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(54) **Lighting device and lamp and lighting apparatus**

(57) According to one embodiment, a lamp includes a lamp main body having a radiation opening on one end side and a base on the other end side, and a luminous body which is provided in the lamp main body so that radiated light of a semiconductor light emitting element is emitted from the radiation opening. In addition, the lamp further includes a lighting unit which is accommodated on the other end side of the lamp main body, and turns on the semiconductor light emitting element; a cylindrical reflecting body which reflects the radiated light of the semiconductor light emitting element, and emits from an emission port to the radiation opening side; and a light-transmissive cover which is attached to the one end side of the lamp main body so as to cover the radiation opening. In addition, the lamp further includes a filter which is formed in a light-transmissive plate shape, is mixed with a color rendering agent, includes a planar portion facing the emission port, and an rugged portion in a region on the outer peripheral side of the planar portion, and is provided between the reflecting body and the cover.

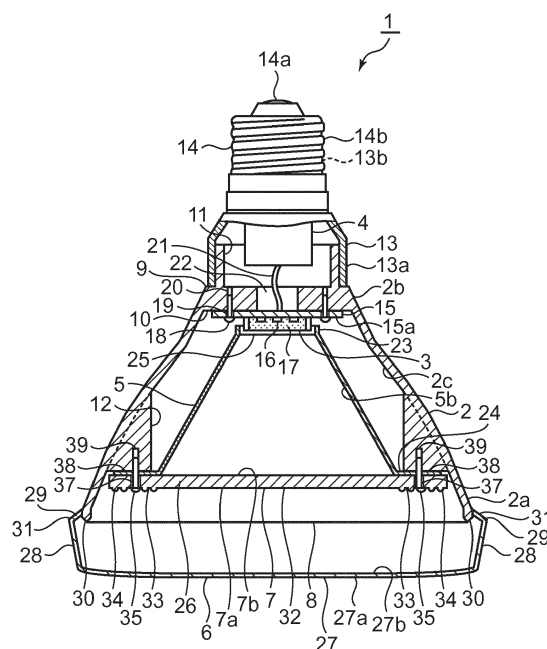


FIG. 1

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based upon and claims the benefit of priority from the prior Japanese Patent Application No. 2013-027469, filed on February 15, 2013, the entire contents of which are incorporated herein by reference.

FIELD

[0002] Embodiments described herein relate generally to a lighting device, a lamp, and a lighting apparatus which have a semiconductor light emitting element as a light source, and use radiated light thereof in illumination.

BACKGROUND

[0003] In the lamp, or the lighting device of this type, there is a lamp or a lighting device in which an LED module of a chip on board (COB) type is used as a light source. In the LED module, a plurality of LED bare chips are arranged on one surface side of a substrate, a bank (frame portion) which surrounds the LED bare chips are provided, a translucent resin in which a fluorescent substance is mixed is filled in the bank, and each of the LED bare chips is buried in the translucent resin, thereby forming the LED module. In addition, in the lamp or the lighting device, there is a lamp or a lighting device which is provided with a reflecting plate (reflecting mirror) which is formed, for example, in a cylindrical shape of a circular truncated cone by facing the LED module so that radiated light from the LED module is effectively emitted in a predetermined direction (for example, JP-A-2011-253787).

[0004] In addition, in the lamp or the lighting device of this type, there is a lamp or a lighting device in which a color rendering index conversion filter is arranged on the front surface side of a luminous body (LED) (for example, JP-A-2010-186725) in order to obtain irradiation light with high color rendering.

[0005] In the lamp or the lighting device which includes the reflecting plate controlling irradiation light of a LED in a predetermined direction, and the color rendering index conversion filter, it is not easy to visually confirm an effect of the color rendering index conversion filter except for an emission portion of radiated light which penetrates a filter portion facing an emission port of the reflecting plate. That is, portions except for the emission portion do not appear bright.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

FIG. 1 is a schematic vertical cross-sectional view of a lamp in which a part of the lamp according to a first embodiment is cut out.

FIG. 2 is a schematic bottom view in which a cover of the lamp is seen through.

FIG. 3 is a schematic side view of a lighting apparatus according to a second embodiment.

FIG. 4 is a schematic vertical cross-sectional view of a lighting device according to a third embodiment.

DETAILED DESCRIPTION

[0007] In view of the above described circumstances, the embodiment provides a lighting device, a lamp, and a lighting apparatus which include a reflecting body controlling radiated light of a luminous body in a predetermined direction, and improve an attraction or an appearance in an emission portion.

In addition, the embodiment provides a lighting device, a lamp, and a lighting apparatus in which an extraction efficiency of the radiated light is high, and diffusion of the radiated light is good.

[0008] The lamp according to the embodiment is configured by including a lamp main body, a luminous body, a lighting unit, a reflecting body, a cover, and a filter. The lamp main body is also referred to as a housing, and includes a radiation opening on one end side, and a base on the other end side.

[0009] The luminous body has a semiconductor light emitting element, and is provided in the lamp main body so that the radiated light of the semiconductor light emitting element is emitted from the radiation opening of the lamp main body. The semiconductor light emitting element is a light emitting diode (LED), an organic electro luminescence (EL) element, or the like.

[0010] The lighting unit is accommodated in the other end side of the lamp main body. In addition, in an electrical relationship, an input side thereof is connected to the base of the lamp main body, and an output side thereof is connected to the semiconductor light emitting element of the luminous body. The lighting unit is formed so as to be operated when, for example, a commercial power supply is fed from the outside through the base, be converted to desired power, and be turning on the semiconductor light emitting element.

[0011] The reflecting body is formed in a cylindrical shape with an emission port, and is formed so as to reflect the radiated light of the semiconductor light emitting element. In addition, the reflecting body is provided in the lamp main body so as to emit the radiated light of the semiconductor light emitting element to the radiation opening of the lamp main body from the emission port. The cover is light-transmissive, namely, has translucency which transmits radiated light of the luminous body. In addition, the cover is attached to the one end side of the lamp main body so as to cover the radiation opening of the lamp main body.

[0012] The filter is mixed with a color rendering agent, and is formed in a plate shape and is light-transmissive, namely, with translucency. In addition, the filter is provided between the reflecting body and the cover. At this

time, the filter is formed so as to have a planar portion facing the emission port of the reflecting body, and a rugged portion in a region on the outer peripheral side of the planar portion. The rugged portion is an irregular portion having concave and convex portion.

[0013] According to the embodiment, the radiated light of the luminous body is input to the planar portion of the filter from the emission port of the reflecting body, is input to the cover by penetrating the planar portion, a part thereof which is input to the planar portion propagates in the filter, and reaches the irregular portion, is emitted by being diffused in the irregular portion, and is input to the cover. Accordingly, in the cover, the periphery of a portion facing the planar portion of the filter also looks bright, and the radiated light is emitted. Due to this, local light emission from the cover is prevented, and accordingly, it is possible to improve an attraction or an appearance of the cover when viewing the cover.

[0014] In addition, since the periphery of the portion facing the planar portion of the filter also looks bright, it is possible to improve the extraction efficiency of the radiated light, and to make diffusion of the radiated light also good.

[0015] Hereinafter, one embodiment will be described with reference to drawings. First, a first embodiment will be described.

[0016] A lamp 1 according to the embodiment is a bulb type lamp, and as illustrated in FIG. 1, is formed as a spotlight. The lamp 1 is configured by a lamp main body 2, a luminous body 3, a lighting unit 4, a reflecting body 5, a cover 6, and a filter 7.

[0017] The lamp main body 2 is also referred to as a housing, and for example, is molded using aluminum die-casting. The lamp main body 2 is formed in approximately a circular truncated cone shape which becomes smaller from one end side 2a to the other end side 2b, and has a circular radiation opening 8 on the one end side 2a, and an attaching unit 9 on the other end side 2b. The attaching unit 9 is formed at a base portion 10 which is a planar shape, and a cylindrical portion 11. In addition, an overhang 12 for connecting is provided on an inner surface 2c of the one end side 2a at an interval of 90° in the circumferential direction.

[0018] An attaching body 13 in approximately a cylindrical shape in which one end side 13a is formed with a large diameter is attached to the cylindrical portion 11 of the attaching unit 9. The attaching body 13 is attached to the lamp main body 2 when the cylindrical portion 11 of the attaching unit 9 is fitted into the one end side 13a until the tip end of the one end side 13a comes into contact with the base portion 10 of the attaching unit 9. The attaching body 13 is molded using an electrically insulative synthetic resin, for example, polybutylene terephthalate (PBT) resin.

[0019] In addition, an E-type base 14 as a base is attached to the other end side 13b of the attaching body 13. The base 14 is, for example, an E-26 type. The attaching body 13 insulates the base 14 and the lamp main

body 2 which is metal. In this manner, the lamp main body 2 includes the base 14 on the other end side 2b through the attaching body 13.

[0020] The luminous body 3 is formed of a substrate 15 in a planar plate shape, a plurality of LED bare chips 16 as a semiconductor light emitting element, which are provided on one surface 15a side of the substrate 15, and a sealing resin 17 which covers the LED bare chips 16. The substrate 15 is formed of, for example, an aluminum (Al) plate, is formed in approximately a circular shape, mounts the LED bare chips 16 on the one surface 15a through a not shown insulation layer, and forms a not shown wiring pattern.

[0021] The plurality of LED bare chips 16 are mounted on, for example, a concentric circle at approximately even intervals, and are connected in series by the wiring pattern. The LED bare chips 16 radiate, for example, blue light. In addition, the plurality of LED bare chips 16 are buried by the sealing resin 17.

[0022] The sealing resin 17 is, for example, a translucent silicone resin, and is mixed with a not shown yellow fluorescent substance. The yellow fluorescent substance performs a wavelength conversion of blue light into yellow light when blue light which is radiated from the LED bare chip 16 is input. White light is radiated from the luminous body 3 when the yellow light and the blue light which is radiated from the LED bare chip 16 are mixed (light mixing). The surface of the sealing resin 17 becomes the light emitting surface of the luminous body 3.

[0023] In addition, in the luminous body 3, the substrate 15 is attached to the base portion 10 of the attaching unit 9 by a plurality of screws 18 by causing the one surface 15a side of the substrate 15 to be the radiation opening 8 side of the lamp main body 2. That is, an insertion holes 19 through which the screws 18 penetrate are formed on the substrate 15, and screw holes 20 through which the screws 18 are screwed are formed on the base portion 10. In addition, a lead wire 21 is derived from the substrate 15, and is connected to the lighting unit 4. A through hole 22 through which the lead wire 21 is inserted is formed on the base portion 10. In this manner, the luminous body 3 is provided in the lamp main body 2 so that the radiated light of the LED bare chips 16 is emitted from the radiation opening 8 of the lamp main body 2.

In addition, the luminous body 3 may be a luminous body which is formed by mounting a surface mounting light emitting diode (package product) on the substrate 15.

[0024] The lighting unit 4 includes a not shown circuit board, and a circuit component which is mounted on the circuit board, and is formed as a well-known lighting circuit which turns on the LED bare chip 16 by supplying a predetermined current to the LED bare chip 16 of the luminous body 3. In addition, the lighting unit 4 is attached into the attaching body 13 by a not shown attaching unit. That is, the lighting unit 4 is accommodated in the other end side 2b of the lamp main body 2.

[0025] An input side of the lighting unit 4 is respectively connected to an eyelet unit 14a, and a shell unit 14b of

the base 14 by a not shown pair of lead wires. In addition, an output side of the lighting unit 4 is connected to the LED bare chip 16 of the luminous body 3 by the lead wire 21. When the lighting unit 4 is fed with power through the base 14, and the lighting circuit is operated, the lighting unit supplies a predetermined current to the LED bare chip 16 of the luminous body 3. In this manner, the LED bare chip 16 is turned on (light emitting).

[0026] The reflecting body 5 is formed of, for example, aluminum (Al) of which a thickness is 1.0 mm, has a cylindrical unit 23 on one end side, and a circular flange unit 24 (portion) on the other end side, and is formed in a cylindrical shape of a circular truncated cone which becomes larger in diameter from the cylindrical unit 23 to the flange unit 24 side. In addition, in the reflecting body 5, the flange unit 24 is fixed to the overhang 12 for connecting of the lamp main body 2 by causing a part of the luminous body 3 to be accommodated in the cylindrical unit 23. An opening of the cylindrical unit 23 becomes an input port 25 of the reflecting body 5, and an opening on the flange unit 24 side becomes an emission port 26 of the reflecting body 5. In addition, an inner surface 5b of the reflecting body 5 is formed as a white reflecting surface which reflects the white light radiated from the luminous body 3.

[0027] The reflecting body 5 causes radiated light which is radiated from the LED bare chip 16, and is radiated from the luminous body 3 to be input from the input port 25, reflects the input light which is input to the emission port 26 side on the inner surface 5b, and emits the input light to the radiation opening 8 side of the lamp main body 2 from the emission port 26 through the filter 7.

[0028] In addition, the reflecting body 5 is not limited to the cylindrical shape of the circular truncated cone, and may be formed in an arbitrary cylindrical shape. However, it is preferable that the reflecting body 5 be formed in rotary symmetry, for example, a regular pyramid shape, or the like. In addition, the reflecting body 5 may be formed of a synthetic resin without being limited to metal. In this case, the synthetic resin has light reflecting characteristics, is not translucent, or may be a synthetic resin on which a non-translucent reflecting film is applied. In addition, it is preferable that the synthetic resin have a heat radiation property. As the synthetic resin, it is possible to use, for example, a poly ASA resin (compound of poly carbonate resin and ASA resin).

[0029] The cover 6 is attached to the one end side 2a of the lamp main body 2 so as to cover the radiation opening 8 of the lamp main body 2. The cover 6 is molded in approximately a cup shape using a translucent synthetic resin, for example, a poly carbonate (PC) resin, and is formed by a bottom 27, a side wall portion 28, and a locking unit 29.

[0030] The bottom 27 is a circular shape, and an outer surface 27a and an inner surface 27b thereof are formed in approximately planar shapes, respectively. The side wall portion 28 is formed so as to be consecutively provided at an edge portion (outer peripheral edge) of the

bottom 27 along the circumference thereof, and be tilted to some extent outward with respect to the bottom 27. The locking unit 29 is formed so as to be consecutively provided at an edge portion (outer peripheral edge) of the side wall portion 28 along the circumference thereof, be tilted to the inner surface 27b side of the bottom 27, and be locked to a ring-shaped claw portion 30 of the lamp main body 2.

[0031] The cover 6 is attached to the lamp main body 2 by causing the claw portion 30 of the lamp main body 2 to be fitted in the locking unit 29, and causes the locking unit 29 to be locked to the claw portion 30. A protrusion 31 for preventing slipping of fingers is provided at the locking unit 29 along the circumference thereof.

[0032] The filter 7 is formed by mixing a high color rendering agent in a translucent synthetic resin, for example, a poly carbonate (PC) resin. The filter is formed in a plate shape of a planar shape, and a disk shape. The filter 7 is formed with the thickness of 3.0 mm to 8.0 mm, for example, 5.0 mm so as to be thicker than the thickness of the reflecting body 5. In addition, the filter 7 is provided in the lamp main body 2 between the reflecting body 5 and the cover 6. According to the embodiment, the filter is provided to be consecutive to the reflecting body 5.

[0033] The filter 7 includes a circular planar portion 32 which faces the emission port 26 of the reflecting body 5, and an irregular portion 33 which is formed in a region on the outer peripheral side of the planar portion 32 on an outer surface 7a side. A plurality of ring-shaped protrusions 34 are concentrically formed in the irregular portion 33. As illustrated in FIG. 2, the protrusions 34 are formed in the irregular portion 33 excluding an attaching unit 36 (area) of a screw 35. The protrusions 34 are formed in a sectional hemisphere with a diameter of 0.5 mm to 1.0 mm, for example, and are provided at an interval of 0.2 mm to 2.0 mm, for example.

[0034] As illustrated in FIG. 1, an insertion hole 37 of the screw 35 is formed in the attaching unit 36. In addition, an insertion hole 38 of the screw 35 is formed in the flange unit 24 of the reflecting body 5 corresponding to the insertion hole 37. In the reflecting body 5, the insertion hole 38 is fixed to the filter 7 using a not shown adhesive so as to match the insertion hole 37 of the filter 7. In addition, the screw 35 is completely screwed to a screw hole 39 which is formed in the overhang 12 for connecting of the lamp main body 2 by passing through the insertion hole 37 of the filter 7, and the insertion hole 38 of the reflecting body 5. In this manner, the reflecting body 5 and the filter 7 are fixed to the lamp main body 2. At this time, a part of the luminous body 3 is inserted into the cylindrical unit 23 of the reflecting body 5, and the luminous body 3 faces the planar portion 32 of the filter 7.

[0035] In addition, the screw 35 may be screwed to the screw hole 39 of the overhang 12 for connecting by passing through the insertion hole 37 of the filter 7, a spacer, and the insertion hole 38 of the reflecting body 5 by interposing, for example, the spacer in a cylindrical shape between the filter 7 and the flange unit 24 of the reflecting

body 5 so that the filter 7 and the reflecting body 5 are separated. In addition, a recession may also be formed in the irregular portion 33, not only the protrusion 34, and protrusions, recessed portions (recession) or the like may be formed along the circumference of the irregular portion.

In addition, the translucent cover 6 may be transparent or semi-transparent, and is set to a smoothing surface. In addition to this, the cover may be formed by appropriately selecting a form thereof by providing an unevenness by processing the outer surface or the inner surface of a portion facing the emission port 26 of the reflecting body 5 in the bottom 27 to have a dimple, or in a lens shape, and on the other hand, by making a portion facing the irregular portion 33 of the filter smooth without performing surface processing, or the like.

[0036] A color rendering agent is mixed in the filter 7 so that a average color rendering index (Ra) of radiated light (white light) of the luminous body 3 which is emitted from the cover 6 is increased. For example, in order to obtain white light with a high average color rendering index (Ra), various compounds such as a cyanine type, a squarylium type, an azo methine type, a xanthene type, an oxonol type, an azo type, and polymethine type, and organometallic compounds are mixed and dispersed as the color rendering agent.

Subsequently, operations of the first embodiment will be described.

[0037] The lamp 1 is attached to a light bulb socket of the lighting apparatus. In addition, when external power supply is applied to the base 14 from the light bulb socket, the lighting unit 4 is fed with power through the base 14, and operates. The lighting unit 4 outputs a predetermined current to the LED bare chips 16 of the luminous body 3, and turns on the LED bare chips 16. When blue light is radiated from the LED bare chip 16, and the blue light and yellow light which is subject to a wavelength conversion by a yellow fluorescent substance which is mixed in the sealing resin 17 are mixed, white light is radiated from the luminous body 3.

[0038] The radiated light which is radiated from the luminous body 3 is input into the reflecting body 5 from the input port 25 of the reflecting body 5, and a part thereof is directly input to the planar portion 32 of the filter 7 from the emission port 26. In addition, a part of the input light is reflected on the inner surface 5b of the reflecting body 5, and is input to the planar portion 32 of the filter 7 from the emission port 26.

[0039] The radiated light which is input to the planar portion 32 of the filter 7 penetrates the filter 7, is input to the bottom 27 of the cover 6, and is emitted to an external space from the outer surface 27a by penetrating the bottom 27. Since the emission light penetrates the filter 7 in which a high color rendering agent is mixed and dispersed, the emission light becomes white light with a high average color rendering index (Ra), for example, of 94.

[0040] In addition, a part of the radiated light which is input to the planar portion 32 of the filter 7 is reflected on

the outer surface 7a and an inner surface 7b of the planar portion 32, and reaches the irregular portion 33 by propagating in the filter 7 by repeating the reflecting. Since the flange unit 24 of the reflecting body 5 is provided on the inner surface 7b side of the irregular portion 33, the radiated light which propagates in the irregular portion 33 is emitted to the cover 6 side from the outer surface 7a side of the irregular portion 33.

[0041] Since the protrusions 34 are formed on the outer surface 7a side of the irregular portion 33, the radiated light which is emitted from the irregular portion 33 is emitted by being diffused by the protrusions 34, is input to the bottom 27 and the side wall portion 28 of the cover 6, and is emitted to an external space by penetrating the bottom 27 and the side wall portion 28. Since the emission light also penetrates the filter 7, the light becomes white light with a high color rendering property.

[0042] In the cover 6, most of the emission light which is emitted from the emission port 26 of the reflecting body 5 is input to a portion of the bottom 27 facing the planar portion 32 of the filter 7. Accordingly, the portion of the bottom 27 looks extremely bright, and emits most of the white light which is radiated from the luminous body 3 to an external space. In addition, emission light which is emitted from the irregular portion 33 of the filter 7 is input to the periphery of the portion of the bottom 27, the periphery of the portion of the bottom 27 looks also bright while being somewhat weakened, and white light is emitted to an external space. That is, when white light is emitted from the bottom 27 and the side wall portion 28 of the cover 6, almost the entire cover 6 looks bright, and white light with a high color rendering property is emitted from the cover 6.

[0043] In addition, the screw 35 which attaches the reflecting body 5 and the filter 7 to the lamp main body 2 is not easily viewed through the cover 6 when the radiated light is radiated from the irregular portion 33 of the filter 7. In addition, a light loss in the irregular portion 33 is reduced, and by that extent, a light flux which is emitted from the cover 6 is increased to some extent, and accordingly, emission efficiency is improved.

[0044] According to the lamp 1 in the embodiment, since the radiated light of the luminous body 3 is input to the planar portion 32 of the filter 7 from the emission port 26 of the reflecting body 5, is input to the cover 6 by penetrating the planar portion 32, a part of the radiated light which is input to the planar portion 32 propagates in the filter 7, and reaches the irregular portion 33, is emitted by being diffused in the irregular portion 33, and is input to the cover 6, in the cover 6, the periphery of a portion facing the planar portion 32 of the filter 7 also looks bright, and radiated light is emitted. Due to this, almost the entire cover 6 looks bright, and it is possible to obtain an effect of improving an attraction or an appearance of the cover 6 when viewing the cover 6.

[0045] In addition, since the radiated light of the luminous body 3 is emitted from the irregular portion 33 of the filter 7, it is possible to reduce a light loss in the ir-

regular portion 33, and to obtain an effect of improving emission efficiency of emission light which is emitted from the cover 6.

In addition, since the peripheral portion also looks bright, it is possible to obtain further diffused radiated light.

[0046] In addition, according to the embodiment, the reflecting body 5 may be formed in a cylindrical shape with a bottom having the emission port 26, and may be provided on the bottom by causing the luminous body 3 to face the emission port 26.

Subsequently, a second embodiment will be described.

[0047] As illustrated in FIG. 3, a lighting apparatus 41 according to the embodiment is configured as a fixture for being attached to a ceiling face. In FIG. 3, 42 denotes a plug, 43 denotes an arm, 44 denotes a fixture main body, 45 denotes a socket, 46 denotes a knob, and 1 denotes the lamp in FIG. 1.

[0048] The plug 42 is attached to a lighting rail which is attached to a ceiling face. For example, the plug is formed in a cylindrical shape using, for example, a poly carbonate resin, and rotatably attaches the arm 43 so as to perform a 360-degree revolution in the horizontal direction. The arm 43 is formed in a long cylindrical shape using an aluminum alloy, for example, and attaches the fixture main body 44 thereto.

[0049] The fixture main body 44 is formed in approximately a cylindrical shape with a bottom in which a pair of attaching wings 47 and 47 (only one is denoted in figure) is provided on an outer peripheral surface 44a. In addition, the porcelain socket 45 is attached into the fixture main body 44 using an attaching plate 48. The base 14 (not shown) of the lamp 1 is electrically connected to the socket 45 by being screwed thereto. The socket 45 is connected to an external power supply by a not shown power line which is wired through the respective inside of the plug 42, the arm 43, and the fixture main body 44.

[0050] The fixture main body 44 is attached to the arm 43 by a not shown rotation axis in the pair of attaching wings 47 and 47. That is, the fixture main body 44 is attached to the arm 43 so as to perform a 90-degree revolution in the vertical direction. In addition, by tightening the knobs 46 and 46 which are provided on outer surfaces 47a and 47a of the pair of attaching wings 47 and 47, the fixture main body is fixed to the arm 43 at a desired vertical angle. The knob 46 is formed by using free-cutting brass, for example.

In the lighting apparatus 41, radiated light of the lamp 1 is radiated in a predetermined direction by setting angles in the horizontal direction and vertical direction of the fixture main body 44, respectively.

[0051] According to the lighting apparatus 41 in the embodiment, since almost the entire cover 6 looks bright, and the lamp 1 from which radiated light with a high color rendering property is emitted from the cover 6 is included, it is possible to improve an attraction, an appearance, or light extraction efficiency of the cover 6 when looking up the lamp 1 and viewing the cover 6, and to obtain an effect of emitting radiated light with a high color rendering

property in a predetermined direction.

Subsequently, a third embodiment will be described.

[0052] A lighting device 51 according to the embodiment is a direct-attached fixture, and is formed as illustrated in FIG. 4. In addition, in FIG. 4, the same portions as those in FIG. 1 are given the same reference numerals, and descriptions thereof will be omitted.

In the lighting device 51, the attaching body 13 in the lamp 1 in FIG. 1 is eliminated. The lighting device is configured by being provided with a receiving body 52 and a mount 53 instead of the attaching body.

[0053] The receiving body 52 is formed of an electrically insulative synthetic resin, for example, a polybutylene terephthalate (PBT) resin, and is formed in approximately a cylindrical shape with a circular flange portion 54 on the other end side 52b. In addition, the receiving body 52 is attached to a lamp main body 2 when a cylindrical portion 11 of an attaching unit 9 is fitted into an one end side 52a until the tip end of the one end side 52a comes into contact with a base portion 10 of the attaching unit 9.

[0054] A lighting unit 4 is attached into the receiving body 52 by a not shown attaching unit. In addition, an input line 56 which is connected to a terminal board 55 of the lighting unit 4 is derived from the receiving body 52. The receiving body 52 is attached to the mount 53 by a plurality of screws 57. The flange portion 54 of the receiving body 52 is provided with insertion holes 58 of the screws 57.

[0055] The mount 53 is formed with a planar attaching unit 59, leg portions 60 and 60 which stand up in a right angle from longitudinal both ends of the attaching unit 59, respectively, and fixing units 61 and 61 which protrude outward from the leg portions 60 and 60 by being in parallel to the attaching unit 59 using a metal plate, for example, a cold rolled steel plate.

[0056] The attaching unit 59 is formed in a rectangular shape in a size of covering the receiving body 52. The attaching unit is provided with a plurality of screw holes 62 with taps corresponding to the insertion holes 58 which are provided at the flange portion 54 of the receiving body 52. The mount 53 is attached to the receiving body 52 when the screws 57 which pass through the insertion holes 58 are completely screwed to the screw holes 62. An insertion hole 63 for drawing out the input line 56 from the lighting unit 4 is provided in a center portion of the attaching unit 59.

[0057] In addition, the mount 53 is attached to a structure 64 such as a ceiling, or a rail. According to the embodiment, the mount is attached to the structure 64 using screws 65. That is, insertion holes 66 of the screws 65 are formed in the fixing units 61 and 61, respectively, and the screws 65 which pass through the insertion holes 66 are completely screwed to the screw holes 67 which are formed in the structure 64. In this manner, the lighting device 51 is attached to the structure 64.

[0058] According to the lighting device 51 in the embodiment, since almost the entire cover 6 looks bright,

and radiated light with a high color rendering property is emitted from the cover 6, it is possible to improve an attraction, an appearance, or light extraction efficiency of the cover 6 when looking up the lighting device 51 and viewing the cover 6, and to obtain an effect of emitting radiated light with a high color rendering property from the cover 6.

[0059] In addition, the lighting device 51 may have a configuration in which the lighting unit 4 is separately provided. In addition, the lamp main body 2 may be formed in a desired shape as long as the lamp main body includes the luminous body 3, the reflecting body 5, the cover 6, and the filter 7 according to the embodiment.

[0060] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the inventions.

Claims

1. A lighting device comprising:

a lamp main body which includes a radiation opening on one end side;
 a luminous body which includes a semiconductor light emitting element, and is provided in the lamp main body so that radiated light of the semiconductor light emitting element is emitted from the radiation opening;
 a reflecting body which is formed in a cylindrical shape with an emission port, reflects the radiated light of the semiconductor light emitting element, and emits the radiated light to the radiation opening side from the emission port;
 a light-transmissive cover which is attached to the one end side of the lamp main body so as to cover the radiation opening; and
 a filter which is formed in a light-transmissive plate shape, is mixed with a color rendering agent, includes a planar portion facing the emission port, and a rugged portion in a region on the outer peripheral side of the planar portion, and is provided between the reflecting body and the cover.

2. The device according to claim 1, wherein the rugged portion is provided with a plurality of ring-shaped protrusions or recessions concentrically.

3. The device according to claim 1 or 2, wherein the rugged portion is formed in a sectional hemisphere shape.

4. The device according to any one of claims 1 to 3, wherein the rugged portion is formed in a region excluding an attaching area of a screw attaching a filter.

5. The device according to any one of claims 1 to 4, wherein the filter is attached to the lamp main body through the reflecting body.

6. The device according to any one of claims 1 to 5, wherein radiated light which propagates in the filter is emitted from an outer surface side of the rugged portion to the cover side.

7. A lamp comprising:

the lighting device according to any one of claims 1 to 6;
 a base which is provided on the other end side of the lamp main body of the lighting device; and
 a lighting unit which is accommodated in the other end side of the lamp main body, and turns on the semiconductor light emitting element by being operated when being fed with power through the base.

8. A lighting apparatus comprising:

the lamp according claim 7; and
 a fixture main body including a socket to which the base of the lamp is electrically connected.

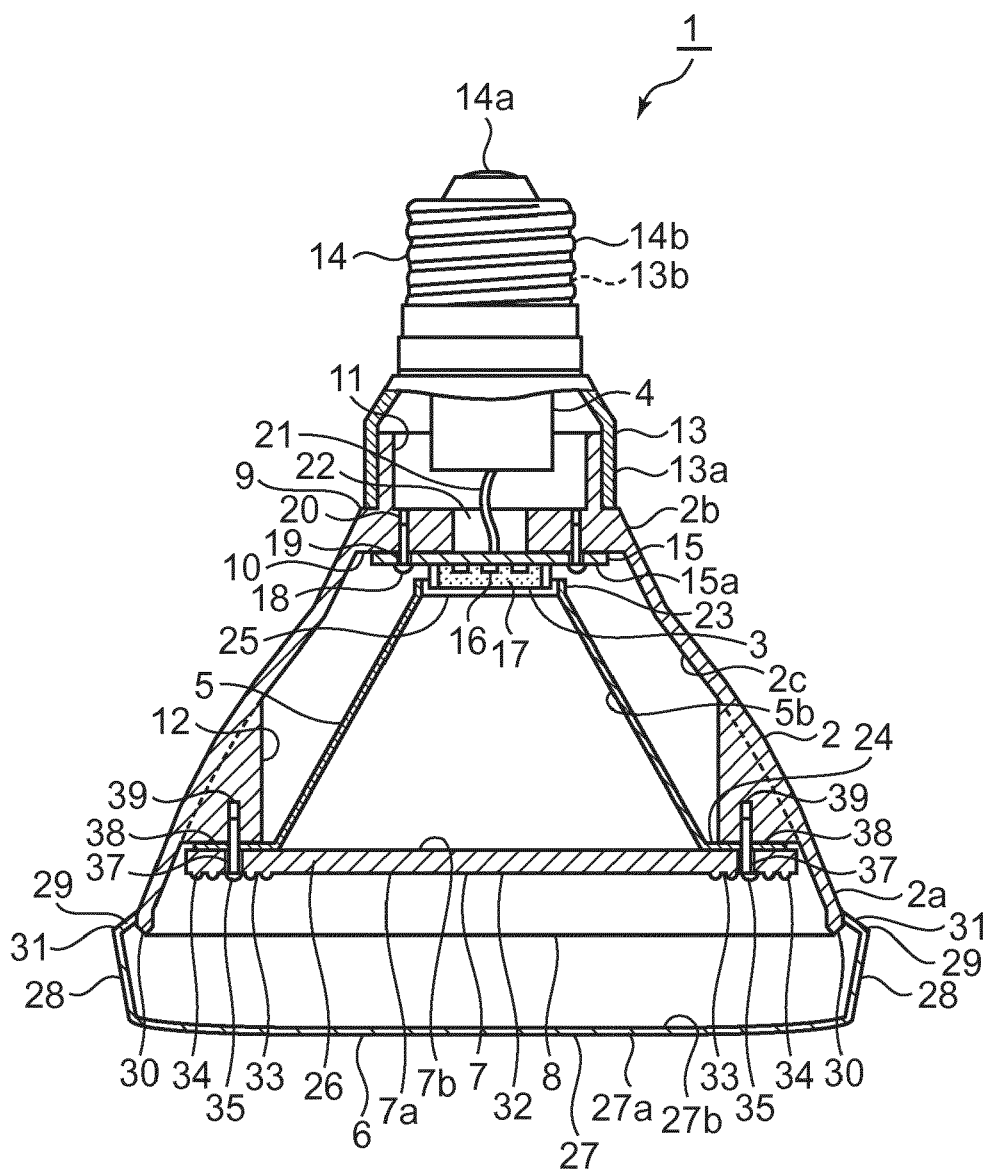


FIG. 1

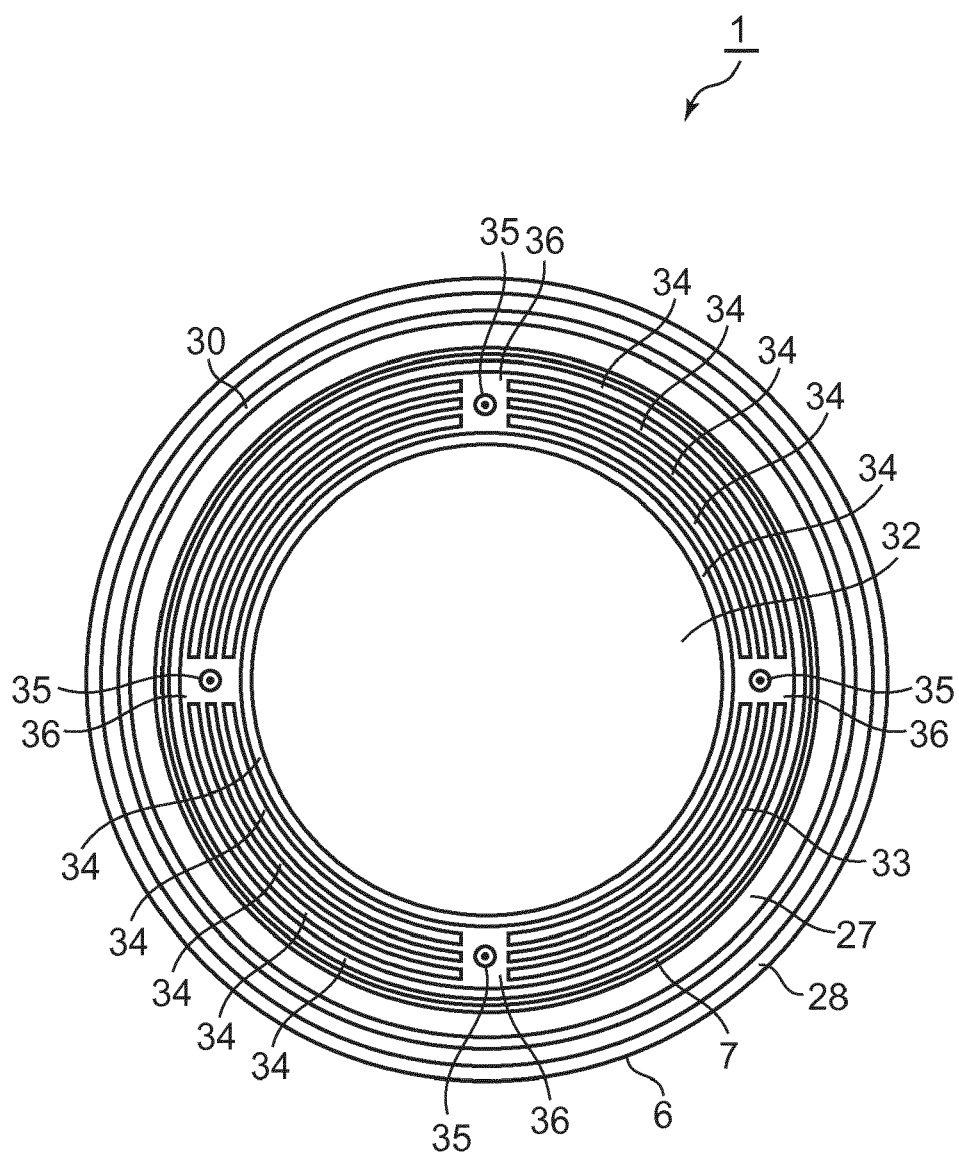


FIG. 2

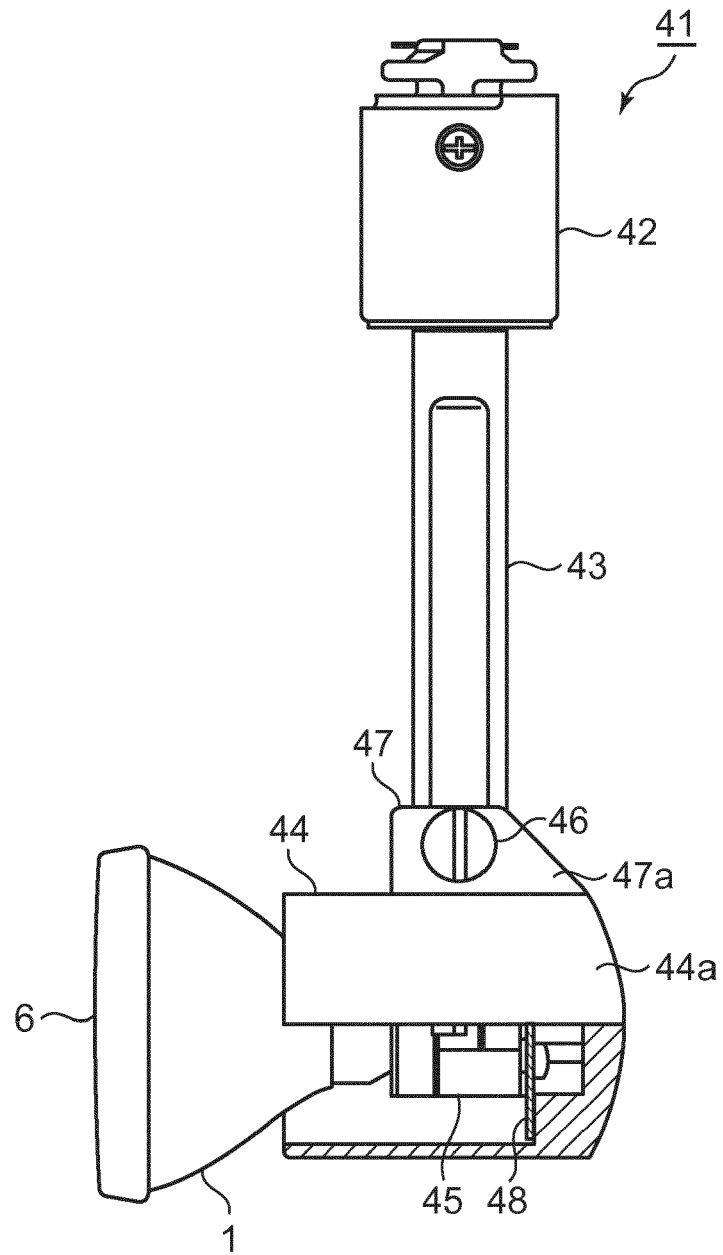


FIG. 3

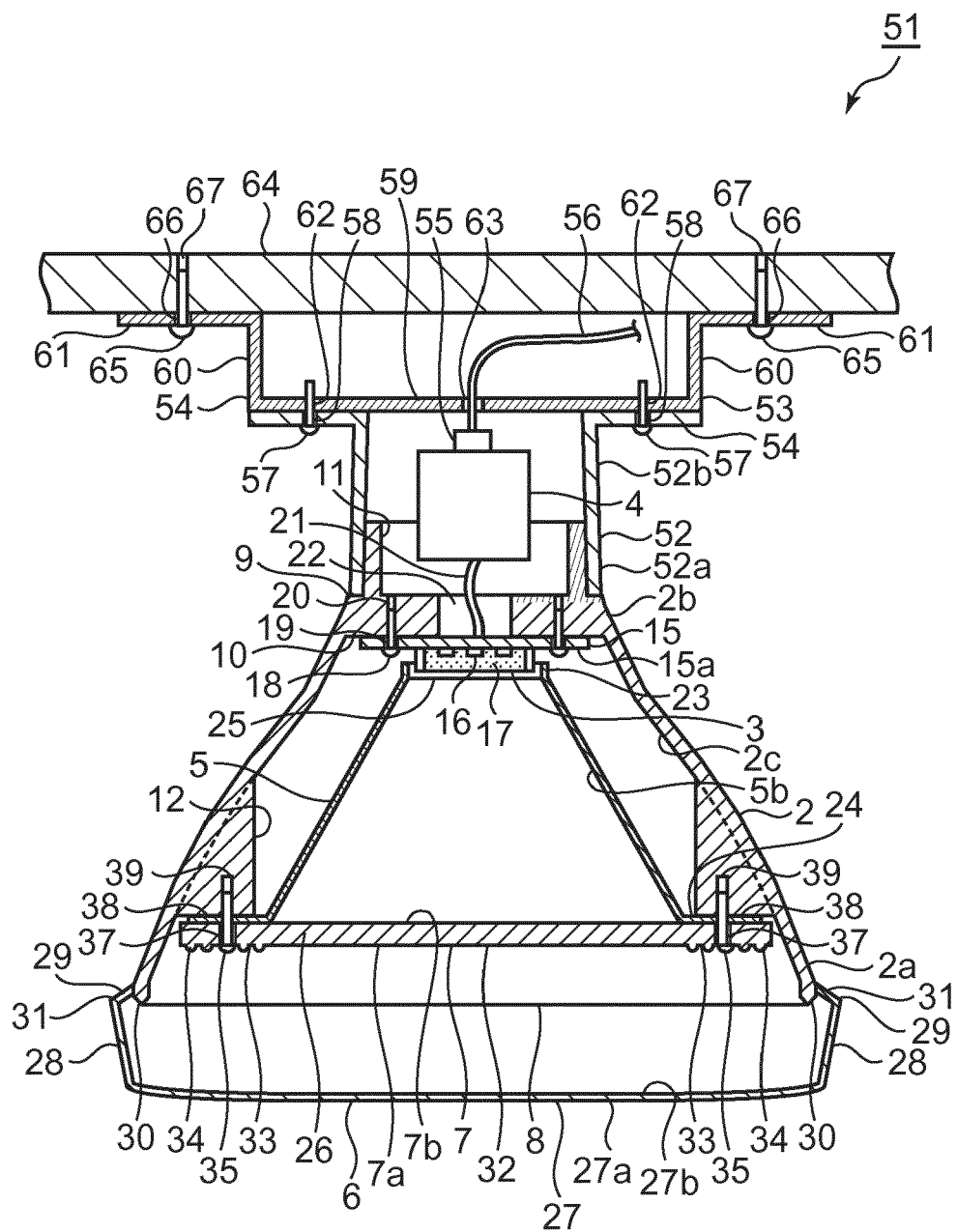


FIG. 4



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Application Number
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