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(54) Title: LENS FOR ILLUMINATING DEVICE AND ILLUMINATING DEVICE COMPRISING THE LENS

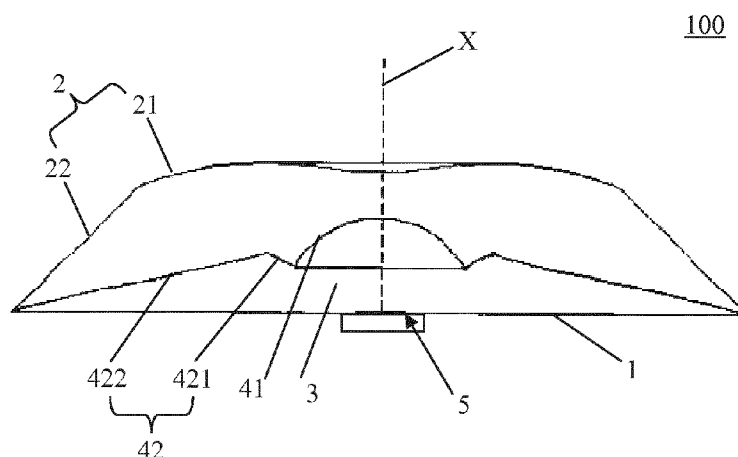


Figure 1

(57) Abstract: The present invention relates to a lens for a light source, comprising a bottom surface defining a recessed region at its center and a top surface rising from the bottom surface, wherein a surface of the recessed region comprises an incident surface disposed at its center and a reflective surface disposed around the incident surface, first incident light from the light source reaches and exits the top surface in a first direction after being refracted by the incident surface to form a first emergent light for forward illumination, and second incident light from the light source is reflected, when being emitted to the reflective surface, and then exits in a second direction to form a second emergent light for backward illumination. The present invention further relates to an illuminating device using the lens.



Description

Lens for Illuminating Device and Illuminating Device
Comprising the Lens

5

Technical Field

The present invention relates to a lens for a illuminating device and an illuminating device comprising the same.

Background Art

10 Solid-state lighting (SSL) devices use light emitting diodes (LEDs) and tend to evolve quickly and gradually replace traditional lighting such as incandescent and fluorescent lamps. LEDs have advantages such as low energy consumption and high efficiency, long lifetime and compact design, which enable
15 the LED devices to be an alternative to the traditional illuminating devices in many situations. The prior art provides many improvements to achieve an omnidirectional illumination effect based on the LED technology.

In the prior art, Patent Document EP 2180234 A1 discloses an
20 invention which provides an omnidirectional light bulb comprising a transparent body member and a contact member at one end of the body member. The light bulb further comprises a disc and a supporting pole disposed therein and is provided with a plurality of LEDs in a circumferential direction of
25 the disc, thus an appropriate illumination effect can be provided in all directions. Patent Document WO2009/091562A2 discloses an invention which provides a light bulb provided therein with an LED support and provided with a plurality of LEDs at each surface of the LED support so as to achieve mul-
30 tidirectional or omnidirectional illumination. However, both the inventions need to use a plurality of LED chips as a basis for achieving multidirectional or omnidirectional illumi-

nation, which not only increases production cost but also limits the application environment of the products.

Summary of the invention

To overcome the above technical problem, the present invention provides a novel lens for an illuminating device. An illuminating device based on the lens can achieve multidirectional or omnidirectional illumination and achieve a uniform light distribution in all directions by using a single LED chip instead of a plurality of LED chips in addition to the lens providing light exiting in a forward direction and light reflected by the lens and exiting in a backward direction, thus the production process is simplified, and also the production cost is reduced. Moreover, leakage of light for forward illumination can be prevented by using a design of a reflective surface in the lens.

A first object of the present invention is achieved by a lens for a light source, comprising a bottom surface defining a recessed region at its center and a top surface rising from the bottom surface, wherein a surface of the recessed region comprises an incident surface disposed at its center and a reflective surface disposed around the incident surface, a first incident light from the light source reaches and exits the top surface in a first direction after being refracted by the incident surface to form first emergent light for forward illumination, and a second incident light from the light source is reflected, when emitted to the reflective surface, and then exits in a second direction to form second emergent light for backward illumination. According to such design, after passing through the lens, light from the light source can achieve an illumination effect simultaneously in multiple directions such as two opposite directions to achieve the possibility of illumination in all directions.

According to the present invention, the first emergent light and the second emergent light jointly achieve omnidirectional illumination. The possibility of illumination in multiple or all directions can be achieved by emergent light in both directions.

Preferably, the incident surface is designed to be transparent or semitransparent so that the first light is transmitted directly through the incident surface and then refracted and exits through the top surface. Thus, the first light from the light source can exit from the exit surface directly after transmitted through the incident surface and can form emergent light directly in the forward direction along the optical axis.

Preferably, a surface of the reflective surface that faces the light source is provided with a reflective coating by which the second light is reflected. Thus, the possibility is achieved that the second light from the light source is reflected and exits in a direction opposed to the incident direction after being subjected to the action of the reflective coating.

Preferably, the reflective coating is a mirror reflective coating. Such reflective coating appropriately allows the second light from the light source to be reflected with high efficiency.

Preferably, viewed from section of the lens, the incident surface is designed to have any shape selected from a semi-circle, a rectangle and a trapezoid. Light incident through the incident surface can form light distributions in different forms after being incident according to different contours.

Preferably, the reflective surface comprises a first portion and a second portion, the second light exits after being reflected by at least the second portion. The first portion connects the second portion of the reflective surface to the incident surface when viewed in section of the lens, so that all the light from the light source is subjected to the action of the incident surface or the reflective surface and the second light is reflected by the second portion of the reflective surface.

Preferably, viewed from section of the lens, the first portion is designed to have a line shape, and the second portion is designed to form any of a line and a spline curve. According to the design of the first portion, an angle between the second portion connected to the first portion and the bottom surface of the lens can be changed to achieve the possibility of changing an exit angle of the emergent light reflected by the second portion.

Preferably, viewed from section of the lens, the first portion is gradually away from an optical axis of the lens from the bottom surface to the top surface. An effective boundary is formed between the reflective surface and incident surface, the second light is incident on the reflective surface only.

Preferably, viewed from section of the lens, the first portion and the second portion jointly form a continuous spline curve, when. Thus, the second light from the light source can be subjected to the action of both the first portion and the second portion and reflected to exit toward the bottom surface.

Preferably, viewed from section of the lens, the first por-

tion and the second portion are jointly formed to be gradually close to an optical axis of the lens from the bottom surface to the top surface. The so formed reflective surface is capable of controlling the emergent angle of the second light
5 after being reflected.

Preferably, the top surface comprises an exit surface and a demoulding surface disposed around the exit surface, the first light exiting through the exit surface after passing through the incident surface. According to such design, light
10 exiting in a forward direction exits only through the exit surface, and moreover, the use of the demoulding surface makes it easier to manufacture and machine the lens while not affecting the illumination effect in the forward direction.

Preferably, the exit surface is designed to form a spline
15 curve when viewed from section of the lens. Thus, uniform circumferential illumination in the forward direction can be formed by the light refracted by the exit surface.

Preferably, the demoulding surface is designed to form any of a spline curve and a line when viewed in section of the lens.
20 Such demoulding surface facilitates the possibility of simplified machining or manufacture of the lens.

Preferably, the lens is designed to be rotationally symmetrical around an optical axis. Such lens can form a rotationally symmetrical light distribution of the emergent light.

25 Preferably, the lens is made of any of optical plastic and glass. Such materials allow the lens to have a suitable economic property while having an excellent optical performance.

Another object of the present invention is achieved by an il-

luminating device comprising a light source and a lens described above. Such illuminating device can achieve an illumination effect in all directions by the aid of the lens.

Preferably, the illuminating device is designed as an LED retrofit lamp. Such retrofit lamp can be advantageously compatible with platforms of other illuminating devices and provide a good economical applicability to widen the application environment.

Preferably, the LED retrofit lamp is an A-type retrofit lamp. Therefore, it can be compatible with a shape of a traditional light bulb in appearance and performance and has an excellent omnidirectional illumination performance similar to that of the traditional light bulb.

Preferably, the illuminating device further comprises a heat sink designed as a plurality of heat sink fins disposed in a circumferential direction at a peripheral of the illuminating device, and viewed from section of the illuminating device, the heat sink fin comprises a first edge which is designed to be inclined away from an optical axis of the lens in a direction from the top surface to the bottom surface of the lens, when. According to such design, light passing through the lens is prevented from being blocked or obstructed by the structural design of the heat sink to decrease the illumination effect.

Brief Description of the Drawings

The drawings constitute a portion of the Description for further understanding of the present invention. These drawings illustrate the embodiments of the present invention and explain the principle of the present invention together with the Description. In the drawings, the same part is represent-

ed by the same reference numeral. In the drawings,

Fig. 1 is a sectional schematic view of a lens according to an embodiment of the present invention;

Fig. 2 is a optical path diagram of the lens according to an
5 embodiment of the present invention; and

Fig. 3 is a sectional schematic view of an illuminating device according to an embodiment of the present invention.

Detailed Description of the Embodiments

Fig. 1 is a sectional schematic view of a lens 100 according
10 to an embodiment of the present invention. As shown in Fig. 1, the lens 100 can be designed to be rotationally symmetrical with respect to an optical axis X and may be made of optical plastic or glass, thus the production cost is reduced, and also an excellent optical performance of the lens
15 100 can be ensured. The lens 100 has a top surface 2 and a bottom surface 1 disposed opposite to the top surface 2, an incident surface 41 and a reflective surface 42 of the lens and a recessed region 3 for accommodating a light source 5 are defined between the bottom surface 1 and the top surface
20 2, the recessed region 3 is designed to be hollow, and as can be seen from the figure, the incident surface includes two parts, i.e., the incident surface 41 and the reflective surface 42.

Refer to Fig. 2 which is a optical path diagram of the lens
25 100 according to an embodiment of the present invention. An LED light source 5 having advantages such as low energy consumption, high efficiency and long lifetime can be disposed at the center of the bottom surface 1, thus light from the LED light source 5 is incident into the lens 100 and reaches

the incident surface after entering the bottom surface 1.

First light L1 from the light source 5 is incident directly on the incident surface 41, and at this time, the first light L1 is refracted on the incident surface 41 to the top surface 2, and further refracted by the top surface 2 and then emitted to the outside of the lens 100. A contour of the incident surface 41 may have different designs, and for example, may be designed into any shape selected from a semicircle, a rectangle and a trapezoid when viewed from section, the contour of the incident surface 41 is, of course, not limited to the above shapes, any similar shape capable of achieving the same or similar function can be used to be designed as the contour of the incident surface 41, and therefore the first light L1 incident from the incident surface 41 can have different light distributions, thereby forming light distributions of emergent light L1' with different effects after finally exiting through the top surface 2. It should be noted that the top surface 2 includes two parts which are respectively an exit surface 21 and a demoulding surface 22, after being refracted by the incident surface 41, the first light L1 from the light source 5 is refracted only by the exit surface 21 and then exits (the details will be described hereinafter), thus no light from the light source 5 is emitted through the demoulding surface 22, the demoulding surface 22 is connected to the exit surface 21 of the top surface 2 and the bottom surface 1 so that the whole lens 100 has a continuous peripheral contour, and such design provides a contour design which is easy to machine or manufacture during the manufacture of the lens 100, and facilitates, for example, the process of demoulding.

As shown in Fig. 1, the reflective surface 42 as the other incident surface is disposed around the incident surface 41 and is rotationally symmetrical with respect to the optical

axis X of the lens 100 around the incident surface 41. When viewed from section of the lens 100, the reflective surface 42 may be disposed to have two portions, i.e., a first portion 421 and a second portion 422, wherein the first portion 421 can be disposed in a line shape when viewed from section, and the second portion 422 can be also disposed in a line shape, thus the first and second portions 421, 422 form a zigzag sectional contour as a whole. In this case, the first portion 421 can achieve the function of defining a boundary between the first light L1 and second light L2 from the same light source 5, and the first light L1 incident through the incident surface 41 is not incident onto the reflective surface 42, thus the first light L1 passes only through the incident surface 41 to form final forward emergent light L1'. On this basis, when the second light L2 from the light source 5 is incident onto the reflective surface 41, since the reflective surface 42 is treated with, for example, a mirror reflective coating, the second light L2 is totally reflected directly by the reflective surface 42, then emitted towards a direction of the bottom surface 1, and finally exits through the bottom surface 1 to form emergent light L2'. According to such design, one part L1 of light from the light source 5 forms, through the incident surface 41, a light distribution in a first direction which is the forward direction, and the other part L2 of the light from the light source 5 forms, after being reflected by the reflective surface 42, a backward light distribution, i.e., another light distribution after exiting in a second direction opposite to the first direction, and an omnidirectional illumination effect is finally provided based on the light distributions in different regions.

As can be seen from Fig. 1, a light flux ratio of the first emergent light L1' exiting in the first direction to the se-

cond emergent light L2' exiting in the second direction can be changed by changing a ratio between volumes of the incident surface 41 and the reflective surface 42 or between sizes of surface contours of the incident surface 41 and the reflective surface 42 depending on the volumes or the sizes of the surface contours of the incident surface 41 and the reflective surface 42 when viewed from section of the lens 100.

Moreover, it should be noted that in an embodiment not shown, the two portions 421, 422 of the reflective surface 42 of the lens 100 can be designed into a line shape and a spline curve, respectively, thus different reflection effects or reflection effects with different exit angles can be finally provided for the second light L2, and thereby the adjustment of, for example, the light distribution and exit angle of the emergent light L2' from the light source 5 can be achieved so that an illumination range of the omnidirectional illumination processed by the lens 100 can be finally adjusted.

In another embodiment not shown, the two portions 421, 422 of the reflective surface 42 of the lens 100 can be designed integrally, that is, the two portions 421, 422 are designed to form, for example, a spline curve when viewed from section of the lens 100, thus the manufacture process of the lens 100 can be simplified to a certain extent, and an excellent omnidirectional illumination effect can be achieved.

Furthermore, an illuminating device 200 is provided based on the lens 100 described above, referring to Fig. 3 which illustrates a sectional schematic view of the illuminating device 200 according to an embodiment of the present invention. According to such design, the lens 100 can be disposed at a top of the illuminating device 200 to receive light from an LED light source to provide illumination in a forward direc-

tion which is a direction from the bottom surface to the top surface of the lens 100 while providing illumination in a backward direction which is a direction from the top surface to the bottom surface of the lens 100, thereby forming a
5 light distribution of omnidirectional illumination of the illuminating device 200. In order to prevent a traditional heat sink 6 designed at a periphery of the illuminating device 200 from blocking or obstructing backward light from the lens 100, the heat sink 6 in the illuminating device 200 is de-
10 signed with heat sink fins 61, and the heat sink fin 61 is designed to have a first edge 611 which is inclined gradually close to the optical axis X in a direction from the bottom to the top of the illuminating device 200, thus it is avoided that downward light from the lens 100 is blocked or obstruct-
15 ed by the heat sink fin 61 and as a result the whole omnidirectional illumination effect is lowered or deteriorated if the first edge 611 is designed to be horizontal.

The above are merely preferred embodiments of the present invention but not to limit the present invention. It would be
20 understood by those skilled in the art that the present invention may have various alterations and changes. Any alterations, equivalent substitutions, and improvements, within the spirit and principle of the present invention, should be covered in the scope of the present invention.

Reference Numerals

	1	bottom surface
	2	top surface
	3	recessed region
5	41	incident surface
	42	reflective surface
	421	first portion
	422	second portion
	5	light source
10	6	heat sink
	61	heat sink fin
	611	first edge
	100	lens
	200	illuminating device
15	21	exit surface
	22	demoulding surface
	L1	first light
	L2	second light

L1' first exit light

L2' second exit light

X optical axis

Patent claims

1. A lens (100) for a light source (5), comprising a bottom surface (1) defining a recessed region (3) at its center and a top surface (2) rising from the bottom surface (1), characterized in that a surface of the recessed region (3) comprises an incident surface (41) disposed at its center and a reflective surface (42) disposed around the incident surface (41), a first incident light (L1) from the light source (5) reaches and exits the top surface (2) in a first direction after being refracted by the incident surface (41) to form a first emergent light (L1') for forward illumination, and second incident light (L2) from the light source (5) is reflected, when being emitted to the reflective surface (42), and then exits in a second direction to form a second exit light (L2') for backward illumination.
2. The lens (100) according to claim 1, characterized in that the first emergent light (L1') and the second emergent light (L2') jointly achieve omnidirectional illumination.
3. The lens (100) according to claim 1 or 2, characterized in that the incident surface (41) is designed to be transparent or semitransparent so that the first light (L1) is transmitted directly through the incident surface (41) and then refracted and exits through the top surface (2).
4. The lens (100) according to claim 1 or 2, characterized in that a surface of the reflective surface (42) that faces the light source (5) is provided with a reflective

coating by which the second light (L2) is reflected.

5. The lens (100) according to claim 4, characterized in that the reflective coating is a mirror reflective coating.

6. The lens (100) according to claim 1 or 2, characterized in that viewed from section of the lens (100), the incident surface (41) is designed to have any shape selected from a semicircle, a rectangle and a trapezoid.

7. The lens (100) according to claim 1 or 2, characterized in that the reflective surface (42) comprises a first portion (421) and a second portion (422), the second light (L2) exits after being reflected by at least the second portion (422).

8. The lens (100) according to claim 7, characterized in that viewed in section of the lens (100), the first portion (421) is designed to have a line shape, and the second portion (422) is designed to form any of a line and a spline curve.

9. The lens (100) according to claim 8, characterized in that viewed in section of the lens (100), the first portion (421) is gradually away from an optical axis (X) of the lens (100) in a direction from the bottom surface (1) to the top surface (2).

10. The lens (100) according to claim 7, characterized in that viewed in section of the lens (100), the first portion (421) and the second portion (422) jointly form a continuous spline curve.

11. The lens (100) according to claim 10, characterized in that viewed in section of the lens (100), the first portion (421) and the second portion (422) are jointly
5 formed to be gradually close to an optical axis (X) of the lens (100) in a direction from the bottom surface (1) to the top surface (2).
12. The lens (100) according to claim 1 or 2, characterized
10 in that the top surface (2) comprises an exit surface (21) and a demoulding surface (22) disposed around the exit surface (21), the first light (L1) exiting through the exit surface (21) after passing through the incident surface (41).
13. The lens (100) according to claim 12, characterized in that viewed in section of the lens (100), the exit surface (21) is designed to form a spline curve.
14. The lens (100) according to claim 13, characterized in that viewed in section of the lens (100), the demoulding surface (22) is designed to form any of a spline curve and a line.
15. The lens (100) according to claim 1 or 2, characterized in that the lens (100) is designed to be rotationally symmetrical around an optical axis (X).
16. The lens (100) according to claim 1 or 2, characterized
30 in that the lens (100) is made of any of optical plastic and glass.
17. An illuminating device (200) characterized in comprising

a light source and a lens (100) according to any one of claims 1 to 16.

18. The illuminating device (200) according to claim 17,
5 characterized in that the illuminating device (200) is designed as an LED retrofit lamp.

19. The illuminating device (200) according to claim 18,
10 characterized in that the LED retrofit lamp is an A-type retrofit lamp.

20. The illuminating device (200) according to claim 17,
characterized in that the illuminating device (200) further comprises a heat sink (6) designed as a plurality
15 of heat sink fins (61) disposed in a circumferential direction at peripheral of the illuminating device (200), and viewed in section of the illuminating device (200), the heat sink fin (61) comprises a first edge (611) which is designed to be inclined away from an optical
20 axis (X) of the lens (100) in a direction from the top surface (2) to the bottom surface (1) of the lens (100).

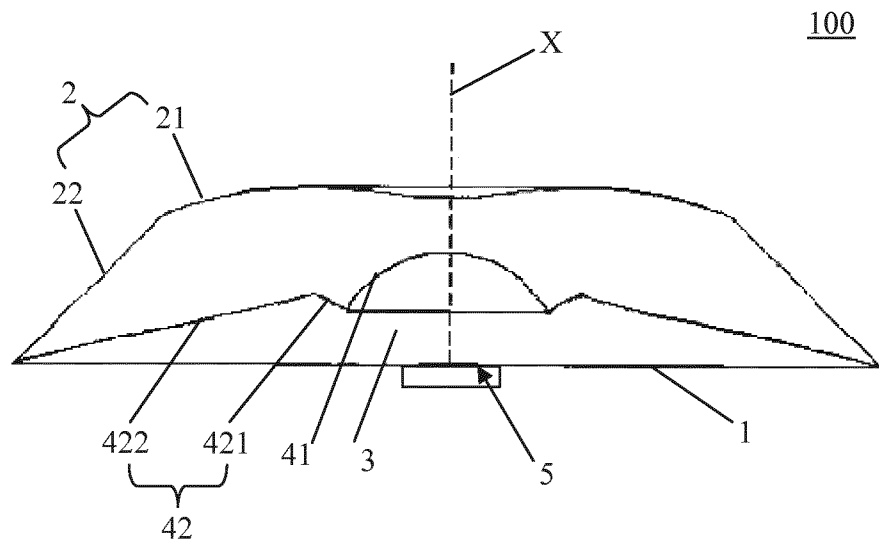


Figure 1

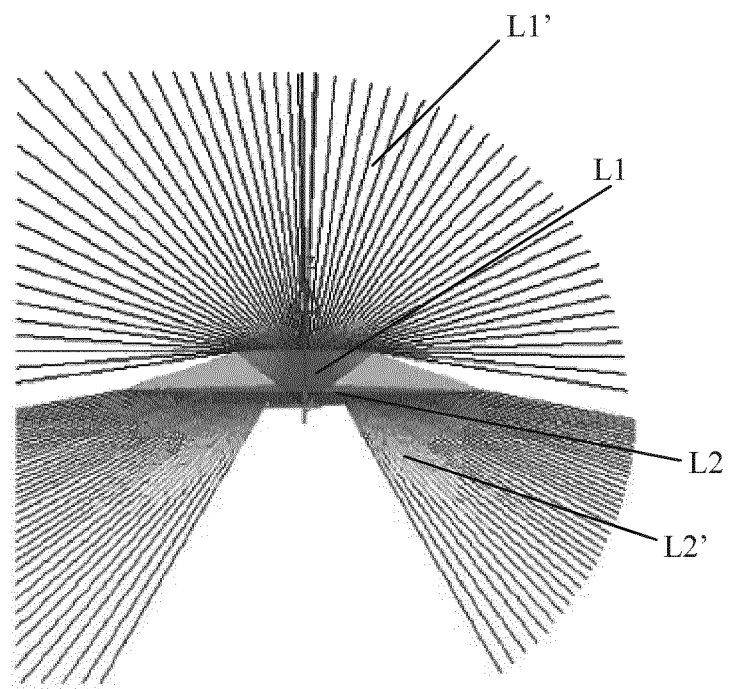


Figure 2

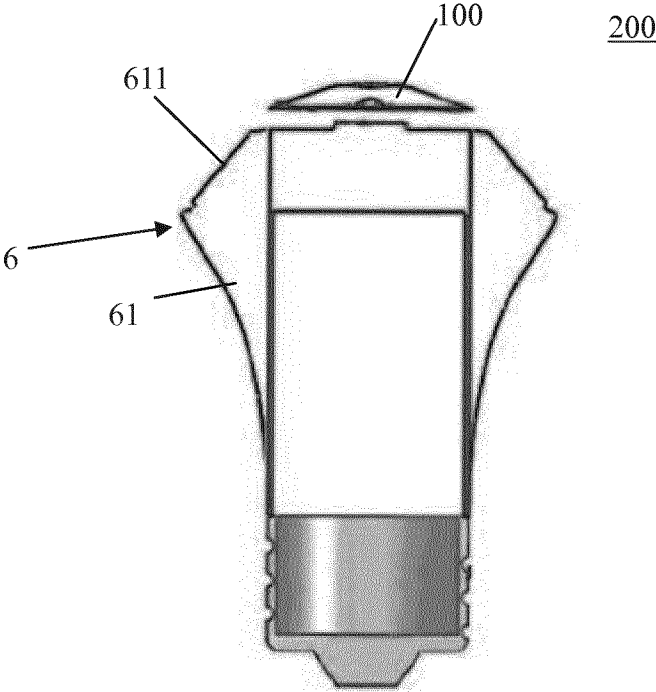


Figure 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/064751

A. CLASSIFICATION OF SUBJECT MATTER

INV. F21K99/00 F21V13/04 G02B27/09 G02B19/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G02B F21K F21V H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 218 785 B1 (INCERTI EDDA [IT]) 17 April 2001 (2001-04-17) column 3, line 9 - line 63; figure 1 -----	1-19
X	US 2011/140148 A1 (LIU KEH SHIUM [TW]) 16 June 2011 (2011-06-16) Paragraphs [0022], [0023], [0026], [0027]; figures 4A, 4B, 5C, 5D -----	1-19
A	US 2011/140149 A1 (LIU KEH SHIUM [TW] ET AL) 16 June 2011 (2011-06-16) figures 2, 4, 5 -----	7-11
A	US 2007/268722 A1 (OHKAWA SHINGO [JP]) 22 November 2007 (2007-11-22) figures 2, 8, 11A, 11B ----- -/-	12-14



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

20 August 2014

Date of mailing of the international search report

30/10/2014

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
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Muller, Nicolas

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2014/064751

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2011/007513 A1 (ZHANG HAI-WEI [CN] ET AL) 13 January 2011 (2011-01-13) paragraph [0021] - paragraph [0023]; figure 3 -----	12-14

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2014/064751

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6218785	B1	17-04-2001	NONE
US 2011140148	A1	16-06-2011	CN 102338347 A 01-02-2012
			TW 201203624 A 16-01-2012
			US 2011140148 A1 16-06-2011
			US 2012211790 A1 23-08-2012
US 2011140149	A1	16-06-2011	CN 102338346 A 01-02-2012
			TW 201202599 A 16-01-2012
			US 2011140149 A1 16-06-2011
			US 2013058084 A1 07-03-2013
			US 2014204579 A1 24-07-2014
US 2007268722	A1	22-11-2007	JP 2007173322 A 05-07-2007
			US 2007268722 A1 22-11-2007
US 2011007513	A1	13-01-2011	CN 101949494 A 19-01-2011
			US 2011007513 A1 13-01-2011

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2014/064751

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-19

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-19

Lens with surfaces of particular characteristics and shapes

2. claim: 20

Illuminating device with heat sink having particular design
