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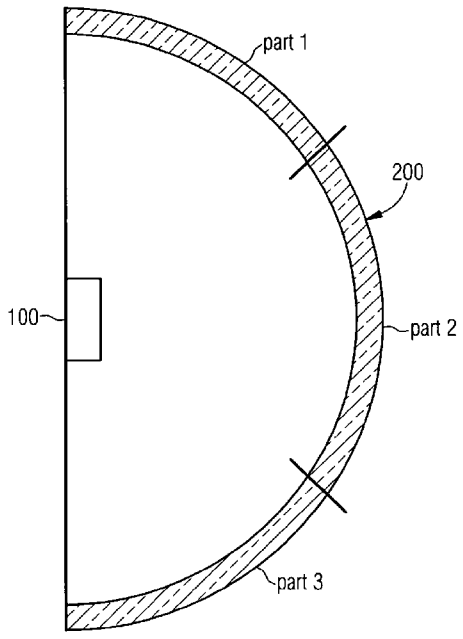
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[Continued on next page]

(54) Title: LIGHT EMITTING UNIT AND LUMINARY INCLUDING THE SAME

FIG 1



(57) Abstract: The present invention discloses a light emitting unit and a luminary including the light emitting element (100). The light emitting unit includes a light emitting element (100) and a lamp enclosure (200) which encloses the light emitting element and includes a plurality of parts (part 1, part 2, part 3), at least two of which have different optical characteristics from each other. The light emitting unit can achieve desired optical distribution without use of any additional optical component in the luminary.

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Description

LIGHT EMITTING UNIT AND LUMINARY INCLUDING THE SAME

Field of the Invention

[0001] The present invention generally relates to the technical field of optics and in particular to a light emitting unit and a luminary including the light emitting unit.

Background of the Invention

[0002] At present, most of luminaries based upon a light emitting unit (e.g., an LED, etc.) are not provided with an integrated secondary optical design, so an additional optical portion outside a light tube is required for a specific graph of optical distribution (e.g., bat-like, etc.). Two solutions in the prior art are available to the secondary optical design. One solution is to add an external reflector for desired optical distribution, and the other is to add an internal lens inside for desired optical distribution. However, such solutions are typically costly and have an unsatisfactory effect.

Summary of the Invention

[0003] In view of the foregoing problem present in the prior art, an embodiment of the invention provides a light emitting unit to achieve desired optical distribution without the use of any additional optical component in a luminary.

[0004] According to an embodiment of the invention, there is provided a light emitting unit including a light emitting element and a lamp enclosure which encloses the light emitting element and includes a plurality of parts, at least two of which have different optical characteristics from each other.

[0005] According to another embodiment of the invention, there is provided a luminary including the light emitting unit.

[0006] With the light emitting unit and the luminary according to the embodiments of the invention, various desired optical characteristics can be attained with a simple structure. Additionally, the cost of a device can be lowered effectively.

Brief Description of the Drawings

[0007] The foregoing and other objects, features and advantages of the invention will become more readily understood from the foregoing description of embodiments of the invention with reference to the drawings in which components have been not necessarily drawn to scale but are intended to only illustrate the principle of the invention. In order to facilitate an illustration and description of some parts of the invention, the corresponding parts in the drawings may be exaggerated, that is, they may become larger than other components in an exemplary device practically manufactured according to the invention. In the drawings, identical or similar technical features or components will be denoted with identical or similar reference numerals.

[0008] Fig.1 is an illustrative cutaway view of a light emitting unit according to an embodiment of the invention;

[0009] Fig.2 is a schematic diagram of an example of distribution of scattering particles in respective parts of a lamp enclosure;

[0010] Fig.3 is a schematic diagram of an example of a surface shape of one part of the lamp enclosure;

[0011] Fig.4 is a schematic diagram of an illustrative arrangement of three parts of the lamp enclosure;

[0012] Fig.5 is a schematic diagram of an illustrative structure of a lamp enclosure in a light emitting unit according

to another embodiment of the invention;

[0013] Fig.6 illustrates a graph of optical intensity distribution generated by the light emitting unit according to the embodiment of the invention;

[0014] Fig.7 illustrates a grey level graph and an illuminance distribution graph generated by the light emitting unit according to the embodiment of the invention; and

[0015] Fig.8 is a cutaway view and a cross sectional view illustrating an LED lamp tube on which the light emitting unit according to the embodiment of the invention is applied.

Detailed Description of the Invention

[0016] Embodiments of the invention will be described below with reference to the drawings. An element and a feature described in a drawing or an embodiment of the invention can be combined with an element and a feature illustrated in one or more other drawings or embodiments. It shall be noted that a representation and a description of components and processes known to those skilled in the art and irrelevant to the invention have been omitted in the drawings and the description.

[0017] According to an embodiment of the invention, there is provided a light emitting unit including a light emitting element and a lamp enclosure which encloses the light emitting element and includes a plurality of parts, at least two of which have different optical characteristics from each other.

[0018] Fig.1 illustrates a cutaway view of an example of the light emitting unit. Noted that an arrangement of other components irrelevant to the invention, e.g., a heat sink, a PCB board, etc., has not been illustrated in Fig.1, and the arrangement of these components are well known to those skilled in the art, so a repeated description thereof will be omitted

here for the sake of clarity.

[0019] As illustrated in Fig.1, the light emitting unit includes a light emitting element 100 and a lamp enclosure 200 including three parts, i.e., a part 1, a part 2 and a part 3, where interfaces between the respective parts are schematically represented with short black solid lines in the figure. Noted Fig.1 illustrates the lamp enclosure 200 including three parts as an example for the sake of convenience, but it shall be appreciated that the invention will not be limited thereto. The lamp enclosure can alternatively include 2, 4 or 6 parts, and those skilled in the art can arrange at will the number of parts constituting the lamp enclosure.

[0020] Not all the scattering coefficients of the three parts are identical. For example, the parts 1 and 2 can have an identical scattering coefficient which is different from that of the part 3, or each of the scattering coefficients of the three parts can be different from the other two scattering coefficients. That is, the scattering coefficients of at least two of the parts will be different from each other. Specific scattering coefficients can be arranged by those skilled in the art as required for practical illumination, and a repeated description thereof will be omitted here. Please be noted that scattering as mentioned in the invention refers to diffusive transmission.

[0021] A base material of the respective parts 1, 2 and 3 may be plastic, e.g., polycarbonate (PC), poly methyl methacrylate (PMMA) or polystyrene (PS). These materials are of a high transmissivity to facilitate an improved efficiency. Scattering particles are embedded in the base materials to achieve scattering characteristics of the respective parts. For different scattering coefficients, the numbers of scattering particles in the respective parts may be different, for example, the scattering particles can be arranged at dif-

ferent densities, or scattering particles with different scattering coefficients may be included in the base material to achieve different scattering characteristics. Fig.2 illustrates an example of distribution of scattering particles, and as illustrated, the size, number, density, etc., of scattering particles can be arranged at will as required for illumination.

[0022] An example of arranging the respective parts with respect to their scattering coefficients has been described above, but the respective parts can alternatively be arranged in term of other optical characteristics, e.g., refraction indexes, etc., and the invention will not be limited in this respect.

[0023] The different scattering coefficients of the different parts of the lamp enclosure can alternatively be achieved by varying their surface shapes instead of arranging their scattering particles and/or numbers of scattering particles. For example, the surfaces of the respective parts of the lamp enclosure 200 may be spherically convex and concave as illustrated in Fig.3a or pyramidally convex and concave as illustrated in Fig.3b. Fig.3a and Fig.3b illustrate the surface shape of one of the parts, e.g., the part 1, constituting the lamp enclosure, but the surface shape can also be applicable to the respective other parts. An example of the surface shape will not be limited to those illustrated in Fig.3a and Fig.3b but can alternatively be any one or combination of various other shapes as illustrated in Fig.3c. Those skilled in the art can arrange at will the surface shapes of the respective parts as required in practical illumination for the scattering coefficients of the respective parts. For example, the surface of the part 1 can be as illustrated in Fig.3a, the surface of the part 2 can be as illustrated in Fig.3b, and the surface of the part 3 can be planar. However there

are other possible combinations, which will not be enumerated here.

[0024] In an alternative embodiment, such a scenario may be possible that, for example, the scattering characteristic of the part 1 can be configured by arranging the surface shape thereof, for example, as illustrated in Fig.3a, the scattering characteristic of the part 2 can be configured by embedding scattering particles in the base material thereof, and the scattering characteristic of the part 3 can be configured by arranging the surface shape thereof, for example, as illustrated in Fig.3c. That is, a scattering characteristics of the respective parts can be configured in any combination of arranging the surface shapes thereof, arranging the scattering particles thereof, etc., so that these parts can be combined together to achieve a desired scattering effect. Those skilled in the art can arrange various combinations as required in practice, which will not be enumerated here.

[0025] In another alternative embodiment, the respective parts in the lamp enclosure can be arranged to have different optical characteristics by arranging the surface areas of the respective parts instead of arranging their scattering particles and/or surface shapes. The proportions of the surface areas of the parts 1 to 3 in the lamp enclosure are illustrated in Fig.1 as being identical, but the proportions may alternatively be different. Those skilled in the art can arrange them at will as required in practice. For example, the surface area of the part 2 can be twice those of the parts 1 and 3, or the ratio of the surface areas of the parts 1 to 3 can be 3:2:1, etc., and enumeration thereof will be omitted here. Undoubtedly, the thicknesses of the respective parts can also be set at will to achieve desired optical distribution. Of course, other profile dimensions than a surface area and a thickness can also be arranged, and enumeration thereof

will be omitted here.

[0026] As can be apparent, optical characteristics of the respective parts can be configured otherwise instead of by arranging their scattering particles and/or surface shapes and/or surface areas and/or thicknesses to configure their scattering characteristics as described above, and a repeated description thereof will be omitted here.

[0027] Furthermore one or two of the parts 1 to 3 can alternatively be transmissive to light, and as illustrated in Fig.4, the parts 1 and 3 are transmissive, and the part 2 is for scattering. The lamp enclosure illustrated in Fig.4 is merely illustrative, and alternatively another structure thereof can be adopted, for example, the parts 1 and 2 are for scattering, and the part 3 is transmissive, and enumeration thereof will be omitted here.

[0028] In a scenario with scattering particles embedded in the base material of the lamp enclosure 200, the lamp enclosure 200 can be manufactured, for example, through three-color plastic injection molding or stretch molding. Fig.1 illustrates a scenario with the lamp enclosure 200 including three parts, and if the number of parts thereof is larger than three, then a bonding process will be required. Fig.5 illustrates a scenario when a bonding process is required. As illustrated in Fig.5, in the scenario with the lamp enclosure including six parts, the parts 1 to 3 and the parts 4 to 6 can be formed respectively through three-color plastic injection molding or stretch molding and then joined together in a bonding process. The joining means can be arbitrary, e.g., buckle type connection, tenon type connection, etc. Fig.5 illustrates an example with identical surface areas of the parts 1 to 6, but those skilled in the art can set at will the surface areas of the parts 1 to 6, i.e., the respective ratios of the heights a to c of the parts 1 to 3 and of the

parts 4-6 as required in practice.

[0029] With the lamp enclosure according to the embodiments of the invention, a desired specific graph of optical distribution can be achieved flexibly without the use of any additional optical component, e.g., a reflector or a lens, and thus good optical uniformity can be achieved with a simple structure. Furthermore the structure of the light emitting unit can be simplified and the size thereof can be made smaller to thereby lower a cost thereof.

[0030] Fig.6 illustrates a graph of optical intensity distribution generated by the light emitting unit illustrated in Fig.4. The bat-like graph in the figure represents graphs of optical intensity distribution along 0-degree and 180-degree cross sections, and the pear-like graph in the figure represents graphs of optical intensity distribution along 90-degree and 270-degree cross sections. Fig.7a to Fig.7c illustrate a grey level graph and an illuminance distribution graph generated by the light emitting unit, where Fig.7a is a gray level graph of the light emitting unit according to the embodiment of the invention illuminating a 2m-by-2m reception plate. As illustrated in Fig.7a, the light emitting unit generates a uniform gray level graph. Fig.7b illustrates an illuminance distribution graph in the direction Y with the abscissa X=0, and Fig.7c illustrates an illuminance distribution graph in the direction X with the ordinate Y=0. As illustrated in Fig.7b and Fig.7c, the light emitting unit according to the embodiment of the invention generates a smooth illuminance graph.

[0031] Fig.8a illustrates a perspective view illustrating a case where the light emitting unit according to the embodiment of the invention is arranged on a luminary, e.g., an LED lamp tube, etc. Fig.8b is a cross sectional view of the lamp tube in Fig.8a. Fig.8 illustrates an example of the light

emitting unit according to the embodiment of the invention applied to the LED lamp tube, but the light emitting unit according to the embodiment of the invention will not be limited to the application to an LED lamp tube but can also be applicable to other luminaries, e.g., an incandescent lamp, etc. The invention will not be limited in this respect.

[0032] Furthermore how to configure optical characteristics of the respective constituting parts in the lamp enclosure of the light emitting unit according to the embodiment of the invention has been described above taking scattering characteristics as an example, any other optical characteristics of the respective constituting parts can be configured similarly to achieve desired optical distribution.

[0033] Although the invention has been disclosed above in the description of the embodiments of the invention, it shall be appreciated that those skilled in the art can make various modifications, adaptations or equivalents to the invention without departing from the spirit and scope of the appended claims, These modifications, adaptations or equivalents shall also be regarded as coming into the claimed scope of the invention.

Claims

1. A light emitting unit, comprising a light emitting element and a lamp enclosure which encloses the light emitting element and comprises a plurality of parts, at least two of which have different optical characteristics from each other.

2. The light emitting unit according to claim 1, wherein the optical characteristics are scattering characteristics of the respective parts of the lamp enclosure.

3. The light emitting unit according to claim 2, wherein respective ones of the at least two parts are different in terms of one or more of the following characteristics so that the scattering characteristics of the at least two parts are different from each other:

the refractive indexes of scattering particles embedded in a base material comprised in the respective parts;

the arrangement densities of the scattering particles embedded in the base material comprised in the respective parts;

the surface shapes of the respective parts; and

the surface areas of the respective parts.

4. The light emitting unit according to claim 3, wherein the surface shapes are any one or combination of the following: spherically convex, spherically concave, pyramidally convex and pyramidally concave.

5. The light emitting unit according to any one of claims 1 to 4, wherein at least one of the parts is a transmissive part to transmit rays of light emitting from the light emitting unit.

6. The light emitting unit according to any one of claims 1 to 5, wherein the light emitting unit is an LED.

7. A luminary, comprising the light emitting unit according to any one of claims 1 to 6.

FIG 1

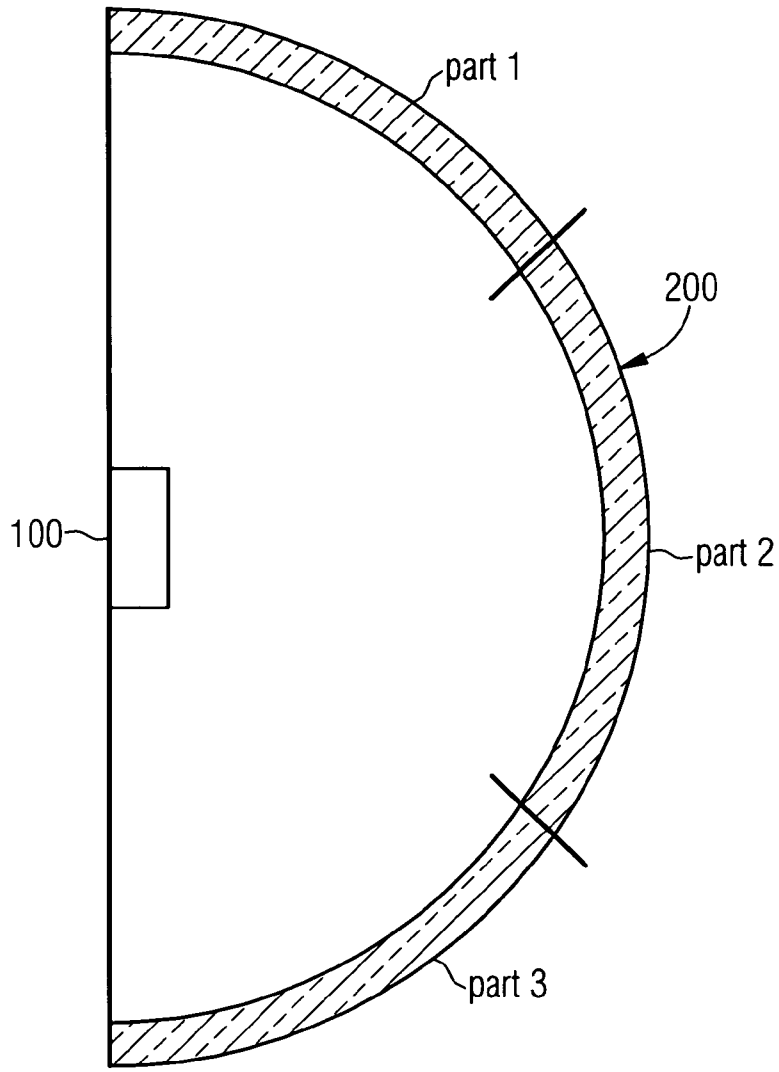


FIG 2

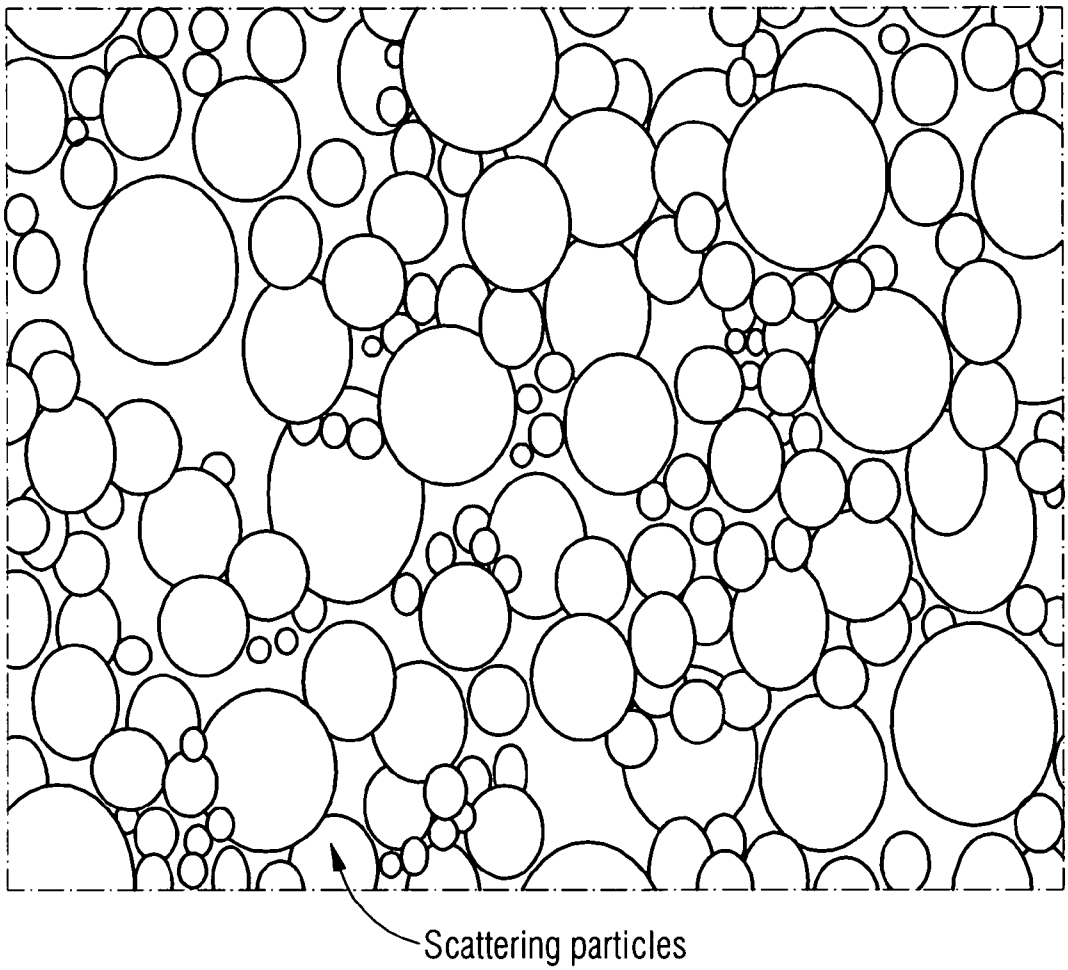


FIG 3a

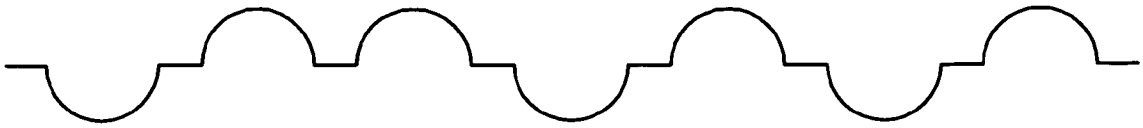


FIG 3b

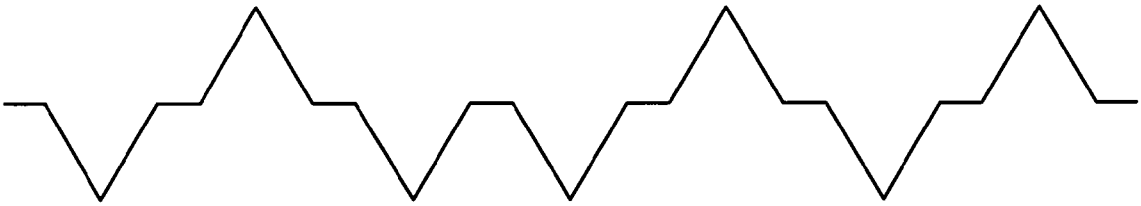


FIG 3c

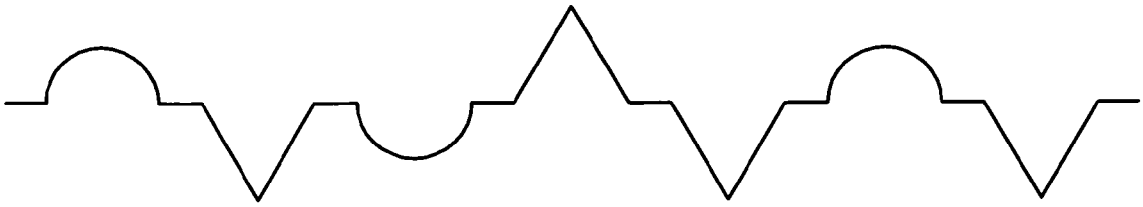


FIG 4

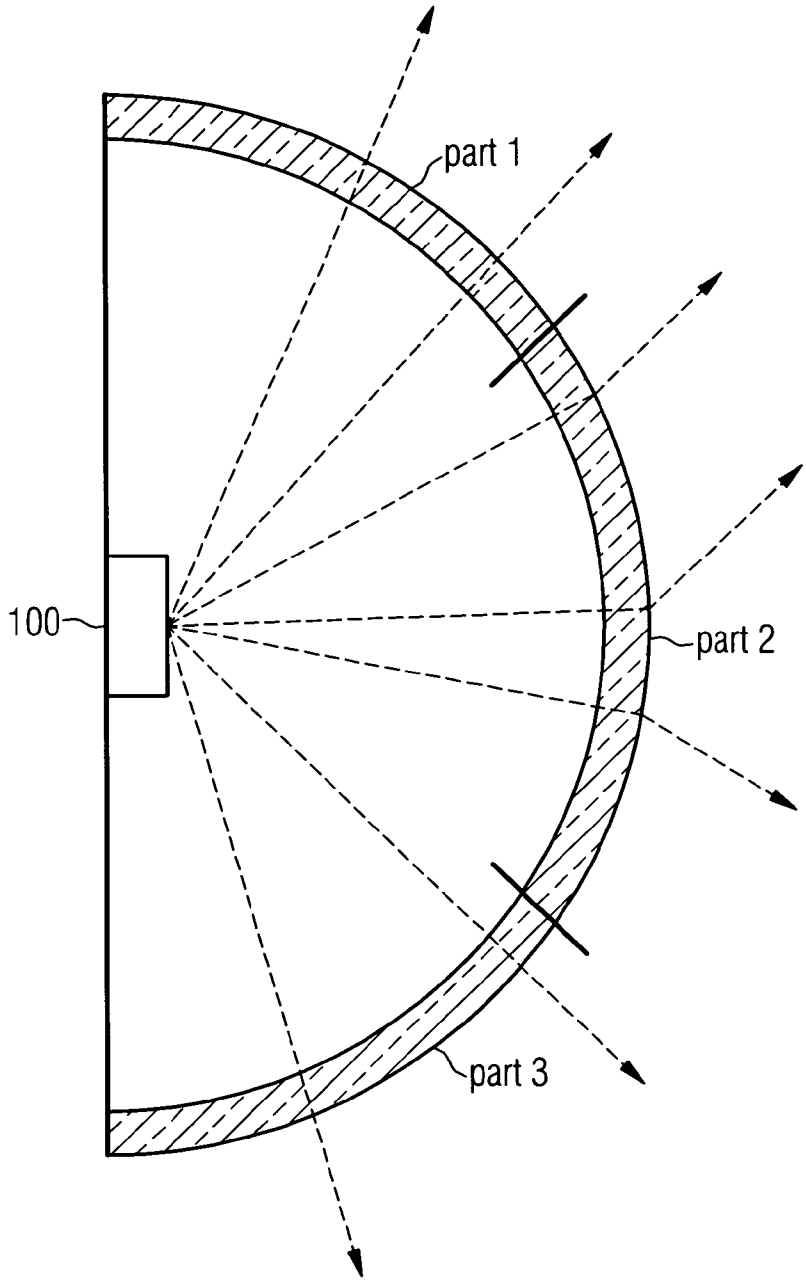


FIG 5

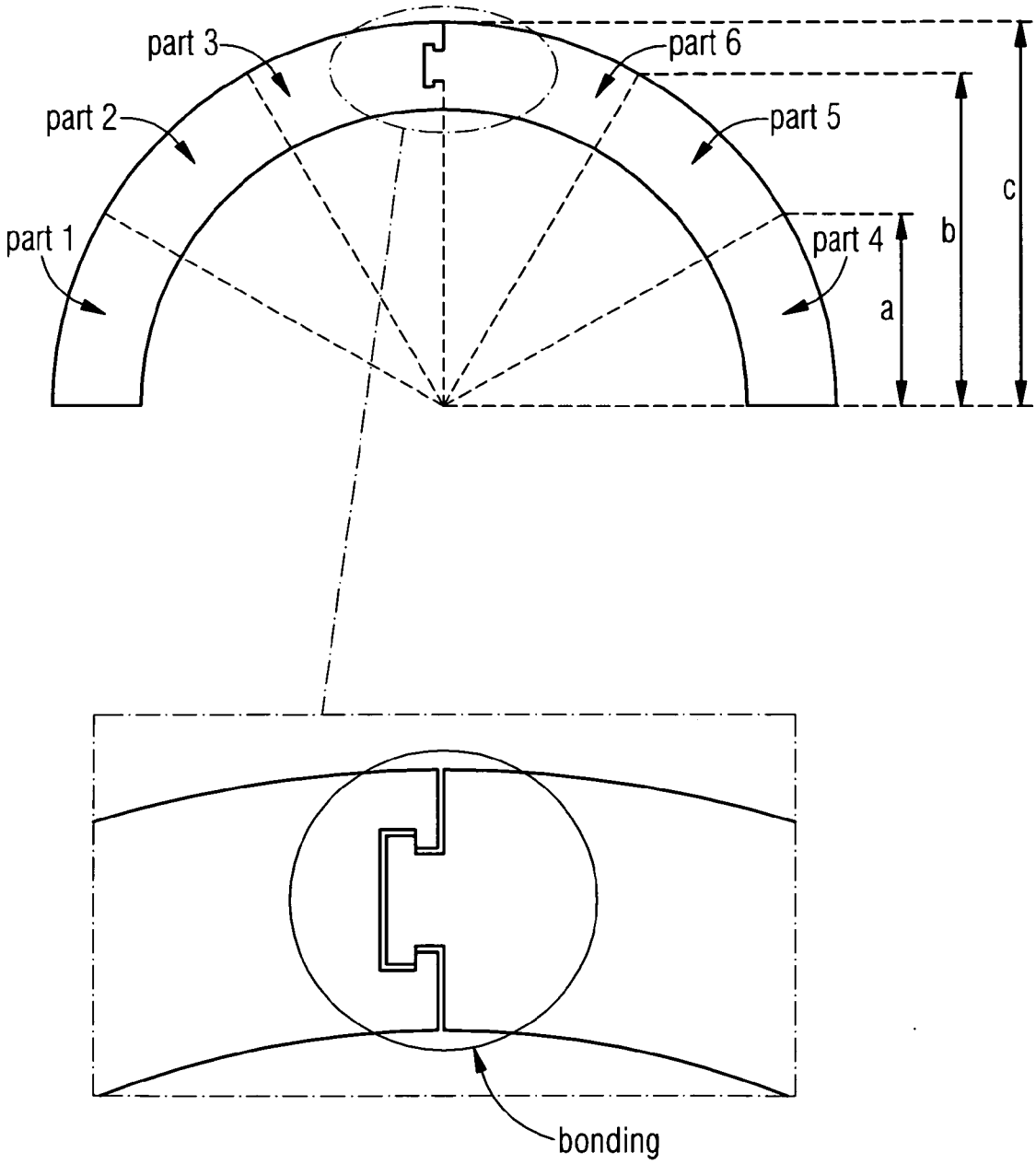


FIG 6

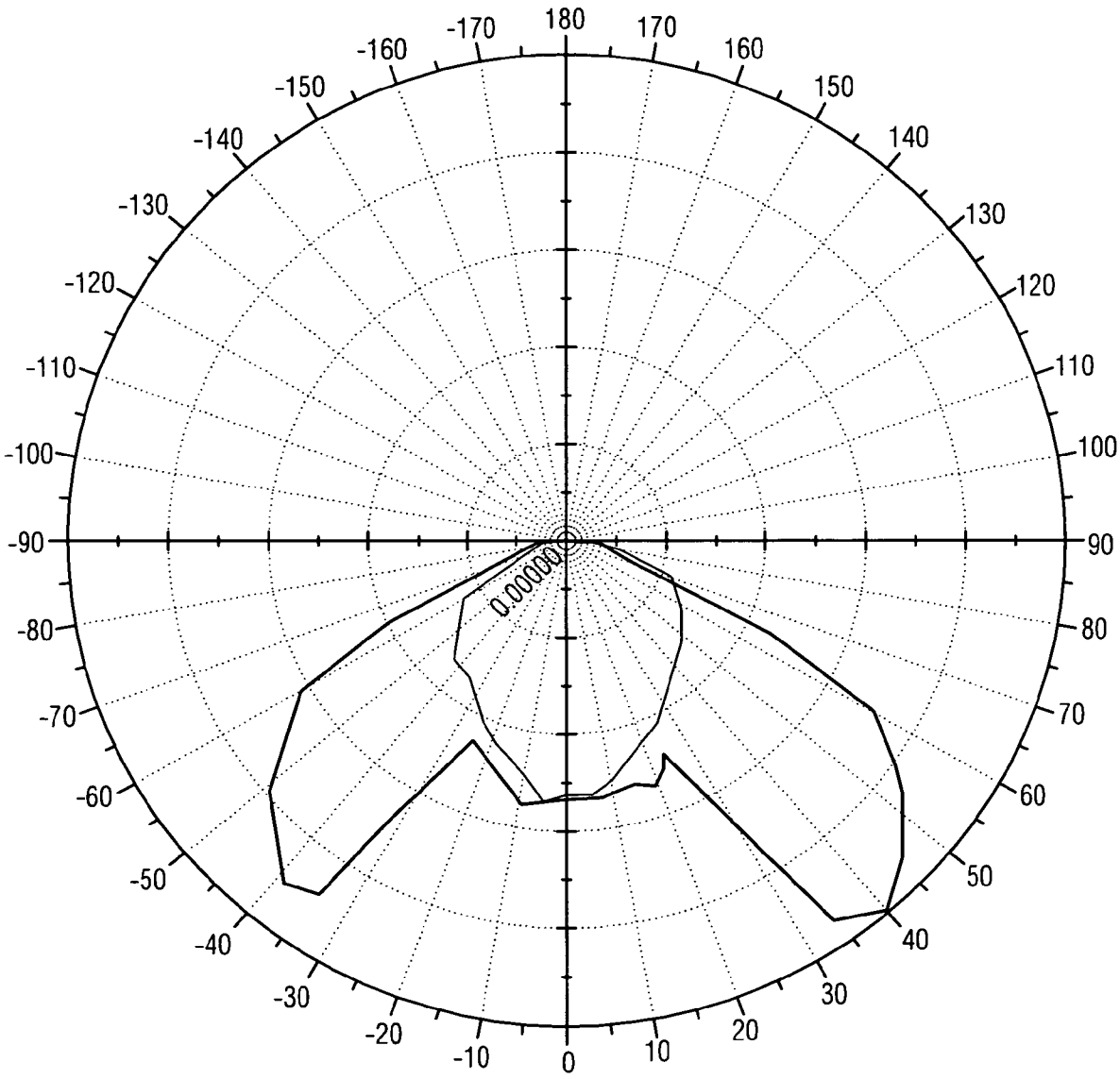
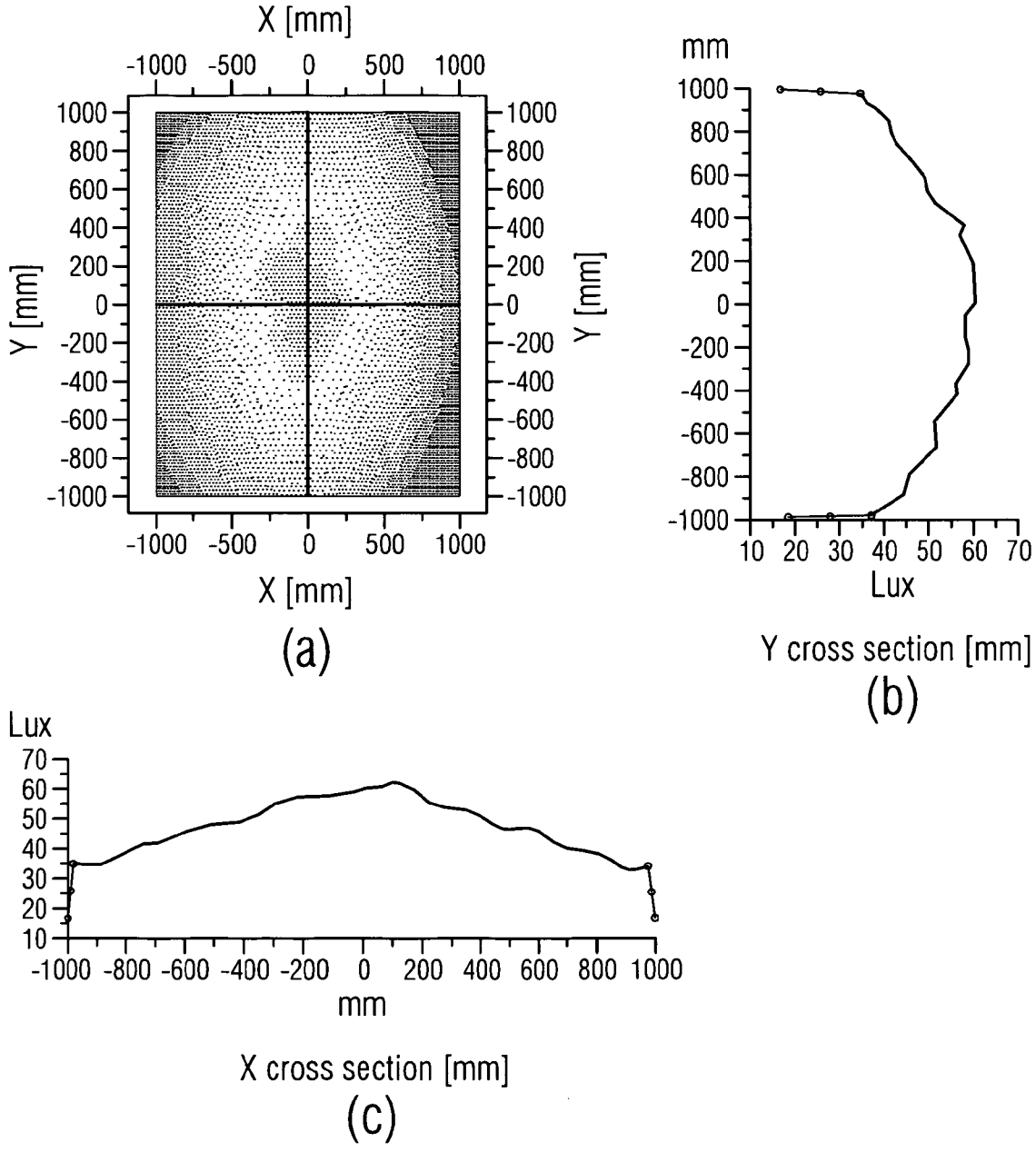

180
170
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150
140
130
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110
100
90
80
70
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-30
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-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
0.00000

FIG 7


X [mm]
-1000 -500 0 500 1000
Y [mm]
1000 800 600 400 200 0 -200 -400 -600 -800 -1000
(a)
mm
Lux
10 20 30 40 50 60 70
Y cross section [mm]
(b)
Lux
70 60 50 40 30 20 10
-1000 -800 -600 -400 -200 0 200 400 600 800 1000
mm
X cross section [mm]
(c)

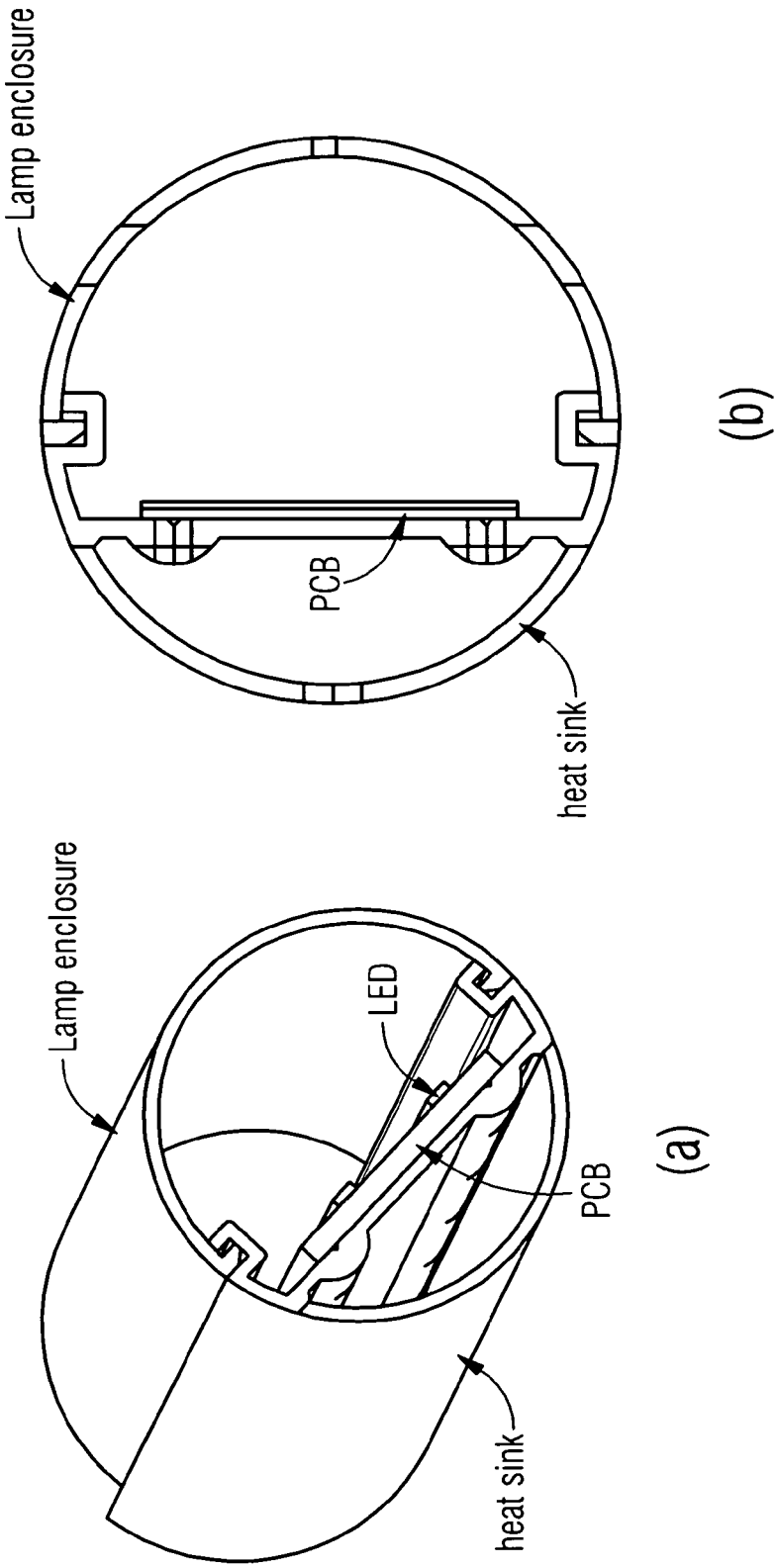

Lamp enclosure
PCB
heat sink
(b)
Lamp enclosure
LED
PCB
heat sink
(a)

FIG 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/067494

A. CLASSIFICATION OF SUBJECT MATTER
INV. F21V23/04
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)
F21V F21K 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

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X	DE 20 2011 000929 U1 (JADE YANG CO [TW]) 11 August 2011 (2011-08-11) figures 1,2	1-7
X	US 2011/163650 A1 (LEE HUNG-WEN [TW]) 7 July 2011 (2011-07-07) figures 1,2 paragraphs [0002], [0017]; claim 7	1-7
X	US 2009/283779 A1 (NEGLEY GERALD [US] ET AL) 19 November 2009 (2009-11-19) paragraphs [0075], [0077] figures 3,4,6,8-11	1-7
X	US 2008/308825 A1 (CHAKRABORTY ARPAN [US] ET AL) 18 December 2008 (2008-12-18) abstract	1-7

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 December 2012	13/12/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Kovács, Endre

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/067494

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/273336 A1 (TSAI HUA-HSIN [TW]) 6 November 2008 (2008-11-06) abstract; claim 1; figures 2-5 paragraph [0011] -----	1-7
X	US 2011/075408 A1 (NEGLEY GERALD H [US] ET AL) 31 March 2011 (2011-03-31) paragraphs [0008], [0009], [0041] claims 8,13,14,18; figures 1,2,5 -----	1-7

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2012/067494

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