US009732931B2

(12) United States Patent
Sun et al.

(10) **Patent No.: US 9,732,931 B2**
(45) **Date of Patent: Aug. 15, 2017**

(54) **LIGHT-EMITTING MODULE AND LIGHT-EMITTING DEVICE**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/058,154**

(22) Filed: **Mar. 2, 2016**

(65) **Prior Publication Data**

US 2016/0348872 A1 Dec. 1, 2016

(30) **Foreign Application Priority Data**

May 25, 2015 (TW) .... 104116633 A

(51) **Int. Cl.**

F21V 5/00	(2015.01)
F21V 13/04	(2006.01)
F21V 7/04	(2006.01)
F21V 5/04	(2006.01)
F21Y 101/02	(2006.01)
F21Y 103/00	(2016.01)

(52) **U.S. Cl.**

CPC ***F21V 5/007*** (2013.01); ***F21V 5/04*** (2013.01); ***F21V 7/04*** (2013.01); ***F21V 13/04*** (2013.01); *F21Y 2101/02* (2013.01); *F21Y 2101/025* (2013.01); *F21Y 2103/003* (2013.01)

(58) **Field of Classification Search**

USPC 362/23.14, 609, 623, 560, 514, 516, 517, 362/217.05, 241, 243, 245, 247, 296.01, 362/301, 302, 341, 169, 215, 268, 335, 362/455

See application file for complete search history.

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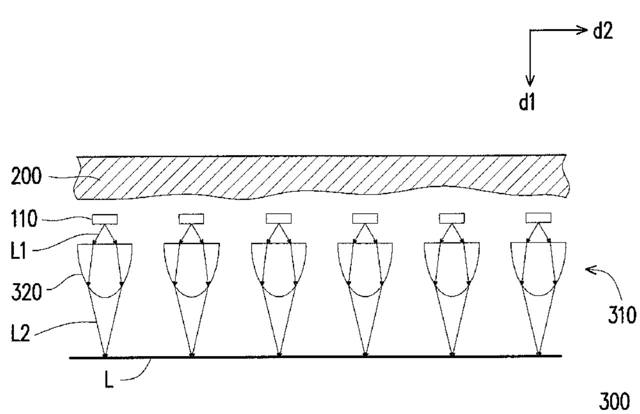
(74) *Attorney, Agent, or Firm* — Jianq Chyun IP Office

(57) **ABSTRACT**

A light-emitting module that includes a light source and an optical lens is provided. The light source emits an original beam along a direction of a light-emitting axis, and the optical lens is disposed on a transmission path of the original beam. The original beam passes the optical lens and becomes an illumination beam. A light shape of the illumination beam has a first full width at half maximum (FWHM) along a first direction and has a second FWHM along a second direction, and a ratio of the second FWHM to the first FWHM is large than 3. The first direction and the second direction are perpendicular to the direction of the light-emitting axis. A light-emitting device is also provided.

15 Claims, 7 Drawing Sheets



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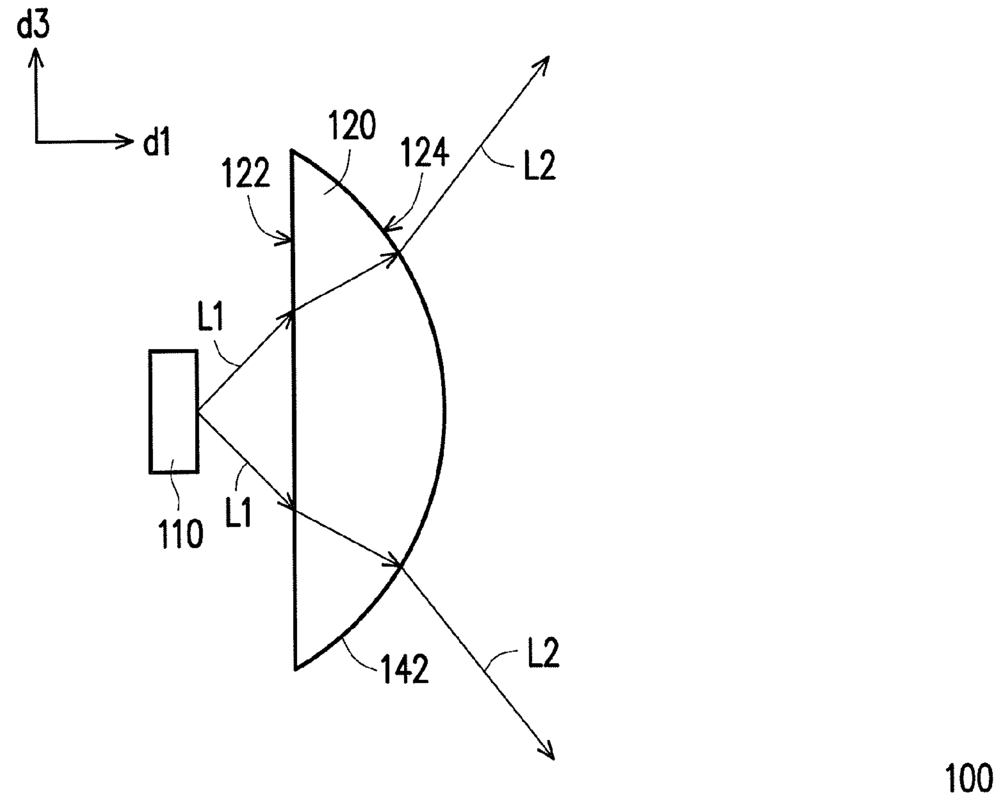
d3
d1
120
122
124
L2
L1
110
L1
142
L2
100

FIG. 1A

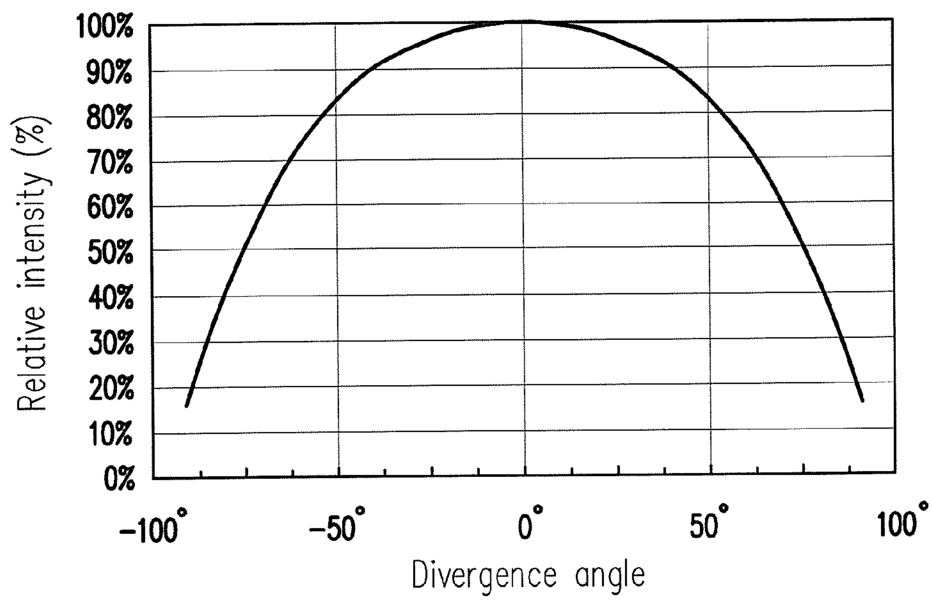
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Relative intensity (%)
-100°
-50°
0°
50°
100°
Divergence angle

FIG. 1A'

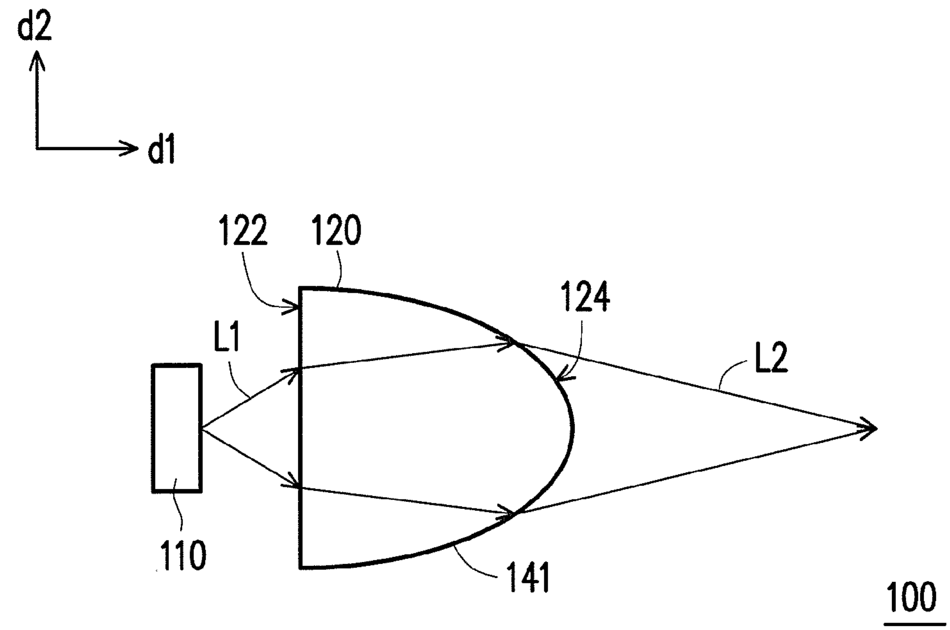
d2
d1
122
120
124
L1
L2
110
141
100

FIG. 1B

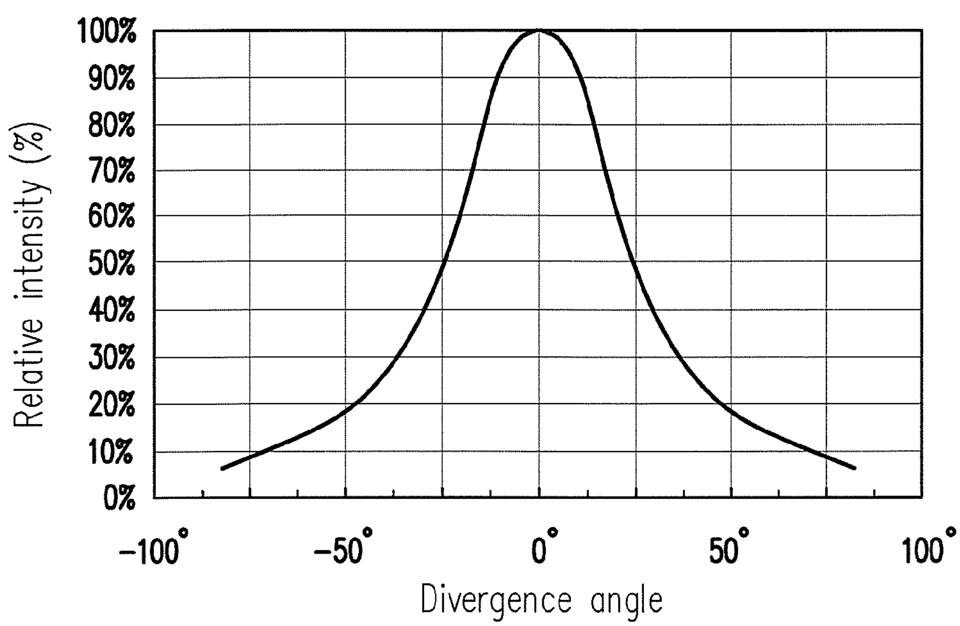
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Relative intensity (%)
-100°
-50°
0°
50°
100°
Divergence angle

FIG. 1B'

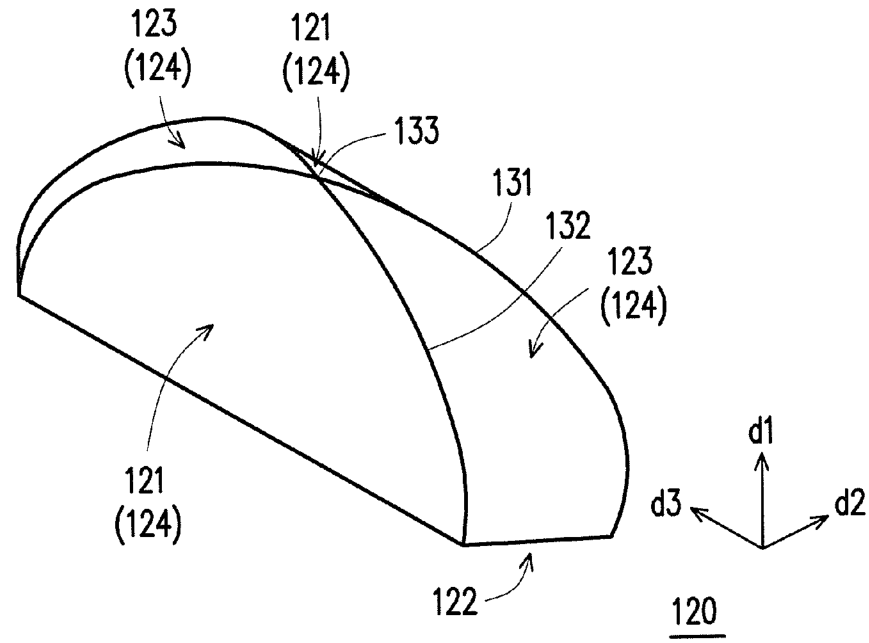
123
(124)
121
(124)
133
131
132
123
(124)
121
(124)
122
d1
d2
d3
120

FIG. 1C

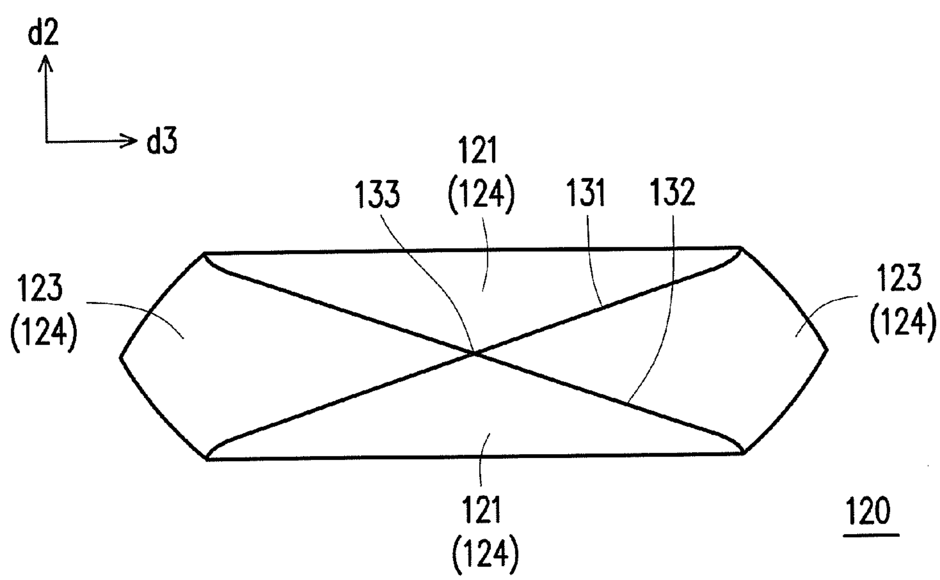
d2
d3
121
(124)
133
131
132
123
(124)
123
(124)
121
(124)
120

FIG. 1D

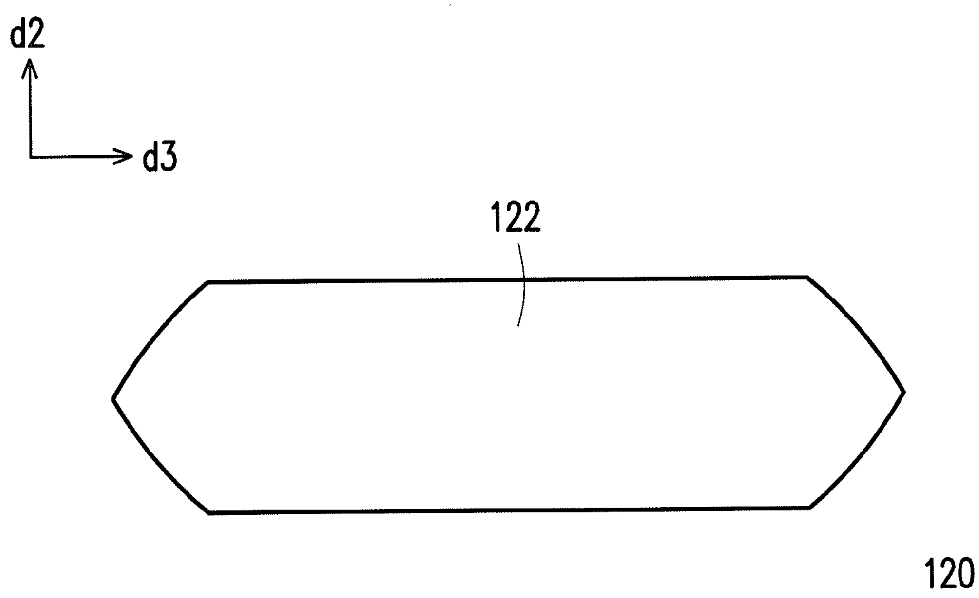

FIG. 1E

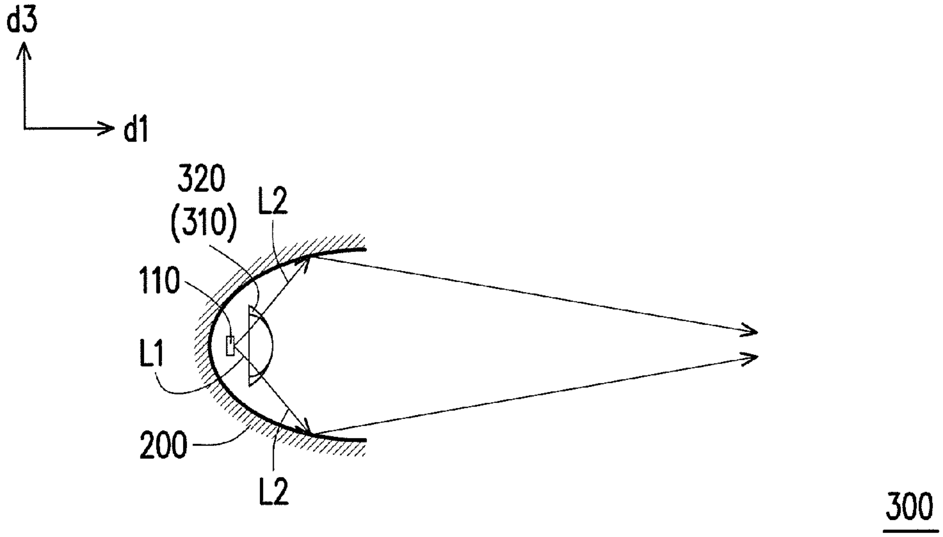

FIG. 2A

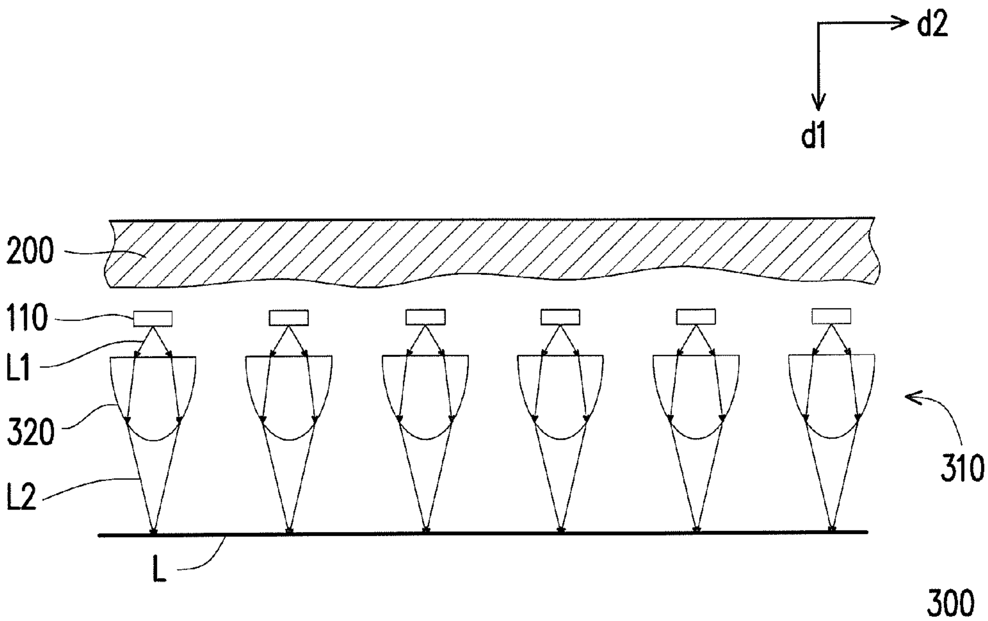

FIG. 2B

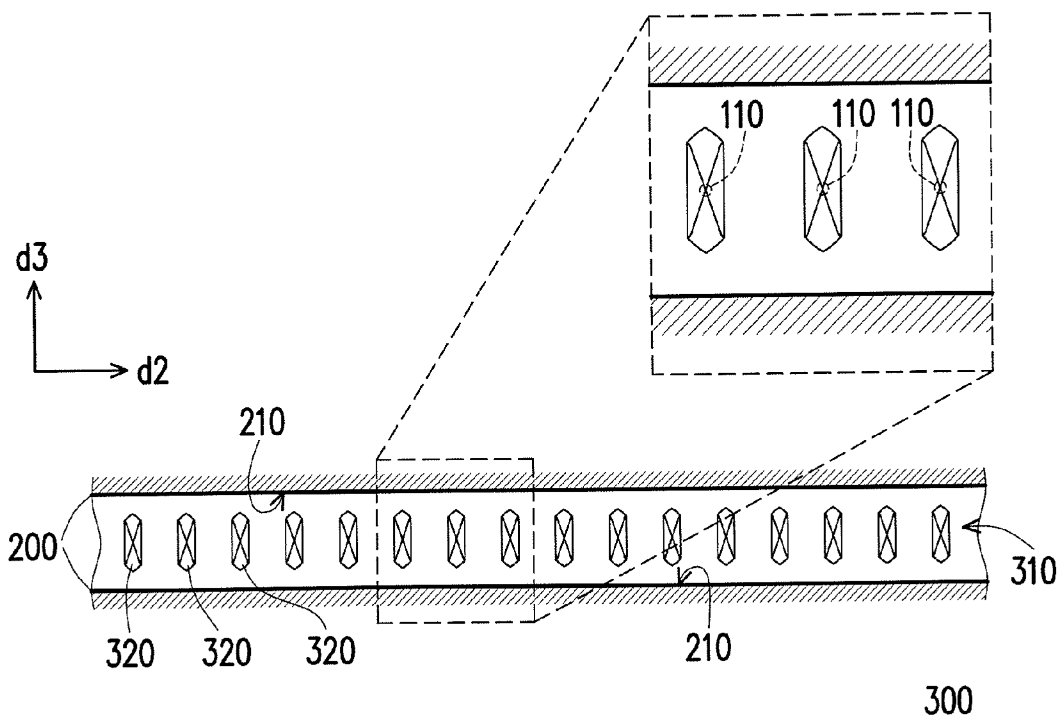

FIG. 2C

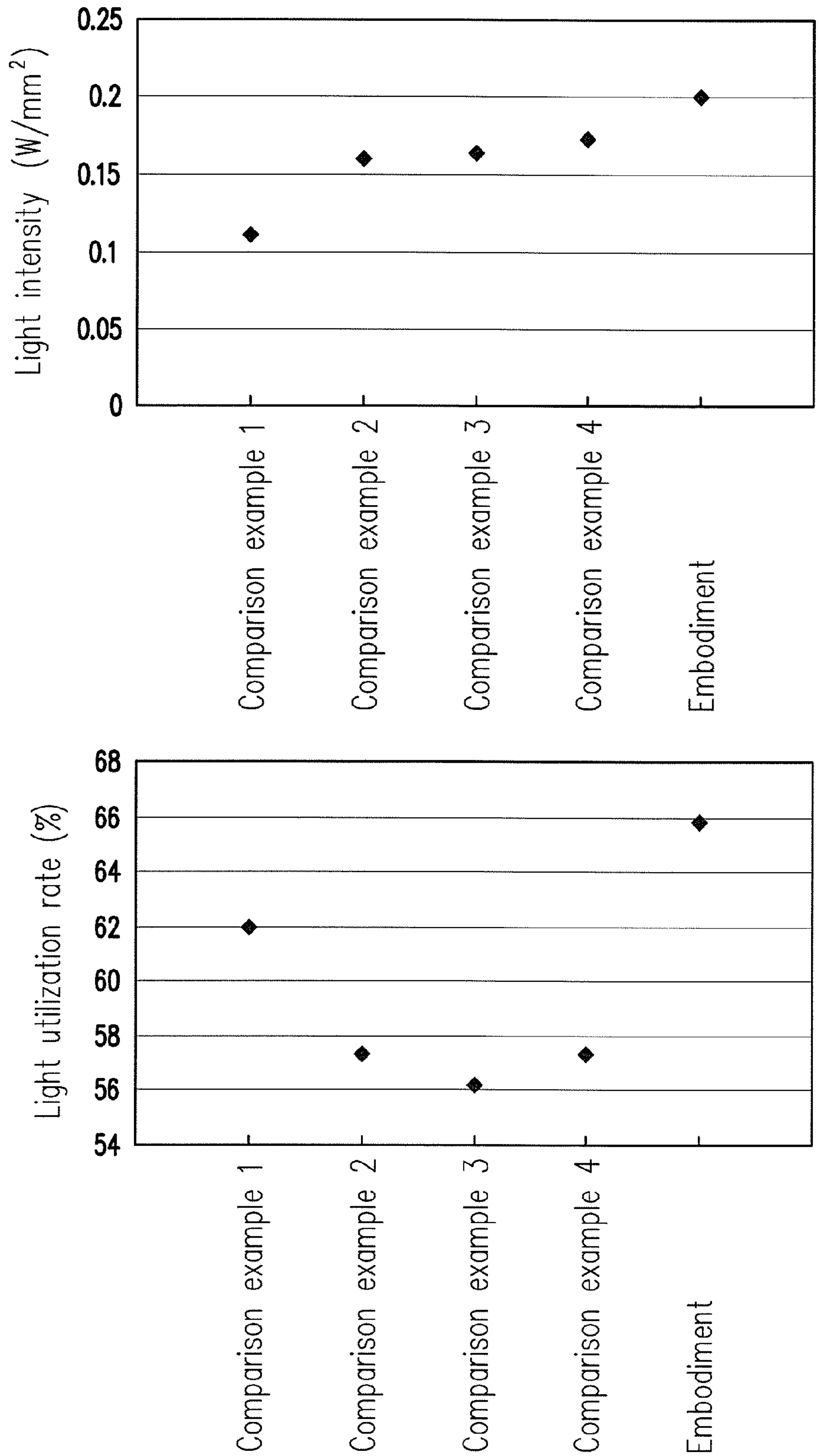
Light intensity (W/mm2)
0.25
0.2
0.15
0.1
0.05
0
Comparison example 1
Comparison example 2
Comparison example 3
Comparison example 4
Embodiment
Light utilization rate (%)
68
66
64
62
60
58
56
54
Comparison example 1
Comparison example 2
Comparison example 3
Comparison example 4
Embodiment

FIG. 3

LIGHT-EMITTING MODULE AND LIGHT-EMITTING DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the priority benefit of Taiwan application serial no. 104116633, filed on May 25, 2015. The entirety of the above-mentioned patent application is hereby incorporated by reference herein and made a part of this specification.

FIELD OF THE INVENTION

The invention relates to an optical module and an optical device. More particularly, the invention relates to a light-emitting module and a light-emitting device.

DESCRIPTION OF RELATED ART

With the development of science and technologies, light-emitting diodes (LEDs) characterized by high efficiency, long life span, and energy-saving ability based on environmental consciousness have gradually replaced the conventional mercury lamps and have been extensively applied as linear light sources in printing curing devices, medical devices, scanning devices, and so forth. Hence, how to develop an LED device capable of providing a satisfactory linear light source has become an important issue nowadays.

While the linear light sources are being employed, the focusing and collimating effects that can be achieved by the linear light source as well as the brightness of the linear light source are often the main concerns. At present, the conventional linear light sources are mostly formed by linearly arranging a plurality of LEDs. However, beams coming from the LEDs are often emitted at a relatively large divergence angle, and thus the resultant beams from the linear light sources are divergent, which reduces the collimation of the linear light sources. Besides, the mixed beams coming from the LEDs are not uniform, which leads to the reduction of the quality of the beams from the linear light sources.

SUMMARY OF THE INVENTION

The invention is directed to a light-emitting module, and light shape distributions of the beams from the light-emitting module are different in two directions.

The invention is also directed to a light-emitting device that can act as a satisfactory linear light source.

In an embodiment of the invention, a light-emitting module that includes a light source and an optical lens is provided. The light source emits an original beam along a direction of a light-emitting axis, and the optical lens is disposed on a transmission path of the original beam. The original beam passes the optical lens and becomes an illumination beam. A light shape of the illumination beam has a first full width at half maximum (FWHM) (e.g. a full width of angle at half maximum light intensity) along a first direction and has a second FWHM along a second direction, and a ratio of the second FWHM to the first FWHM is large than 3. The first direction and the second direction are perpendicular to the direction of the light-emitting axis.

According to an embodiment of the invention, the first FWHM is within a range from 20 degrees to 60 degrees, and the second FWHM is within a range from 100 degrees to 180 degrees.

According to an embodiment of the invention, the optical lens includes a light incident surface and a light output combination surface opposite to the light incident surface. The light output combination surface is axis-symmetrical along the first direction and the second direction.

According to an embodiment of the invention, the light output combination surface includes at least two first light output surfaces and at least two second light output surfaces, the at least two first light output surfaces are arranged along the first direction, and the at least two second light output surfaces are arranged along the second direction.

According to an embodiment of the invention, the at least two first light output surfaces and the at least two second light output surfaces constitute a plurality of boundary lines intersecting at a center of the light output combination surface.

According to an embodiment of the invention, a profile of the light output combination surface on a first plane is a first arc, and a profile of the light output combination surface on a second plane is a second arc. A normal vector of the first plane is parallel to the second direction, and a normal vector of the second plane is parallel to the first direction. An average curvature radius of the second arc is greater than an average curvature radius of the first arc.

In an embodiment of the invention, a light-emitting device that includes a lens module, a reflective mask, and a plurality of light sources disposed between the reflective mask and the lens module is provided. The light sources are arranged along a first direction, and each of the light sources emits an original beam along a direction of a light-emitting axis. The lens module is disposed on transmission paths of the original beams. Each of the original beams passes the lens module and becomes an illumination beam. A light shape of each of the illumination beams has a first FWHM along a first direction and has a second FWHM along a second direction, and a ratio of the second FWHM to the first FWHM is large than 3. The first direction and the second direction are perpendicular to the direction of the light-emitting axis. The reflective mask is configured to reflect one portion of the illumination beams toward the direction of the light-emitting axis, and the reflected portion of the illumination beams and another portion of the illumination beams are substantially transmitted along the direction of the light-emitting axis.

According to an embodiment of the invention, the lens module includes a plurality of optical lenses arranged along the first direction. Each of the optical lenses is located on the transmission path of one of the original beams, and the original beam passes a corresponding optical lens and becomes the illumination beam.

According to an embodiment of the invention, at least half of the illumination beams transmitted on a second plane are reflected by the reflective mask, the reflected portion of the illumination beams converges in the second direction, and a normal vector of the second plane is parallel to the first direction.

According to an embodiment of the invention, the reflective mask includes a reflective concave surface, and the lens module and the light sources are adjacent to a location of a focus of the reflective concave surface in the second direction.

In view of the above, the light-emitting module provided in an embodiment of the invention is able to emit the illumination beams whose light shape distributions are different in two directions through the optical lens. Here, the illumination beams can be reflected toward and transmitted along a direction in an effective manner. The beams emitted by the light-emitting device converge along one direction according to an embodiment of the invention, and therefore the light-emitting device described herein can serve as a satisfactory linear light source.

Several exemplary embodiments accompanied with figures are described in detail below to further describe the disclosure in details.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings are included to provide further understanding, and are incorporated in and constitute a part of this specification. The drawings illustrate exemplary embodiments and, together with the description, serve to explain the principles of the invention.

FIG. **1**A and FIG. **1**B are schematic views illustrating a light-emitting module according to a first embodiment of the invention.

FIG. **1**A' and FIG. **1**B' illustrate light shape distributions of the light-emitting module according to the first embodiment of the invention.

FIG. **1**C is a schematic three-dimensional view illustrating an optical lens according to the first embodiment of the invention.

FIG. **1**D is a top view illustrating the optical lens according to the first embodiment of the invention.

FIG. **1**E is a bottom view illustrating the optical lens according to the first embodiment of the invention.

FIG. **2**A, FIG. **2**B, and FIG. **2**C are schematic views illustrating an optical device according to a second embodiment of the invention.

FIG. **3** schematically illustrates light intensity and light utilization rate in Table 1 according to an embodiment of the invention and some comparison examples.

DETAILED DESCRIPTION OF DISCLOSED EMBODIMENTS

FIG. **1**A and FIG. **1**B are schematic views illustrating a light-emitting module according to a first embodiment of the invention. With reference to FIG. **1**A and FIG. **1**B, in the first embodiment of the invention, the light-emitting module **100** includes a light source **110** and an optical lens **120**. The light source **110** emits an original beam L**1** along a direction d**1** of a light-emitting axis, and the optical lens **120** is disposed on a transmission path of the original beam L**1**. The original beam L**1** passes through the optical lens **120** and becomes an illumination beam L**2**. Specifically, in order to clearly explain the light-emitting module provided in an embodiment of the invention, FIG. **1**A is a schematic view illustrating the light-emitting module **100** along a first direction d**2**, so as to show the transmission path of the illumination beam L**2** along a second direction d**3**; FIG. **1**B is a schematic view illustrating the light-emitting module **100** along the second direction d**3**, so as to show the transmission path of the illumination beam L**2** along the first direction d**2**. Both the first direction d**2** and the second direction d**3** are perpendicular to the direction d**1** of the optical axis (i.e. the light-emitting axis). Specifically, the first direction d**2** is perpendicular to the second direction d**3**.

FIG. **1**A' and FIG. **1**B' illustrate light shape distributions of a light-emitting module according to the first embodiment of the invention. With reference to FIG. **1**A', the light shape of the illumination beam L**2** has a second full width at half maximum (FWHM) along the second direction d**3**. With reference to FIG. **1**B', the light shape of the illumination beam L**2** has a first FWHM along the first direction d**2**. FIG. **1**A' and FIG. **1**B' show the corresponding relation between the light intensity and the divergence angle of the illumination beam L**2**. Here, the first FWHM is within a range from 20 degrees to 60 degrees, and the second FWHM is within a range from 100 degrees to 180 degrees. Particularly, the second FWHM of the illumination beam L**2** in the second direction d**3** is greater than the first FWHM of the illumination beam L**2** in the first direction d**2**, and thus the illumination beam L**2** diverges in the second direction d**3** and converges in the first direction d**2**. Preferably, a ratio of the second FWHM to the first FWHM is large than 3. According to the present embodiment, the first FWHM of the illumination beam L**2** in the first direction d**2** is about 50 degrees, and the second FWHM of the illumination beam L**2** in the second direction d**3** is about 150 degrees. If the ratio of the FWHM of an illumination beam in two directions is less than 3, the difference of distribution ranges of the illumination beam in the two different directions is overly small, such that said convergence and divergence effects are not apparent. Specifically, in an embodiment of the invention, the ratio of the second FWHM to the first FWHM is preferably greater than 5, and thereby the difference of the distribution ranges of the light shape of the illumination beam L**2** in the two different directions is apparent. As such, after a reflective element (not shown) is subsequently foamed, for instance, favorable optical effects can be accomplished. It should be mentioned that the original beam L**1** can have a third FWHM which is less than the second FWHM and greater than the first FWHM; through the optical lens **120**, the original beam L**1** becomes the illumination beam L**2** whose distribution range difference in the two different directions is apparent, and thereby the resultant effects can be more satisfactory.

In light of the foregoing, the light shape distributions of the illumination beam L**2** from the light-emitting module **100** described herein are different in two different directions, and the ratio of the second FWHM to the first FWHM in the two directions is greater than 3; hence, the focusing effect achieved by the illumination beam L**2** in the first direction d**2** is more satisfactory than that accomplished by the original beam L**1**, and the divergence angle of the illumination beam L**2** in the second direction d**3** is greater than that of the original beam L**1**. Here, the light source **110** is an LED, a laser diode, or any other light-emitting device suitable for emitting beams. The original beam L**1** is emitted from the light source **110** at a certain divergence angle. Through the optical lens **120** described in the present embodiment, the original beam L**1** can become the illumination beam L**2** whose distribution range in the first direction d**2** and the second direction d**3** is different. Besides, the illumination beam L**2** in the second direction d**3** can easily converge in the direction d**1** of the light-emitting axis after the illumination beam L**2** is reflected by a reflective element (not shown). In other words, the light-emitting module **100** provided herein can act as a linear light source capable of emitting lights with uniformity and achieving the favorable focusing effect after said reflection.

FIG. **1**C is a schematic three-dimensional view illustrating an optical lens according to the first embodiment of the invention. FIG. **1**D is a top view illustrating the optical lens according to the first embodiment of the invention. FIG. **1**E is a bottom view illustrating the optical lens according to the first embodiment of the invention. With reference to FIG. **1**C, FIG. **1**D, and FIG. **1**E, to be specific, the optical lens **120** includes a light incident surface **122** and a light output combination surface **124** opposite to the light incident surface **122**. The light output combination surface **124** can be axis-symmetrical along the first direction d**2** and the second direction d**3**. According to an embodiment of the invention, the light output combination surface **124** includes at least two first light output surfaces **121** and at least two second light output surfaces **123**, the at least two first light output surfaces **121** are arranged along the first direction d**2**, and the at least two second light output surfaces **123** are arranged along the second direction d**3**. In two different directions, the first light output surfaces **121** and the second light output surfaces **123** are different curved surfaces. Therefore, in the original beam L**1** emitted from the light source **110**, one portion of the original beam L**1** deviating along the first direction d**2** substantially penetrates the first light output surfaces **121** while passing through the optical lens **120**, and another portion of the original beam L**1** deviating along the second direction d**3** substantially penetrates the second light output surfaces **123** while passing through the optical lens **120**. Here, a profile of the light output combination surface **124** on a first plane (i.e., the plane shown in FIG. **1**B) whose normal vector is parallel to the second direction d**3** is a first arc **141**, and a profile of the light output combination surface **124** on a second plane (i.e., the plane shown in FIG. **1**A) whose normal vector is parallel to the first direction d**2** is a second arc **142**. An average curvature radius of the second arc **142** is greater than an average curvature radius of the first arc **141**; accordingly, the illumination beam L**2** converted by the optical lens **120** can achieve different divergence and convergence effects. Namely, the illumination beam L**2** converges along the first direction d**2** and diverges along the second direction d**3**. In particular, the optical lens **120** is asymmetrical to the direction of the light-emitting axis. Superficially, the light incident surface **122** may be a plane (i.e., the plane shown in FIG. **1**E) and may have accommodation space (not shown) to hold the light source **110**; thereby, the volume of light-emitting module **100** can be further reduced.

The two first light output surfaces **121** and the two second light output surfaces **123** of the light output combination surface **124** described herein may be alternately arranged along the center **133** of the light output combination surface **124**. Hence, the optical lens **120** allows the illumination beam L**2** to accomplish different divergence and convergence effects in at least two different directions. Besides, in the present embodiment, the first light output surfaces **121** and the second light output surfaces **123** constitute boundary lines **131** and **132** intersecting at the center **133** of the light output combination surface **124**; therefore, when the light source **110** is disposed corresponding to the center **133** of the optical lens **120**, i.e., the light-emitting axis of the light source **110** passes the center **133** of the optical lens **120**, the original beam L**1** emitted toward the center **133** along the light-emitting axis d**1** can be effectively deviated by the light output combination surface **124** to form the illumination beam L**2** which can achieve different convergence and divergence effects in different directions.

Said arrangement of the first and second light output surfaces **121** and **123** of the light output combination surface **124** in the optical lens **120** is not limited to the embodiment provided herein; in another embodiment, the light output combination surface can be constituted by other numbers and types of light output surfaces surrounding the center of the light output combination surface. In another embodiment of the invention, the center of the light output combination surface can further has a light-emitting center surface, and peripheries of the light-emitting center surface are connected to different light-emitting surfaces that are bent. The invention is not limited thereto.

FIG. **2**A, FIG. **2**B, and FIG. **2**C are schematic views illustrating an optical device according to a second embodiment of the invention. To clearly illustrate the light-emitting device **300** provided in the present embodiment, the light-emitting device **300** is depicted along the first direction d**2** in FIG. **2**A, along the second direction d**3** in FIG. **2**B, and along the direction d**1** of the light-emitting axis in FIG. **2**C. Besides, identical or similar reference numbers represent identical or similar elements, and repetitive descriptions are omitted. The omitted descriptions may be found in the previous exemplary embodiments.

With reference to FIG. **2**A to FIG. **2**C, in the second embodiment, the light-emitting device **300** includes a lens module **310**, a reflective mask **200**, and a plurality of light sources **110** disposed between the reflective mask **200** and the lens module **310**. Each of the light sources **110** emits the original beam L**1** along the direction d**1** of the light-emitting axis. The lens module **310** is located on the transmission paths of the original beams L**1** emitted from the light sources **110**, and each of the original beams L**1** passes the lens module **310** and becomes the illumination beam L**2**.

As shown in the partial enlarged view in FIG. **2**C, the light sources **110** are arranged along the first direction d**2**, the light shape of each of the illumination beams L**2** passing through the lens module **310** has a first FWHM along the first direction d**2** perpendicular to the direction d**1** of the light-emitting axis and has a second FWHM along the second direction d**3** perpendicular to the direction d**1** of the light-emitting axis, and a ratio of the second FWHM to the first FWHM is large than 3. That is, most of the illumination beams L**2** passing through the lens module **310** provided in the present embodiment converge in the first direction d**2** and diverge in the second direction d**3**, as shown in FIG. **2**A and FIG. **2**B. The reflective mask **200** is configured to reflect one portion of the illumination beams L**2** diverging in the second direction d**3** toward the direction d**1** of the light-emitting axis, and the reflected portion of the illumination beams L**2** and another portion of the illumination beams L**2** converging in the first direction d**2** are substantially transmitted along the direction d**1** of the light-emitting axis. That is, the reflective mask **200** reflects the portion of the illumination beams L**2** diverging in the second direction d**3** toward the direction d**1** of the light-emitting axis and allows the reflected portion of the illumination beams L**2** and the other portion of the illumination beams L**2** converging in the first direction d**2** to gather in one area in a uniform manner, so as to create a linear light source L extending along the first direction d**2**. In order to clearly illustrate the locations and the connection relationship of the elements provided in the present embodiment, note that the FIG. **2**A to FIG. **2**C are enlarged views, and these views should not be construed as limitations to the dimensions and the locations of the elements provided herein. Based on such design, the linear light source L capable of emitting uniform beams can be formed.

Preferably, with reference to FIG. **2**A and FIG. **2**C, in the present embodiment, at least half of the illumination beams L**2** transmitted on a second plane (whose normal vector is parallel to the first direction d**2**) are reflected by the reflective mask **200**, the reflected portion of the illumination beams L**2** converges along the second direction d**3**, and the reflected portion of the illumination beams L**2** and another portion of the illumination beams L**2** converging along the first direction d**2** gather at the same area in a uniform manner, so as to form the linear light source L extending along the first direction d**2**. As such, the light-emitting device **300** provided in the present embodiment can emit the illumination beams L**2** that can achieve the favorable focusing effect.

Specifically, as shown in FIG. **2**C, the reflective mask **200** described in the present embodiment includes a reflective concave surface **210**, and the lens module **310** includes a plurality of optical lens **320** arranged along the first direction d**2**. Each of the optical lenses **320** is located on the transmission path of one of the original beams L**1**, and the original beams L**1** passes a corresponding optical lens **320** and becomes the illumination beam L**2**. The lens module **310** and the light sources **110** are located in the recess area constituted by the reflective concave surface **210**. Since the optical lenses **320** in the lens module **310** provided in the present embodiment are similar to the optical lens **120** provided in the previous embodiment, the illumination beams L**2** that are emitted from the light sources **110** and pass through the lens module **310** are reflected by the reflective concave surface **210** in the second direction d**3**, such that the beams emitted by the light-emitting device **300** can all accomplish the satisfactory focusing effect. In particular, for instance, the reflective concave surface **210** is an elliptic reflective surface, and the lens module **310** and the light sources **110** are located on a focus of the cross-section of the elliptic reflective surface, such that the reflected illumination beams L**2** can achieve the favorable focusing effect; however, the invention is not limited thereto. In another embodiment of the invention, the lens module **310** and the light sources **110** may be adjacent to the location of the focus of the elliptic reflective surface according to actual demands.

In other words, each of the illumination beams L**2** emitted from the light-emitting device **300** in the present embodiment converges along the first direction d**2**, and the illumination beams L**2** along the second direction d**3** also converge in the second direction d**3** after the illumination beams L**2** are reflected by the reflective mask **200**. Hence, the illumination beams L**2** gather at the same area in a uniform manner. From another perspective, the optical lenses **320** in the lens module **310** may be closely arranged; together with the closely arranged light sources **110**, the light-emitting device **300** provided in the present embodiment can serve as a linear light source because these beams that are emitted from the closely arranged light sources **110** and pass through the closely arranged optical lenses **320** can be added up in the first direction d**2** in a uniform manner. Since the light-emitting device **300** provided in the present embodiment can act as the linear light source emitting uniform beams that achieve the favorable focusing effect, the light-emitting device **300** is rather applicable in the ultraviolet curing field that requires beams for achieving the favorable focusing effect and having uniform intensities. The conventional light-emitting device emits diverged beams which cannot evenly converge in the same direction even though these diverged beams are reflected by the reflective mask. By contrast, the illumination beams L**2** emitted from the light-emitting device **300** provided herein not only accomplish the favorable focusing effect but also have uniform intensities in the first direction d**2**.

The optical effects achieved in an embodiment of the invention and in other comparison examples are further explained hereinafter. Table 1 shows experimental data obtained through comparison between the illumination beams emitted from the light-emitting module described in an embodiment of the invention and reflected by the reflective mask and the illumination beams emitted from light-emitting modules provided in other comparison examples and reflected by a reflective mask. Here, the light-emitting module in the comparison example 1 has the 60-degree FWHM, the light-emitting module in the comparison example 2 has the Lambertian light shape, the light-emitting module in the comparison example 3 has the 145-degree FWHM, and the light-emitting module in the comparison example 4 has the Batwing light shape, for instance. FIG. **3** schematically illustrates light intensity and light utilization rate in Table 1 according to an embodiment of the invention and the comparison examples. With reference to FIG. **3** and Table 1, according to the data recorded in Table 1, the light utilization rate is the percentage

TABLE 1

Experimental data comparison table showing the comparison between the illumination beams emitted from the light-emitting module described in an embodiment of the invention and reflected by the reflective mask and the illumination beams emitted from light-emitting modules provided in other comparison examples and reflected by a reflective mask.

	Comparison Example 1	Comparison Example 2	Comparison Example 3	Comparison Example 4	Embodiment
Light intensity (W/mm^2)	0.112	0.161	0.164	0.172	0.201
Light utilization rate (%)	61.9	57.3	56.2	57.3	65.8

To sum up, in the light-emitting module provided in an embodiment of the invention, the optical lens converts the original beams emitted by the light sources to the illumination beams with different light shape distributions in two different directions. After the illumination beams in one direction are converged by the optical lens, the illumination beams can achieve the favorable focusing effect. In addition, the illumination beams diverging in another direction can be reflected by a reflective element and can then easily become converged beams. The illumination beams emitted by the light-emitting device converge along one direction and achieve the favorable focusing effect according to an embodiment of the invention, and therefore the light-emitting device described herein can serve as a satisfactory linear light source.

Although the invention has been described with reference to the above embodiments, it will be apparent to one of ordinary skill in the art that modifications to the described embodiments may be made without departing from the spirit of the invention. Accordingly, the scope of the invention will be defined by the attached claims and not by the above detailed descriptions.

What is claimed is:

1. A light-emitting module comprising:

a light source emitting an original beam along a direction of a light-emitting axis; and

an optical lens disposed on a transmission path of the original beam, the original beam passing the optical lens and becoming an illumination beam, wherein a light shape of the illumination beam has a first full width at half maximum along a first direction and has a second full width at half maximum along a second direction, a ratio of the second full width at half maximum to the first full width at half maximum is large than 3, and the first direction and the second direction are perpendicular to the direction of the light-emitting axis, wherein a numerator of the ratio is the second full width at half maximum, and a denominator of the ratio is the first full width at half maximum.

2. The light-emitting module of claim 1, wherein the first full width at half maximum is within a range from 20 degrees to 60 degrees, and the second full width at half maximum is within a range from 100 degrees to 180 degrees.

3. The light-emitting module of claim 1, wherein the optical lens comprises a light incident surface and a light output combination surface opposite to the light incident surface, and the light output combination surface is axis-symmetrical along the first direction and the second direction.

4. The light-emitting module of claim 1, wherein the light output combination surface comprises at least two first light output surfaces and at least two second light output surfaces, the at least two first light output surfaces are arranged along the first direction, and the at least two second light output surfaces are arranged along the second direction.

5. The light-emitting module of claim 4, wherein the at least two first light output surfaces and the at least two second light output surfaces constitute a plurality of boundary lines intersecting at a center of the light output combination surface.

6. The light-emitting module of claim 3, wherein a profile of the light output combination surface on a first plane is a first arc, a profile of the light output combination surface on a second plane is a second arc, a normal vector of the first plane is parallel to the second direction, a normal vector of the second plane is parallel to the first direction, and an average curvature radius of the second arc is greater than an average curvature radius of the first arc.

7. A light-emitting device comprising:

a plurality of light sources arranged along a first direction, each of the light sources emitting an original beam along a direction of a light-emitting axis;

a lens module disposed on transmission paths of the original beams, each of the original beams passing the lens module and becoming an illumination beam, wherein a light shape of each of the illumination beams has a first full width at half maximum along the first direction and has a second full width at half maximum along the second direction, a ratio of the second full width at half maximum to the first full width at half maximum is large than 3, and the first direction and the second direction are perpendicular to the direction of the light-emitting axis, wherein a numerator of the ratio is the second full width at half maximum, and a denominator of the ratio is the first full width at half maximum; and

a reflective mask, wherein the light sources are disposed between the reflective mask and the lens module, the reflective mask is configured to reflect one portion of the illumination beams toward the direction of the light-emitting axis, and the reflected portion of the illumination beams and another portion of the illumination beams are substantially transmitted along the direction of the light-emitting axis.

8. The light-emitting device of claim 7, wherein the first full width at half maximum is within a range from 20 degrees to 60 degrees, and the second full width at half maximum is within a range from 100 degrees to 180 degrees.

9. The light-emitting device of claim 7, wherein the lens module comprises a plurality of optical lenses, each of the optical lenses is located on the transmission path of one of the original beams, the original beam passes the corresponding optical lens and becomes the illumination beam, and the optical lenses are arranged along the first direction.

10. The light-emitting device of claim 9, wherein the optical lens comprises a light incident surface and a light output combination surface opposite to the light incident surface, and the light output combination surface is axis-symmetrical along the first direction and the second direction.

11. The light-emitting device of claim 10, wherein the light output combination surface comprises at least two first light output surfaces and at least two second light output surfaces, the at least two first light output surfaces are arranged along the first direction, and the at least two second light output surfaces are arranged along the second direction.

12. The light-emitting device of claim 11, wherein the at least two first light output surfaces and the at least two second light output surfaces constitute a plurality of boundary lines intersecting at a center of the light output combination surface.

13. The light-emitting device of claim 10, wherein a profile of the light output combination surface on a first plane is a first arc, a profile of the light output combination surface on a second plane is a second arc, a normal vector of the first plane is parallel to the second direction, a normal vector of the second plane is parallel to the first direction, and an average curvature radius of the second arc is greater than an average curvature radius of the first arc.

14. The light-emitting device of claim 7, wherein at least half of the illumination beams transmitted on a second plane are reflected by the reflective mask, the reflected portion of the illumination beams converges in the second direction, and a no al vector of the second plane is parallel to the first direction.

15. The light-emitting device of claim 7, wherein the reflective mask comprises a reflective concave surface, and the lens module and the light sources are adjacent to a location of a focus of the reflective concave surface in the second direction.

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