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(54) **Lighting unit and luminaire for lighting pedestrian crossings**

(57) A lighting unit (1) for use in a luminaire, in particular a luminaire for pedestrian crossing lighting, comprises a light source (3) and a reflector unit (5) to control the distribution of the light emitted by said light source (3), wherein said reflector unit (5) comprises a first reflector surface (7) extending in a longitudinal direction of

said reflector unit (5) and having a trough profile corresponding approximately to an ellipse and second and third reflector surfaces (8, 9) being arranged at the front and rear end of the first reflector surface (7), respectively, the second reflector surface (8) being tilted by around 45° with respect to an light emanating opening (6) of the reflector unit (5).

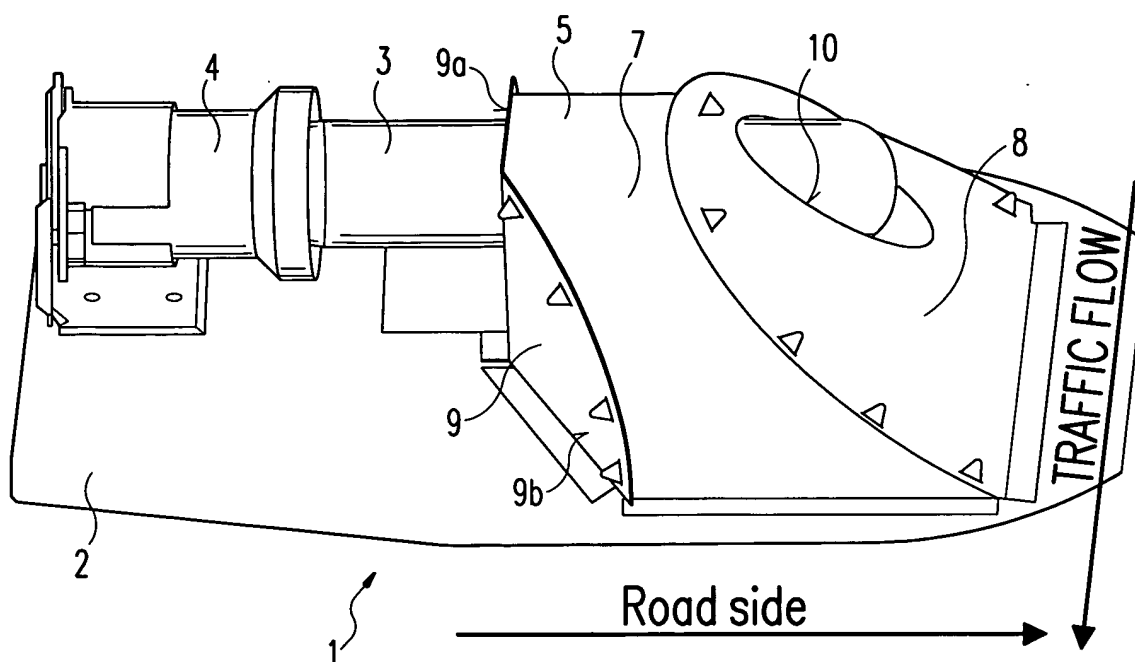


Fig. 1

Description

[0001] The present invention is directed to a lighting unit for use in a luminaire, in particular in a luminaire which is used for lighting pedestrian crossings and their surroundings.

[0002] It is known that even on well lighted roads with luminance levels complying with roadway regulations, for automotive drivers, pedestrians are seen thanks to a negative contrast, i.e., a low average luminance level of the pedestrians compared to the higher luminance level of the road surface. Unfortunately, this contrast strongly depends on pedestrian clothing, the relative situation of the pedestrian versus road lighting luminaires and moisture conditions of the road surface.

[0003] To increase safety, pedestrian crossings were created with a specific road marking, a pattern of white stripes often called zebra, combined with two main kinds of systems: signalling or lighting positioned on both sides of the road at a short distance from the crossing and on the side of the crossing from which the traffic approaches.

[0004] Existing signalling systems are medium heighted poles (around 3 meters) with translucent globes on the top. The globe size and lamp power are adjusted so as to give a non disturbing luminance level provided that these globes are in the viewing field of drivers. Sometimes, flashing of the light sources increases the visual efficacy. This system is widely accepted where low ambient luminance levels exists, e.g., in small towns and on low traffic roads. On the contrary, such a system is less efficient in large towns where the contrast between numerous ambient lights and the signalling device is not sufficient. Moreover, the vertical illumination on pedestrians is very low when using these systems.

[0005] Existing lighting fittings installed on 5 meters or more height posts are mainly built around a trough parabolic shaped reflector and a set of blades arranged to absorb or cut off the useless and disturbing part of direct flux (coming directly from the lamp). The extrusion direction of the reflector parabolic section and the blade arrangement are perpendicular to the road lanes. Such lighting fittings have to be tilted in two directions to cover the zebra marking with a sufficient amount of vertical illuminance. For the same purpose, asymmetric floodlights with a broad light distribution are also used with trough reflectors. In such systems, the extrusion direction is parallel to the road lanes.

[0006] A cut off of the useless and disturbing part of direct flux is obtained with the help of auxiliary reflectors.

[0007] Generally, it is desirable to illuminate not only the pedestrian crossing itself but also at least the near surrounding thereof. The reason is that a lot of pedestrians that are crossing a road are not crossing the road on the pedestrian crossing but on its surrounding. These pedestrians also need to be clearly seen by a driver and therefore the lighting of this particular area should also be optimized.

[0008] Based on these known prior art systems, it is therefore an object of the present invention to provide a new optical illumination system for pedestrian crossings and their near surroundings providing a high visibility level for drivers, without any glare, with good contrast between the zebra marking and the road pavement and an adequate vertical illuminance on pedestrians. A further object of the present invention is to provide an illuminating system build around a specific reflective optical system designed to allow an integration in existing luminaire housings so that they can be matched to the luminaires used elsewhere on the road.

[0009] The above-mentioned objects are solved by a lighting unit as defined in claim 1. Preferred embodiments of the present invention are subject matter of the dependent claims.

[0010] The lighting unit of the present invention comprises a specific reflector unit which has been designed in order to meet the requirements mentioned above. In particular, the reflector unit allows an efficient illumination of pedestrian crossings and their near surroundings while it has a relatively small size and can thus be included in conventional luminaire housings. The inventive reflector unit comprises three reflector surfaces with a first main reflector surface extending in a longitudinal axis of the reflector unit and having a trough profile corresponding to an ellipse. The second and third reflector surfaces are arranged at the front and rear end of the first reflector surface, respectively, wherein the second reflector surface is tilted about 45° with respect to a light emanating opening of the reflector unit.

[0011] Accordingly, the present invention provides a lighting unit for use in a luminaire, in particular a luminaire for pedestrian crossing lighting, wherein said lighting unit has a light source and a reflector unit to control the distribution of the light emitted by said light source, wherein said reflector unit comprises a first reflector surface extending in a longitudinal axis of said reflector unit and having a trough profile corresponding to an ellipse and second and third reflector surfaces being arranged at the front and rear end of the first reflector surface, respectively, the second reflector surface being tilted by about 45° with respect to a light emanating opening of the reflector unit.

[0012] Preferably, the third reflector surface is kinked so as to have a first portion being arranged perpendicular to the longitudinal axis of said reflector unit and a second portion extending by an acute angle from said first portion.

[0013] In accordance with another preferred embodiment of the present invention, the second reflector surface comprises an opening wherein the front end of the light source extends at least partly in said opening. This specific structure allows building an extremely small lighting unit which nevertheless provides an efficient illumination of the pedestrian crossing.

[0014] Since luminaires for pedestrian crossing lighting are usually arranged close to the corner of the pedestrian crossing, an asymmetric light distribution is desired. In accordance with another aspect of the present invention, the light

source is therefore arranged besides the centre axis of the reflector unit.

[0015] The light emanating opening of the reflective unit is covered by a transparent element which is preferably flat.

[0016] According to another aspect of the present invention, there is provided a luminaire for pedestrian crossing lighting which luminaire has a lighting head with a casing accommodating a lighting unit as mentioned above. Preferably, the lighting head is horizontally arranged.

[0017] In the following, the present invention and preferred embodiments thereof will be explained in more detail with respect to the enclosed drawings. In these drawings:

Figure 1 shows an embodiment of a lighting unit for use in a luminaire for pedestrian crossing lighting in accordance with the present invention;

Figure 2 shows an example of accommodating the lighting unit of figure 1 inside an existing road lighting fitting;

Figures 3 to 5 are ray tracing diagrams showing the light emission provided by the reflector of the inventive lighting unit;

Figures 6 to 9 are transversal ray tracing diagrams of the inventive lighting unit;

Figures 10 and 11 are diagrams showing the influence of the kink of the rear reflector surface; and

Figures 12 and 13 show examples of a pedestrian crossing illuminated by one or two inventive luminaires.

[0018] The optical system used in accordance with the present invention takes advantage of modern discharge lamps technologies: a small burner, a diffusing surface of said burner, white colour, long life and availability in different makes. Such light sources are metal halide lamps with alumina burners (commonly named ceramic) available from 70W to 250W. Of course any new kind of luminous source with the same or a comparable flux distribution and size is acceptable.

[0019] It is well known that the efficacy of an optical system depends on the relative size of the light emitter vs. the optical system size. This is the reason why the present invention takes advantage of such metal halide sources with clear envelope and compact burner to obtain results which can only hardly be achieved with other sources such as high pressure sodium lamps and discharge lamps with a diffusing envelope.

[0020] High vertical illuminance levels on pedestrians can be achieved only if the light source is placed at a given distance before the zebra crossing. In many existing systems, the lighting fitting have to be tilted so that the peak intensity reaches the zebra crossing. The optical system according to the present invention has been designed so as to avoid any luminaire tilting.

[0021] A preferred embodiment of the inventive lighting unit is shown in figures 1 and 2 and generally designated by 1. The different components of the lighting unit 1 are mounted on a tray 2 and comprise at first a lamp 3, in particular a metal halide lamp which is mounted in a socket 4 arranged at the rear end of the tray 2. The lamp 3 extends in a longitudinal direction of the lighting unit 1 and is with its forward portion inserted in a reflector unit 5.

[0022] As shown in figure 2, the reflector unit 5 forms a light emanating opening 6 on the bottom side of the lighting unit 1 which is used to emit the light of the lamp 3. Due to the specific form of the reflector unit 5, the light emanating opening 6 can be covered by a transparent flat element which is made of glass or any other transparent material. Although a flat transparent element is used which does not further influence the light emission of the lighting unit 1, an efficient illumination of the pedestrian crossing can nevertheless be obtained even if the lighting unit is horizontally arranged as a result of the structure of the reflector unit 5 which will be explained in more detail in the following. Of course, it would also be possible to use a bombed glass to cover the light emanating opening 6.

[0023] The reflector unit 5 comprises in summary three reflector surfaces, a trough reflector 7, a front reflector 8 and a rear reflector 9.

[0024] The shape of the trough reflector 7 can be gathered from figure 1 and in particular also from figures 3 to 5 which show that this reflector 7 has the shape of an elliptical reflector which has been further adapted/deformed in such a way that its shape is a spline which has been carefully adjusted with control of the points to meet the required illumination levels and uniformity. In order to avoid a tilting of the entire optical system, the trough reflector 7 further has been optically tilted which means that the virtual line extending between the two ellipse foci (i.e., the major axis of the ellipse) is pointed in the direction of the pedestrian crossing. Further, the lamp 4 has been displaced from the centre to the side of the centre axis of the reflector 7 which finally results in an asymmetric emission of the light as shown in the three ray tracing diagrams of figures 3 to 5. These diagrams show that the light is directed towards the pedestrian crossing within a relatively narrow angle and with no rays leading to glare or obtrusive light.

[0025] A second important feature of the inventive reflector unit 5 is the fact that the front reflector 8 is tilted by an

angle of approximately 45°. The result of this tilting of the front reflector 8 is shown in figures 6 to 9 which show that the light beams are mainly directed towards the middle of the road which results in an improved illumination of the pedestrian crossing. Again, it has to be noted that this advantageous illumination is obtained without the need of additional optical elements in front of the lighting unit 1. In particular, a flat transparent element can be used to cover the light emanating opening 6 and the lighting unit 1 can be horizontally arranged.

[0026] Figures 1 and 6 to 9 further show that the front reflector 8 is provided with an opening 10 wherein the front end of the lamp 3 at least partly extends into this opening 10. With this configuration, the size of the reflector unit 5 can be reduced such that the lighting unit 1 can be easily accommodated within a conventional luminaire housing.

[0027] Finally, also the rear reflector 9 has been adapted in order to further improve the efficiency of the reflector unit 5. In particular, the rear reflector 9 has been folded or provided with a kink in such a way that a first part 9a is obtained comprising a through opening 11 for inserting the lamp 3 as well as an inclined second part 9b. The effect of the kink can be gathered from figures 10 to 11 which show that a slightly folded rear reflector 9 results in increased illumination levels in an area corresponding to the opposite side of the road in comparison to a flat rear reflector which is shown in figure 10.

[0028] Thus, the three reflector surfaces in combination lead to an efficient illumination of a pedestrian crossing and its surrounding as can be gathered from figure 12. Additionally, figure 13 shows a configuration where two identical luminaires are arranged at opposite positions of the pedestrian crossing. The two figures 12 and 13 clearly show that light illumination levels complying with roadway regulations can be easily obtained. Further, the desired light distribution is obtained without any glare resulting in an improved illumination of pedestrian crossings and their surroundings.

Claims

1. Lighting unit (1) for use in a luminaire, in particular a luminaire for pedestrian crossing lighting, said lighting unit (1) having a light source (3) and a reflector unit (5) to control the distribution of the light emitted by said light source (3), wherein said reflector unit (5) comprises a first reflector surface (7) extending in a longitudinal direction of said reflector unit (5) and having a trough profile corresponding approximately to an ellipse and second and third reflector surfaces (8, 9) being arranged at the front and rear end of the first reflector surface (7), respectively, the second reflector surface (8) being tilted by around 45° with respect to an light emanating opening (6) of the reflector unit (5).
2. Lighting unit of claim 1, wherein the third reflector surface (9) is kinked so as to have a first portion (9a) being arranged perpendicular to the longitudinal axis of said reflector unit (5) and a second portion (9b) extending by an acute angle from said first portion (9a).
3. Lighting unit according to claim 1 or 2, wherein said second reflector surface (8) comprises an opening (10), the front end of the light source (3) extending at least partly in said opening (10).
4. Lighting unit according to one of the preceding claims, wherein the light source (3) is arranged besides a middle axis of said reflector unit (5).
5. Lighting unit according to one of the preceding claims, wherein the light emanating opening (6) of the reflector unit (5) is covered by a transparent element.
6. Lighting unit according to claim 5, wherein the transparent element is a flat element or a bombed element.
7. Lighting unit according to one of the preceding claims, wherein the first reflector surface (7) has the shape of a deformed ellipse.
8. Lighting unit according to claim 7, wherein the ellipse of the first reflector unit (7) is optically tilted.
9. Lighting unit according to one of the preceding claims, wherein the light source is a metal halide lamp comprising preferably an alumina burner.
10. Luminaire for pedestrian crossing lighting, said luminaire having a lighting head with a casing accommodating a

lighting unit (1) according to one of the preceding claims.

11. Luminaire according to claim 10,
wherein the lighting head is horizontally arranged.

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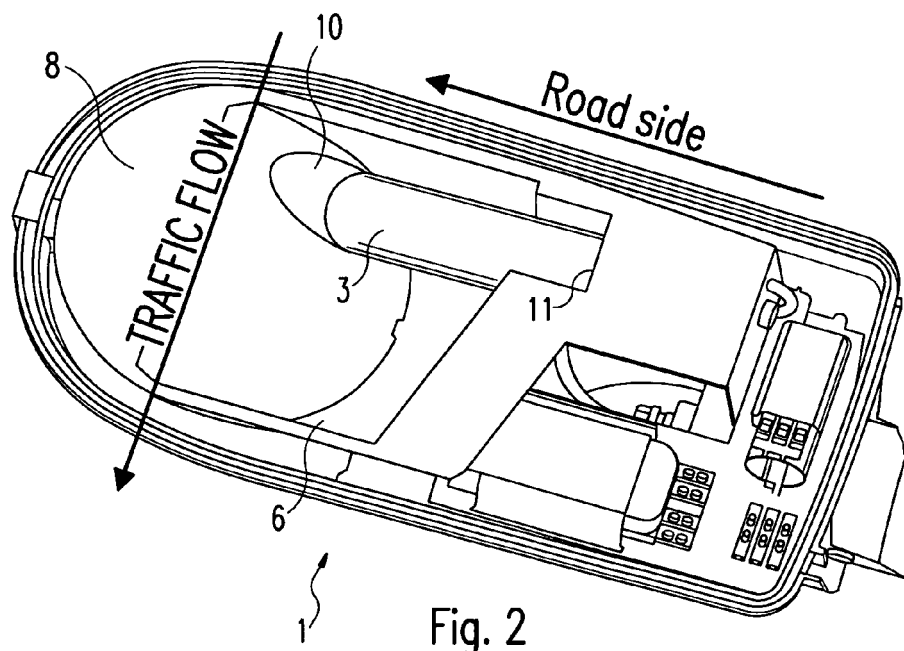
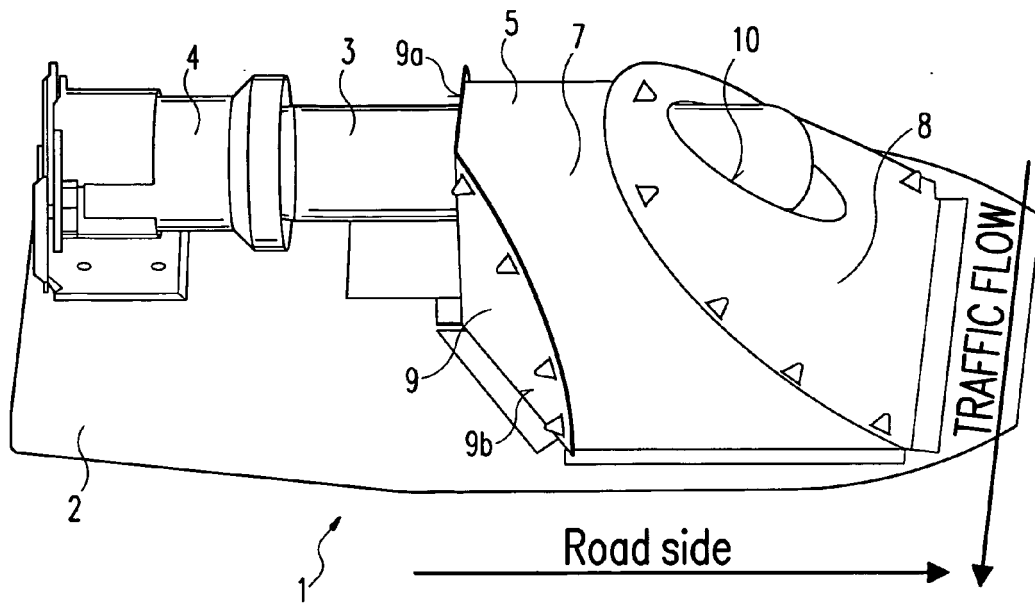
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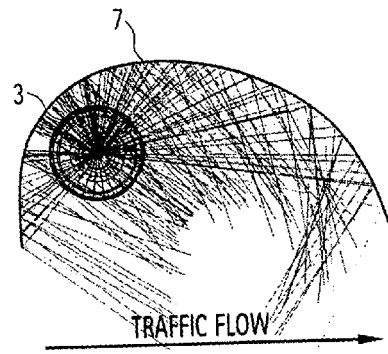


Fig. 3

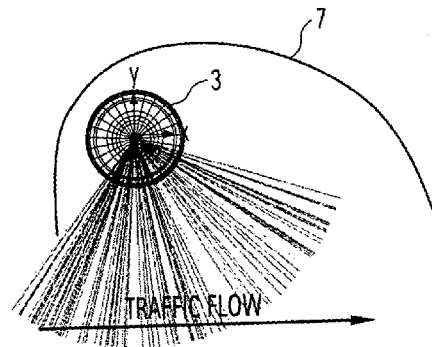


Fig. 4

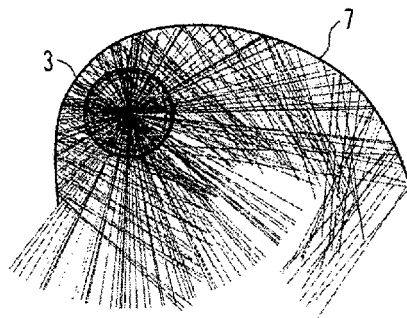


Fig. 5

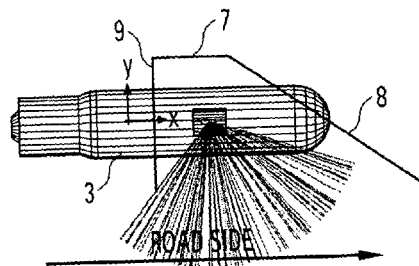


Fig. 6

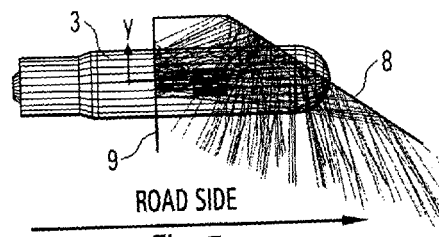


Fig. 7

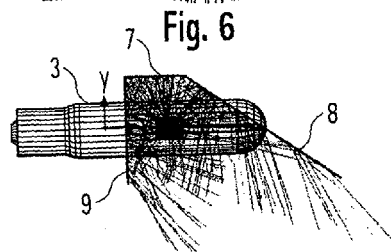


Fig. 8

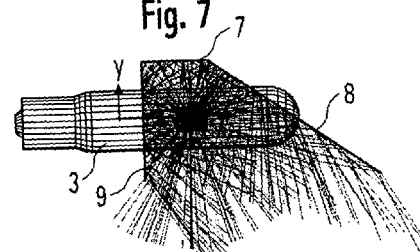


Fig. 9

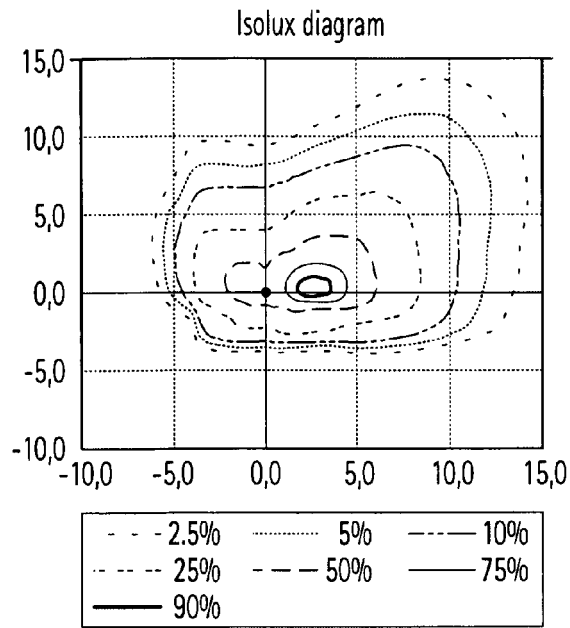


Fig. 10

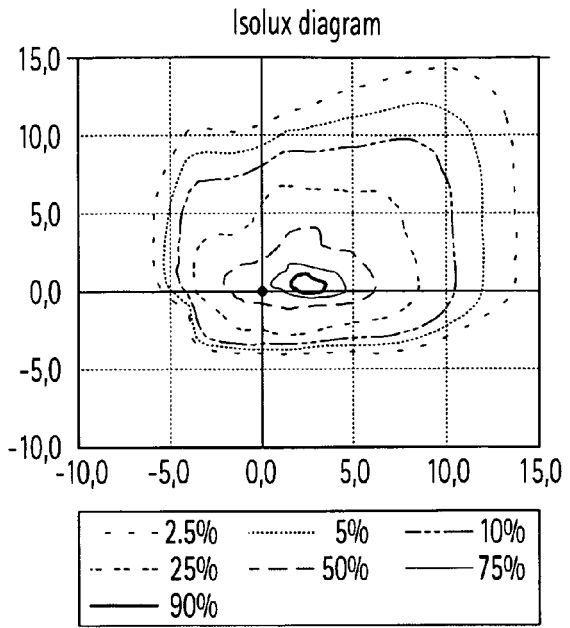


Fig. 11

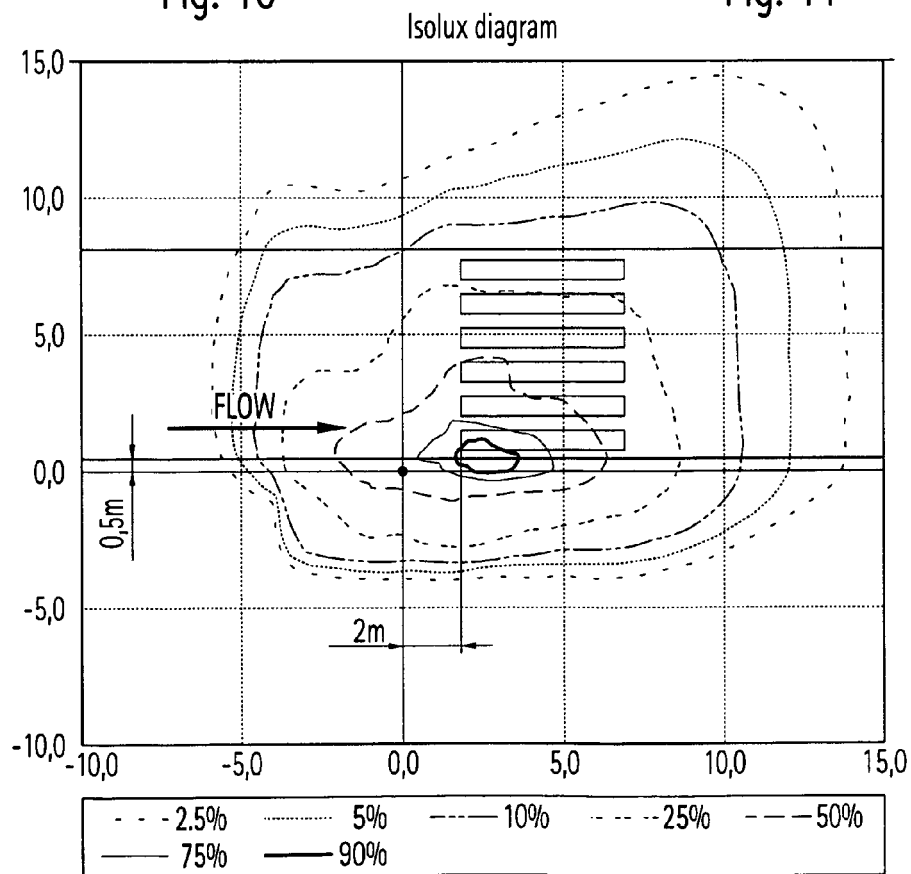


Fig. 12

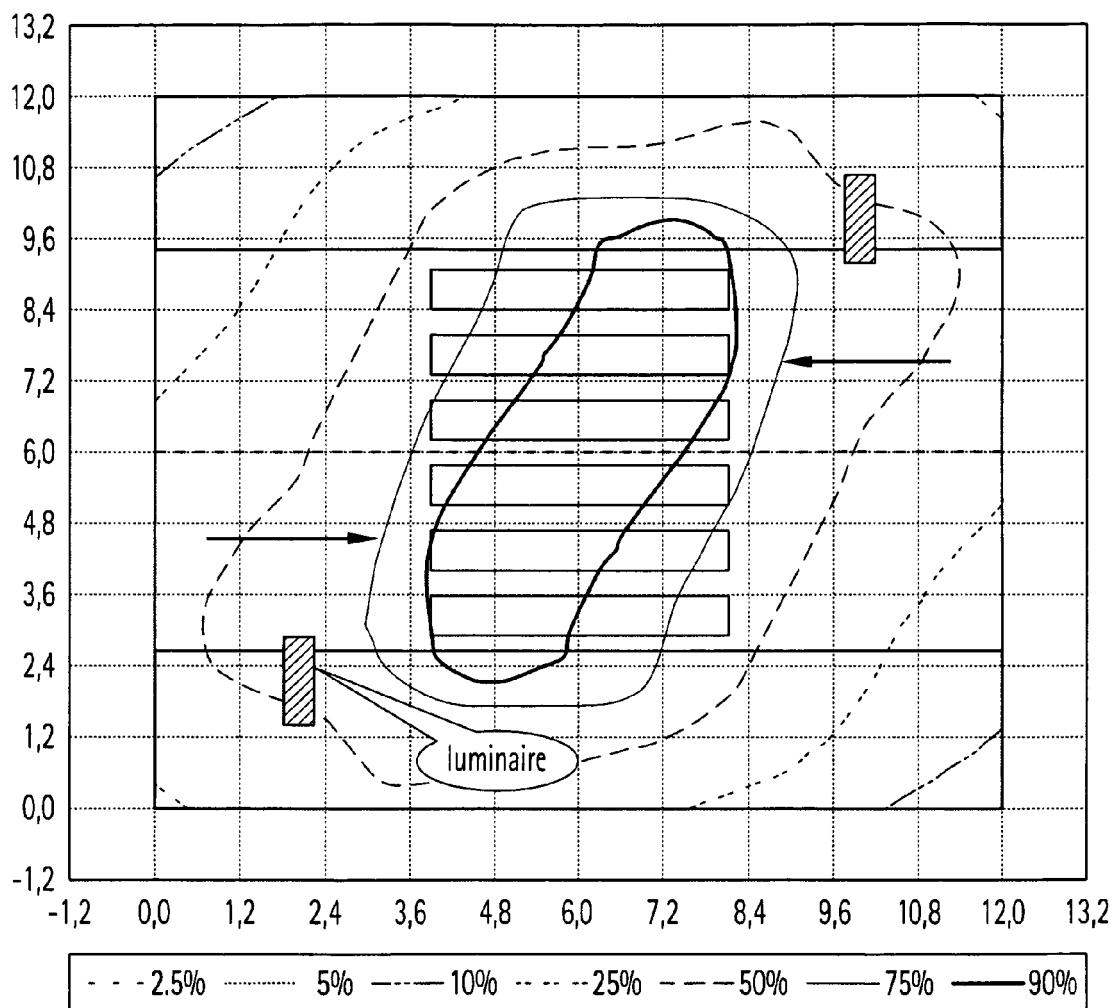


Fig. 13



EUROPEAN SEARCH REPORT

Application Number
EP 09 29 0191

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 4 379 322 A (KELLY JAMES P) 5 April 1983 (1983-04-05) * column 1, line 50 - column 5, line 7; figures 1-4 *	1,3,5-7, 9	INV. F21S8/08 F21V7/09
A	-----	2,4,10, 11	
Y	DE 15 97 995 A1 (SIEMENS AG) 3 September 1970 (1970-09-03) * page 3, line 11 - page 5, line 26; figure 1 *	1,5-7,9	
Y	----- US 2003/053314 A1 (SUMMERFORD ROBERT L [US] ET AL) 20 March 2003 (2003-03-20) * paragraph [0027] - paragraph [0054]; figures 1-9 * -----	3	
			TECHNICAL FIELDS SEARCHED (IPC)
			F21S F21V
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 August 2009	Examiner Arboreanu, Antoniu
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	

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EPO FORM 1503 03.02 (P04C01)

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

EP 09 29 0191

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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18-08-2009

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4379322	A	05-04-1983	AU 549149 B2 16-01-1986
			AU 8189482 A 30-09-1982
			CA 1174214 A1 11-09-1984
DE 1597995	A1	03-09-1970	NONE
US 2003053314	A1	20-03-2003	NONE