12-14) * page 5, line 30 - page 11, line 25; figures 1-3 *	1-4,6,8	
X	EP 2 405 181 A1 (SCHREDER [BE]) 11 January 2012 (2012-01-11) * paragraph [0019] - paragraph [0045]; figures 1-6 *	1-4,6,8	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 9 September 2014	Examiner Schmid, Klaus
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 14 16 7797

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-09-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2012142447 A1	18-10-2012	US 2014098530 A1 WO 2012142447 A1	10-04-2014 18-10-2012
DE 102011082454 A1	20-12-2012	NONE	
US 2008080178 A1	03-04-2008	CN 101158454 A JP 4745184 B2 JP 2008091232 A US 2008080178 A1	09-04-2008 10-08-2011 17-04-2008 03-04-2008
US 2012287618 A1	15-11-2012	CN 102869920 A EP 2541127 A1 JP 5421817 B2 JP 2011175802 A US 2012287618 A1 WO 2011105423 A1	09-01-2013 02-01-2013 19-02-2014 08-09-2011 15-11-2012 01-09-2011
WO 2010010494 A1	28-01-2010	TW 201018828 A WO 2010010494 A1	16-05-2010 28-01-2010
WO 2006132533 A2	14-12-2006	CA 2609974 A1 CN 101694274 A EP 1891367 A2 KR 20080017023 A US 2009175038 A1 WO 2006132533 A2	14-12-2006 14-04-2010 27-02-2008 25-02-2008 09-07-2009 14-12-2006
EP 2405181 A1	11-01-2012	NONE	

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2012142447 A [0012]
- DE 102011082454 [0015]
- US 20080080178 A [0015]