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(54) **Lighting device**

(57) According to one embodiment, a lighting device includes: a common body (11), a light source unit (12), and a light control unit (13). The common body (11) is open on front and rear sides and has a front-side common mounting section (24) on a front side and a rear-side common mounting section (22) on a rear side. The light source unit (12) has a plurality of light source sections (35) and a radiator (36) in which the light source sections (35) are disposed, and is mounted on the rear-side common mounting section (22) of the common body (11). The light control unit (13) has a plurality of reflectors (49) respectively facing the light source sections (35) and controlling light distribution, and is mounted on the front-side common mounting section (24) of the common body (11).

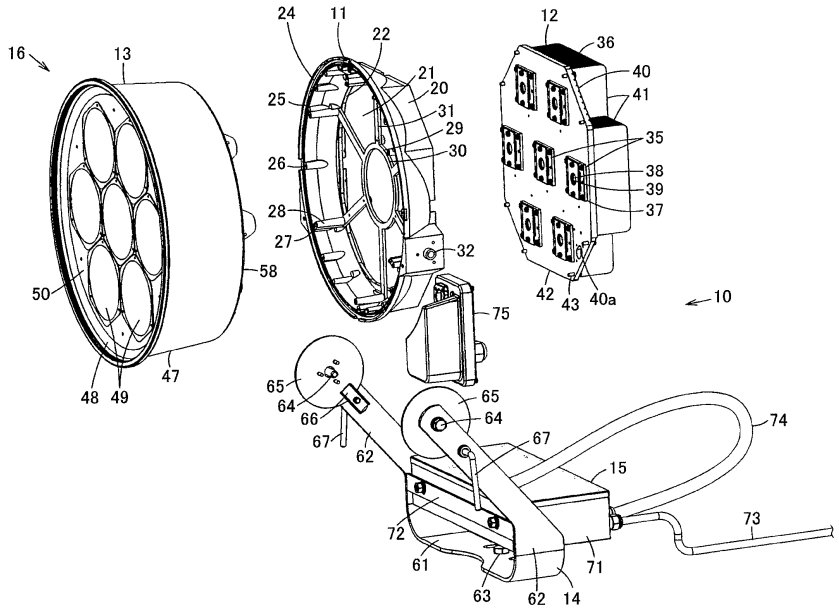

FIG. 1

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Description

FIELD

[0001] Embodiments described herein relate generally to a lighting device of which a light source is a light emitting element.

BACKGROUND

[0002] In the related art, there is a lighting device that is used as a projector for lighting, for example, a building and the like. In such a lighting device, an LED is used as a light source instead of an HID lamp before now due to improvement of performance of the LED as a light emitting element.

[0003] In the lighting device of which a light source is the LED, a structure in which heat generated by the LED is radiated with a radiator is employed, but since an amount of generated heat is different depending on a light output of the LED, a radiator having radiation performance depending on the amount of heat is used. Furthermore, in order to control light distribution of the light emitted from the LED, a reflector that is necessary for the light distribution is used. Thus, a plurality of types of lighting devices are prepared depending on a combination of the different light outputs and the different light distributions.

[0004] However, if a plurality of types of lighting devices are prepared depending on the combination of the different light outputs and light distributions, a com mon structure is unlikely to be used and a dedicated lighting device should be prepared for each type.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005]

FIG. 1 is a perspective view illustrating an exploded state of a lighting device of narrow-angle light distribution of a first embodiment.

FIG. 2 is a perspective view of the lighting device viewed from a front side.

FIG. 3 is a perspective view of the lighting device viewed from a rear side.

FIG. 4 is a perspective view illustrating an exploded state of a light control unit of the lighting device.

FIG. 5 is a cross-sectional view of the lighting device.

FIG. 6 is a perspective view of a light device of middle-angle light distribution viewed from the front side.

FIG. 7 is a cross-sectional view of the lighting device.

FIG. 8 is a perspective view of a lighting device of wide-angle light distribution viewed from the front side.

FIG. 9 is a cross-sectional view of the lighting device.

FIG. 10 is a perspective view of a radiator illustrating a lighting device of a second embodiment.

FIGS. 11(a), 11(b), and 11(c) illustrate flow of cooling air in the radiator, FIG. 11(a) is a side view of Comparison Example 1, FIG. 11 (b) is a side view of Comparison Example 2, and FIG. 11(c) is a side view of the embodiment.

FIG. 12 is a graph illustrating measured results of temperatures of Comparison Examples 1, 2, and the embodiment.

DETAILED DESCRIPTION

[0006] According to an embodiment, a lighting device includes: a common body, a light source unit, and a light control unit. The common body is open on front and rear sides and has a front-side common mounting section on a front side and a rear-side common mounting section on a rear side. The light source unit has a plurality of light source sections using a light emitting element and a radiator in which the light source sections are disposed, and is mounted on the rear-side common mounting section of the common body. The light control unit has a plurality of reflectors respectively facing the light source sections and controlling light distribution, and is mounted on the front-side common mounting section of the common body.

[0007] According to the lighting device, it is possible to respectively combine the light source unit having different light outputs and the light control unit having different light distributions with respect to the rear-side common mounting section and the front-side common mounting section of the common body, and it is possible to expect to use the common body as a common structure.

[0008] Hereinafter, a first embodiment will be described with reference to FI GS. 1 to 9.

[0009] FIGS. 1 to 3 illustrate a projector as a lighting device 10. The lighting device 10 includes a common body 11, a light source unit 12 that is disposed on a rear portion side of the common body 11, a light control unit 13 that is disposed on a front portion side of the com mon body 11, a fixing stand 14 that supports the common body 11, and a power supply unit 15 that is disposed in the fixing stand 14. In addition, a lamp body 16 that is a projector body is configured of the common body 11, the light source unit 12, and the light control unit 13.

[0010] In addition, the common body 11 is, for example, formed by aluminum die-casting. The common body 11 has a cylindrical frame section 20 and an opening section 21 that is open on front and rear sides is formed inside the frame section 20.

[0011] As illustrated in FIG. 5, a rear-side common mounting section 22 on which the light source unit 12 is mounted is formed on the rear side of the frame section 20. The rear-side common mounting section 22 has an octagonal recessed section 23 that is formed on a rear surface of the frame section 20 and a plurality of mounting holes are formed in the recessed section 23.

[0012] A front-side common mounting section 24 on which the light control unit 13 is mounted is formed on a front side of the frame section 20. The front-side common

mounting section 24 has an annular recessed section 25 that is formed on the front surface of the frame section 20 and a plurality of mounting holes 26 are formed in the recessed section 25. Furthermore, the front-side common mounting section 24 has a plurality of bosses 28 having mounting holes 27 inside the frame section 20, respectively.

[0013] As illustrated in FI G. 1, a support section 29 for reinforcing the frame section 20 is integrally formed on the rear portion side on the inside of the frame section 20. The support section 29 includes a ring section 30 in the center and a plurality of connection sections 31 that connect the ring section 30 and the frame section 20. Then, the opening section 21 is open between the ring section 30, the connection sections 31, and the frame section 20 on the inside of the ring section 30.

[0014] Cylindrical shaft sections 32 that are connected to the fixing stand 14 protrude on both sides of the frame section 20 in a left-right direction (width direction).

[0015] Furthermore, the light source unit 12 includes a plurality of light source sections 35 and a radiator 36 on which the light source sections 35 are mounted.

[0016] The light source section 35 includes a substrate 37 and a light emitting section 39 on which LEDs 38 as a plurality of light emitting elements are mounted on a front surface of the substrate 37. The light source section 35 is configured of a Chip On Board (COB) module. The substrate 37 is fixed and thermally connected to the front surface of the radiator 36 by screws. Then, in the embodiment, one light source section 35 is disposed in the center portion of a front surface of the radiator 36 and six light source sections 35 are disposed in a peripheral portion of the front surface of the radiator 36 so as to surround the light source section 35 at the center thereof, but the embodiment is not limited to such a disposition form.

[0017] For example, the radiator 36 is formed of a metal material such as aluminum or magnesium having thermal conductivity of 50 W/m·K to 250 W/m·K. The radiator 36 includes a base 40 and a plurality of radiation fins 41 that protrude from a rear surface of the base 40. The base 40 is formed in an octagonal flat shape. A thickness of the base 40 is 8 m m to 15 m m and preferably 9 m m to 11 mm. A wiring hole 40a passing through the front and rear of the base 40 is formed in the base 40. The plurality of light source sections 35 are mounted on the front surface of the base 40. A plurality of grooves are formed on the rear surface of the base 40 along an up-down direction (vertical direction) and front ends of the radiation fins 41 are press-fitted and fixed into the grooves. The plurality of radiation fins 41 are disposed in the base 40 along the up-down direction and a gap 41 a in which air circulates is provided between radiation fins 41 adjacent to each other in the left-right direction. The gap 41 a between the radiation fins 41 is 6 mm to 10 mm and preferably 7 mm to 9 mm.

[0018] A light source unit-side common mounting section 42 as a radiator common mounting section that is mounted on the rear-side common mounting section 22 of the common body 11 is formed in a peripheral portion of the radiator 36, that is, a peripheral portion of the base 40. Then, the light source unit-side common mounting section 42 is fitted into the recessed section 23 and a plurality of screws 43 passing through the light source unit-side common mounting section 42 are screwed into mounting holes of the common body 11, and the radiator 36 is fixed to the common body 11.

[0019] Furthermore, FIGS. 1 to 4 illustrate the light control unit 13 for narrow-angle light distribution. The light control unit 13 includes a reflector unit 46, a case 47 accommodating the reflector unit 46, and a light-transmitting cover 48 that closes the front surface of the case 47.

[0020] The reflector unit 46 includes a plurality of reflectors 49 and a holder 50 that integrally holds the reflectors 49.

[0021] Each reflector 49 has a cylindrical shape that is open on front and rear sides and is formed in a parabolic shape of which an opening widens from the rear side to the front side. A mirror surface-form reflection surface is formed on the inner surface of each reflector 49. A flange 51 protrudes on a periphery of a front end of each reflector 49.

[0022] The holder 50 is formed having a flat disk shape and a plurality of through holes 52 passing through the plurality of reflectors 49 are formed in the holder 50. The flange 51 of the reflector passing through the through holes 52 is fixed to the holder 50 by screws. In the embodiment, one reflector is fixed to the center portion of the holder 50 and six reflectors are fixed to the peripheral portion corresponding to the disposition of the light source sections 35. A plurality of mounting holes 53 are formed in the holder 50 corresponding to the mounting holes 27 of the bosses 28 of the common body 11.

[0023] In order to mount the reflector unit 46 on the common body 11, a plurality of mounting members 54 and screws 55 passing through the mounting members 54 are used. The mounting member 54 has a cylindrical shape and is formed having a length of a dedicated narrow-angle light distribution. The mounting member 54 functions as a spacer that is interposed between the holder 50 and the boss 28 of the common body 11. The screw 55 is screwed into the mounting hole 27 of the boss 28 through the mounting hole 53 of the holder 50 and the mounting member 54, and fixes the reflector unit 46 to the common body 11. Then, a rear end opening of each reflector 49 is arranged facing the light emitting section 39 of each light source section 35 and light emitted from the light emitting section 39 is made to be incident on the reflector 49 by fixing the reflector unit 46 to the common body 11.

[0024] The case 47 is formed of a metal material such as aluminum. The case 47 has a cylindrical shape that is open on front and rear sides, and is formed so that the opening widens from the rear side to the front side. A flange 56 is bent on an inner diameter side in a rear end of the case 47. The flange 56 is fitted into the recessed

section 25 of the com mon body 11 and screws 57 passing through the flange 56 are screwed into the mounting holes 26 thereby being fixing to the common body 11.

[0025] Then, the holder 50 and the mounting member 54 of the reflector unit 46, the flange 56 of the case 47, and the like are configured as a light control unit-side common mounting section 58 for mounting the light control unit 13 on the front-side common mounting section 24 of the common body 11.

[0026] The light-transmitting cover 48 is a transparent glass and is formed in a disk shape. Then, a peripheral portion of the light-transmitting cover 48 is disposed in a front end of the case 47 through a seal material 59 and the front end of the case 47 is caulked whereby the light-transmitting cover 48 is fixed to the front surface of the case 47.

[0027] Moreover, the fixing stand 14 includes a mounting section 61 and a pair of arms 62 that are bent from both sides of the mounting section 61. The mounting section 61 is fixed to a building by a bolt 63. The arm 62 rises inclined forward from the mounting section 61. A shaft member 64 that rotatably supports the common body 11 by insertion into the shaft section 32 of the common body 11 is mounted on the front end of the arm 62.

[0028] A disk 65 is screwed to a side surface of the common body 11 and a clamping member 66 capable of clamping the disk 65 between the arm 62 and the common body 11 is disposed on the inside of the arms 62, and a handle 67 that is rotatably mounted on the arm 62 is screwed to the clamping member 66. Then, when the handle 67 is operated to be fastened, the disk 65 is clamped between the arm 62 and the clamping member 66 and the common body 11 is fixed to the arms 62, and when the handle 67 is loosened, the common body 11 is capable of rotating with respect to the arms 62 and it is possible to change a light irradiation direction of the lighting device 10.

[0029] Moreover, the power supply unit 15 includes a power supply circuit 70 and a power supply case 71 accommodating the power supply circuit 70. The power supply circuit 70 supplies DC power supply to the LED 38 of the light source section 35 by converting AC power supply to a predetermined DC power supply. The power supply case 71 is mounted by a mounting bracket 72 that is connected between the pair of arms 62. A power supply cable 73 that supplies the AC power supply to the power supply circuit 70 and a power feeding cable 74 that supplies the DC power supply that is converted by the power supply circuit 70 to the LED 38 of the light source section 35 are connected to the power supply case 71. A front end of the power feeding cable 74 is connected to a wiring box 75 mounted on a rear portion of the common body 11. The wiring box 75 is electrically connected to the power feeding cable 74 and the light source section 35 through the wiring hole 40a of the base 40. The power supply circuit 70 is capable of independently performing light dimming control of each light source section 35.

[0030] Next, an operation of the lighting device 10 of the first embodiment will be described.

[0031] For assembling the lighting device 10, the light source unit-side common mounting section 42 of the light source unit 12 is mounted on the rear-side common mounting section 22 of the common body 11. That is, the base 40 of the radiator 36 is fitted into the recessed section 23 of the common body 11 and the base 40 is screwed from the rear side. Each light source section 35 and the wiring box 75 are electrically wired.

[0032] The light control unit-side common mounting section 58 of the light control unit 13 is mounted on the front-side common mounting section 24 of the common body 11. That is, first, the flange 56 of the case 47 is fitted into the recessed section 25 of the common body 11 and the flange 56 is screwed from the front side. Subsequently, the reflector unit 46 is screwed to the common body 11 from the front side through the mounting member 54. Subsequently, the light-transmitting cover 48 is disposed in the front end of the case 47 and the front end of the case 47 is caulked, and then the light-transmitting cover 48 is fixed to the front end of the case 47.

[0033] Moreover, the mounting order of the light source unit 12 and the light control unit 13 with respect to the common body 11 may be arbitrary.

[0034] The fixing stand 14 is mounted on the common body 11 and the power feeding cable 74 from the power supply unit 15 disposed in the fixing stand 14 is connected to the wiring box 75.

[0035] Then, each light source section 35 emits light, the light from each light source section 35 is incident on each reflector 49, the light distribution is controlled, and the light in which the light distribution is controlled penetrates the light-transmitting cover 48 and is emitted, and then lights a light target by supplying the DC power supply from the power supply unit 15 to each light source section 35.

[0036] Heat that is generated when emitting the light from each light source section 35 is transmitted to the base 40 of the radiator 36 and is transmitted from the base 40 to the plurality of radiation fins 41, and is naturally radiated from the plurality of radiation fins 41 to the atmosphere.

[0037] Furthermore, it is possible to perform the light dimming control of the light output of the light source section 35 by the power supply circuit 70. In this case, for example, lowering of light output efficiency of the light source section 35 is small when performing the light dimming from a light dimming ratio of 100% in which all lights are lighted to the light dimming ratio of approximately 50%, but when performing the light dimming further to the light dimming ratio of 0%, the light output efficiency of the light source section 35 is remarkably lowered. Thus, the light dimming of all light source sections 35 is continuously performed from the light dimming ratio of 100% to the light dimming ratio of approximately 50% and the light dimming is performed stepwise in the light dimming of 50% or less so that the plurality of light source sections 35 are lighted off sequentially one by one. It is

possible to perform the light dimming while suppressing the lowering of the light output efficiency of the light source section 35 by the light dimming control in which the continuous light dimming and the stepwise light dimming are combined.

[0038] Then, FIGS. 1 to 5 illustrate the lighting device 10 that is configured of the narrow-angle light distribution. Since the lighting device 10 includes the light control unit 13 for the narrow-angle light distribution, the emitted light gains the narrow-angle light distribution.

[0039] Moreover, FI GS. 6 and 7 illustrate the lighting device 10 that is configured of middle-angle light distribution. Since the lighting device 10 includes the light control unit 13 for the middle-angle light distribution, the emitted light gains the middle-angle light distribution.

[0040] The lighting device 10 has the same configuration as that of the lighting device 10 that is configured of the narrow-angle light distribution illustrated in FIGS. 1 to 5 except that the light control unit 13 for the middle-angle light distribution is different. That is, the common body 11, the light source unit 12, and the like are common to both lighting devices. Then, the light control unit 13 for the middle-angle light distribution has the case 47, the reflector 49, the mounting member 54, and the like which mainly have different dimensions in the front-rear direction from those of the light control unit 13 for the narrow-angle light distribution, and the mounting structures with respect to the common body 11 are common. That is, the light control unit 13 for the middle-angle light distribution also includes the light control unit-side common mounting section 58. Therefore, it is possible to mount the light control unit 13 for the middle-angle light distribution on the common body 11 instead of the light control unit 13 for the narrow-angle light distribution.

[0041] Moreover, FIGS. 8 and 9 illustrate the lighting device 10 that is configured of wide-angle light distribution. Since the lighting device 10 includes the light control unit 13 for the wide-angle light distribution, the emitted light gains the wide-angle light distribution.

[0042] The lighting device 10 has the same configuration as that of the lighting device 10 that is configured of the narrow-angle light distribution illustrated in FIGS. 1 to 5 except that the light control unit 13 for the wide-angle light distribution is different. That is, the common body 11, the light source unit 12, and the like are common to both lighting devices. Then, the light control unit 13 for the wide-angle light distribution has the case 47, the reflector 49, the mounting member 54, and the like which mainly have different dimensions in the front-rear direction from those of the light control unit 13 for the narrow-angle light, and the mounting structures with respect to the common body 11 are common. That is, the light control unit 13 for the wide-angle light distribution also includes the light control unit-side common mounting section 58. Therefore, it is possible to mount the light control unit 13 for the wide-angle light distribution on the common body 11 instead of the light control unit 13 for the narrow-angle light distribution.

[0043] The light control unit 13 for the wide-angle light distribution can have the case 47 and the light-transmitting cover 48 in common with the light control unit 13 for the middle-angle light distribution, but the reflector units 46 are different from each other. In this case, the reflector unit 46 is close to the common body 11 side and a space between the front surface of the reflector unit 46 and the rear surface of the light-transmitting cover 48 is enlarged. A louver 78 may be disposed inside the light control unit 13 by using the space. The louver 78 is mounted on the front surface of the reflector unit 46. Then, it is possible to block the emission of the light by the louver 78 in an arbitrary direction. Furthermore, it is possible to miniaturize the lighting device 10 and to prevent the louver 78 from receiving influence of wind and the like when mounting outdoors by disposing the louver 78 inside the light control unit 13.

[0044] As described above, in the lighting device 10 of the embodiment, since the light control unit 13 of different angle light distributions can be assembled in the common body 11, it is possible to commonly use the common body 11, the light source unit 12, the fixing stand 14, and the like if only the light control unit 13 that is assembled in the common body 11 is changed.

[0045] Furthermore, it is possible to assemble the light source unit 12 of different light outputs in the common body 11. In the light source unit 12 of different light outputs, for example, brightness of the light source section 35, the number of the light source sections 35, or the like is different and thus radiation performance of the radiator 36 is also different. I n this case, when only changing the light source unit 12 that is assembled in the common body 11, it is possible to commonly use the common body 11, the light control unit 13, the fixing stand 14, and the like.

[0046] Furthermore, it is possible to arbitrarily assemble the light control unit 13 of different angle light distributions and the light source unit 12 of different light outputs with respect to the common body 11.

[0047] Therefore, according to the lighting device 10, it is possible to respectively assemble the light source unit 12 of different light outputs and the light control unit 13 of different angle light distributions with respect to the rear-side common mounting section 22 and the front-side common mounting section 24 of the common body 11, and to use the common body 11 as the common structure.

[0048] Next, FIGS. 10 to 12 illustrate a second embodiment. Moreover, the same reference numerals are given to the same configurations as those of the first embodiment and description of the configurations and the operational effects will be omitted.

[0049] As illustrated in FIG. 10, a radiation fin 41 of a radiator 36 is configured such that a protrusion dimension from a base 40 increases from a lower portion side to an upper portion side thereof and a rear end of the radiation fin 41 is formed in an inclined shape.

[0050] For example, in the protrusion dimension of the

radiation fin 41 illustrated in Comparison Example 1 of FIG. 11 (a), if the radiation performance is not sufficient, as illustrated in Comparison Example 2 of FIG. 11 (b), it is possible to secure the radiation performance by increasing the protrusion dimension of an entirety of the radiation fin 41, but there is a drawback that a mass of the radiator 36 is remarkably increased.

[0051] As illustrated in the embodiment of FIG. 11 (c), it is possible to suppress the increase of the mass of the radiator 36 while securing a desired radiation performance by further increasing the protrusion dimension on the upper portion side than lower portion side of the radiation fin 41.

[0052] FIG. 12 illustrates measured results of temperatures of the LED 38 of the light source section 35 disposed in the up-down direction in Comparison Example 1, Comparison Example 2, and the embodiment. Moreover, in the view, the LED 38 on the lower portion side is represented as A, the LED 38 of an intermediate portion is represented as B, and the LED 38 on the upper portion side is represented as C.

[0053] In Comparison Example 1, the temperature of the light source section 35 of the lowermost portion is high and a temperature difference between the upper and lower light source sections 35 is great. In Comparison Example 2, it is possible to decrease the temperature of the light source section 35 of the lowermost portion further than that of Comparison Example 1, but the temperature difference between the upper and lower light source sections 35 is still great.

[0054] In the embodiment, it is possible to decrease the temperature of the light source section 35 of the lowermost portion further than that of Comparison Examples 1 and 2 and to reduce the temperature difference between the upper and lower light source sections 35. Since the heat is transmitted from the light source section 35 of each height position to the radiation fin 41, the temperature is likely to be increased on the upper portion side of the radiation fin 41, but since the protrusion dimension on the upper portion side of the radiation fin 41 is increased and the radiation performance is high, it is possible to average the temperature of the upper and lower light source sections 35. Furthermore, since the rear end of the radiation fin 41 has the inclined shape, air is likely to enter the gap 41 a between the radiation fins 41 from any height position on the rear end side of the radiation fin 41 and it is possible to improve the radiation performance.

[0055] Moreover, if the lighting device 10 is a closed structure, the seal material may be interposed in a connection section of each member. As the seal material, general silicone rubber may be used. However, since silicone rubber has a property of allowing gases to penetrate, there is a concern that chlorine gas, hydrogen sulfide, and the like that are active gases may intrude into the lighting device 10 and then influence the light source section 35 depending on usage conditions. In such a case, it is possible to reduce the penetration of gas by applying grease on the connection section of each member or the silicone rubber. As a material for the grease, polytetrafluroethylene (PTFE), fluorine-based oil, and the like may be used. A film thickness of the grease is preferably approximately 100 μm to 200 μm. Then, if gas permeability of the silicone rubber is 1, the gas permeability of grease is approximately 0.0025 and it is possible to reliably reduce entry of chlorine gas into the lighting device 10.

[0056] 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 (10) comprising:

a common body (11) that is open on front and rear sides and has a front-side common mounting section (24) on a front side, and has a rear-side common mounting section (22) on a rear side;
a light source unit (12) that has a plurality of light source sections (35) using a light emitting element and a radiator (36) in which the light source sections (35) are disposed, and is mounted on the rear-side common mounting section (22) of the common body (11); and
a light control unit (13) that has a plurality of reflectors (49) respectively facing the light source sections (35) and controlling light distribution, and is mounted on the front-side common mounting section (24) of the common body (11).

2. The device (10) according to claim 1,
wherein the light control unit (13) has a case (47) that is open on front and rear sides and a light-transmitting cover (48) that closes a front surface of the case (47), and accommodates the reflectors (49) inside the case (47).

3. The device (10) according to claim 2,
wherein the light control unit (13) has a reflector unit (46) that holds the reflector (49) and the case (47) and the reflector unit (46) are respectively mounted on the front-side common mounting section (24) of the common body (11).

4. The device (10) according to claim 2 or 3,

wherein the light control unit (13) has a louver (78) that is disposed between the reflector (49) and the light-transmitting cover (48).

5. The device (10) according to any one of claims 2 to 4, wherein the case (47) allows the light-transmitting cover (48) to be mounted by caulking a front end of the case (47).

6. The device (10) according to any one of claims 1 to 5, wherein the radiator (36) has a base (40) in which the light source sections (35) are disposed on the front side and a plurality of radiation fins (41) which protrude from a rear side of the base (40), and a protrusion dimension of the radiation fins (41) from the base (40) is greater on an upper portion side than on a lower portion side of the radiation fins (41).

7. The device (10) according to claim 6,
wherein gaps (41 a) that are open in an up-down direction and on the rear side are formed between the plurality of radiation fins (41).

8. The device (10) according to any one of claims 1 to 7, further comprising:

a fixing stand (14) that supports the common body (11).

9. The device (10) according to claim 8, further comprising:

a power supply unit (15) that is mounted on the fixing stand (14) and supplies power to the light source sections (35).

10. The device (10) according to claim 9, further comprising:

a wiring box (75) which is mounted on the com mon body (11) and in which a power feeding cable (74) that electrically connects the light source sections (35) and the power supply unit (15) is wired.

11. The device (10) according to any one of claims 1 to 10,
wherein the rear-side common mounting section (22) has a recessed section (23) having a polygonal shape, and
wherein the light source unit (12) has a light source unit-side common mounting section (42) having a polygonal shape which is fitted into and mounted on the recessed section (23).

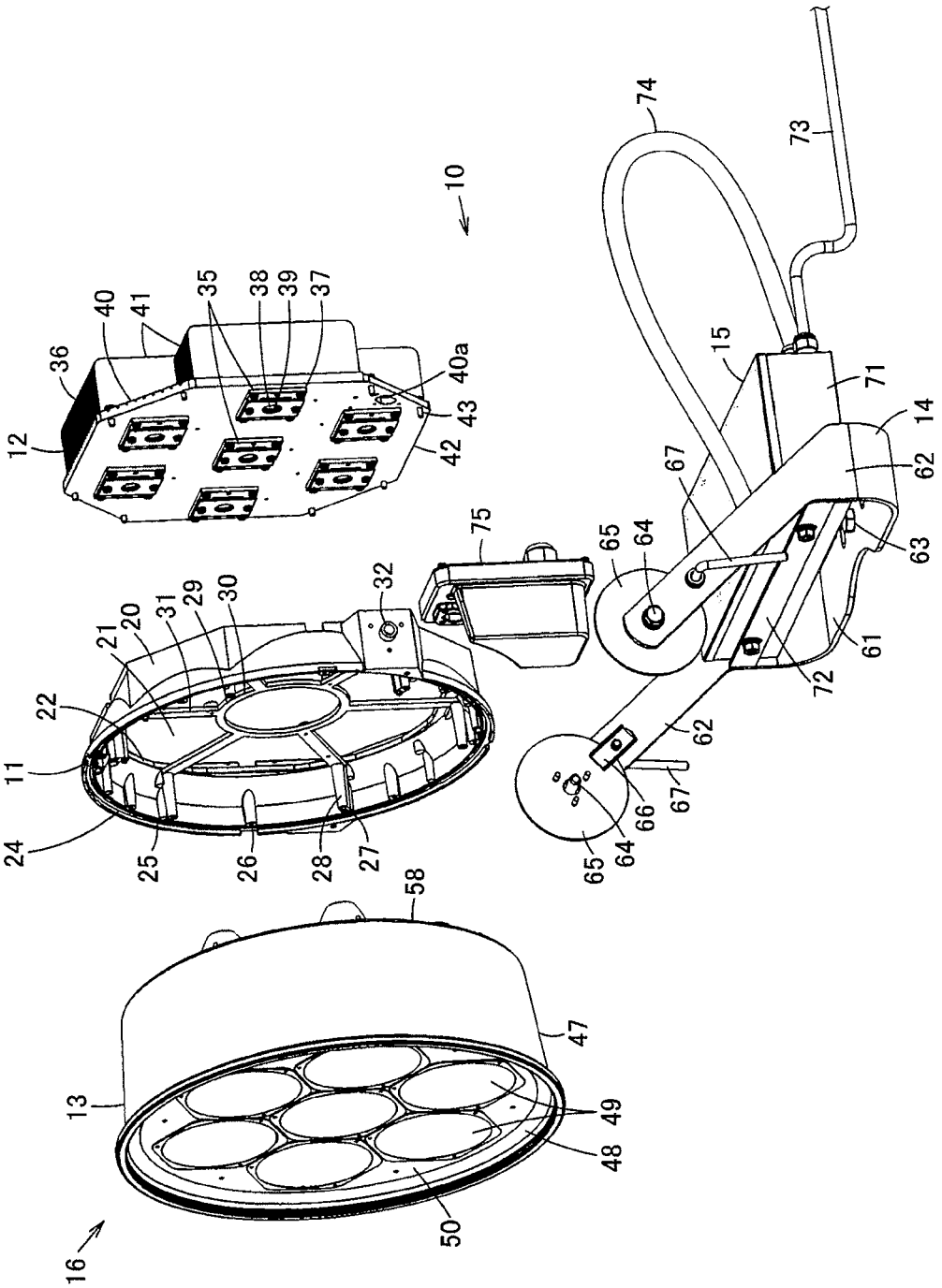
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FIG. 1

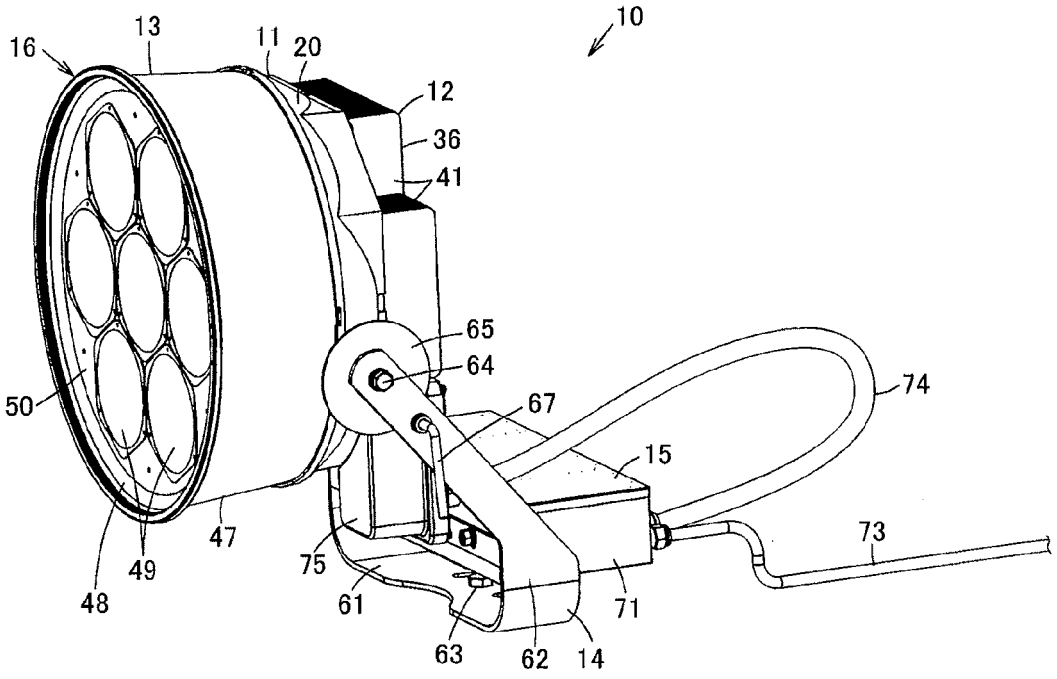

FIG. 2

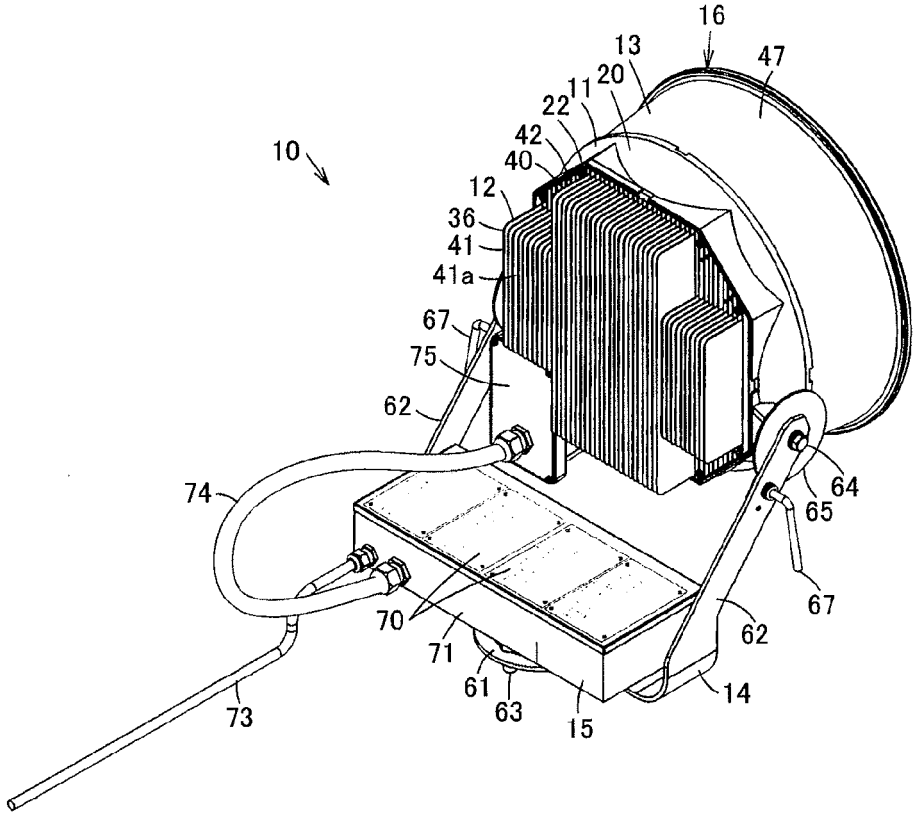
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FIG. 3

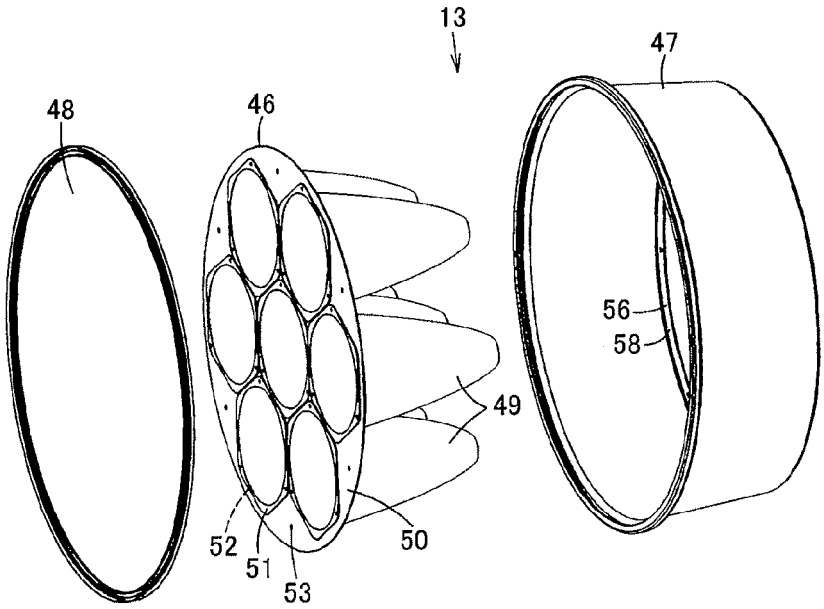

FIG. 4

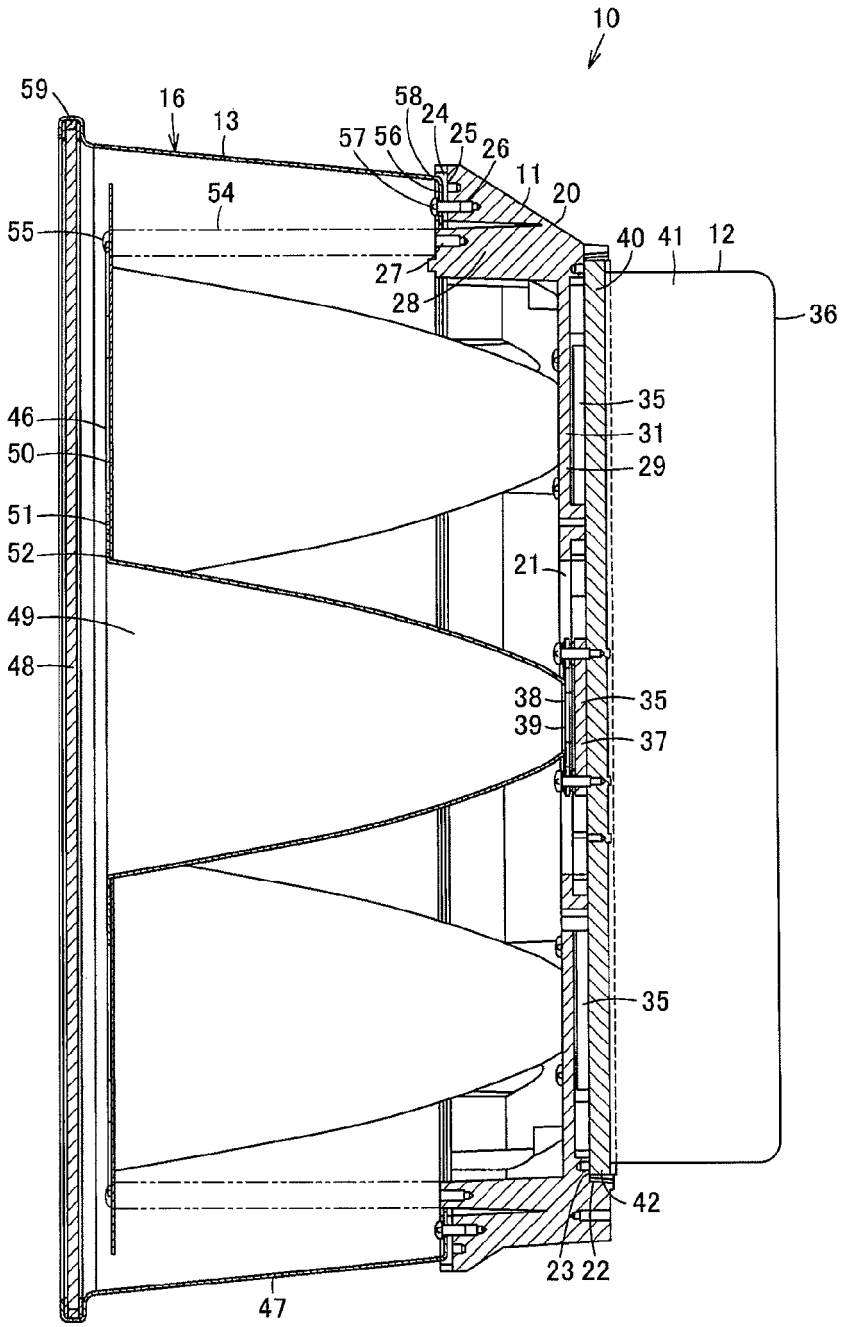
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FIG. 5

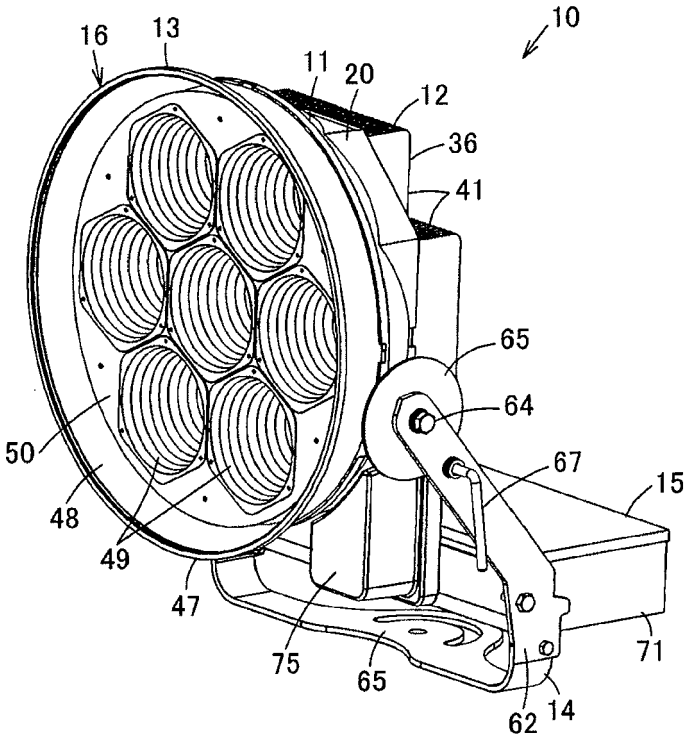

FIG. 6

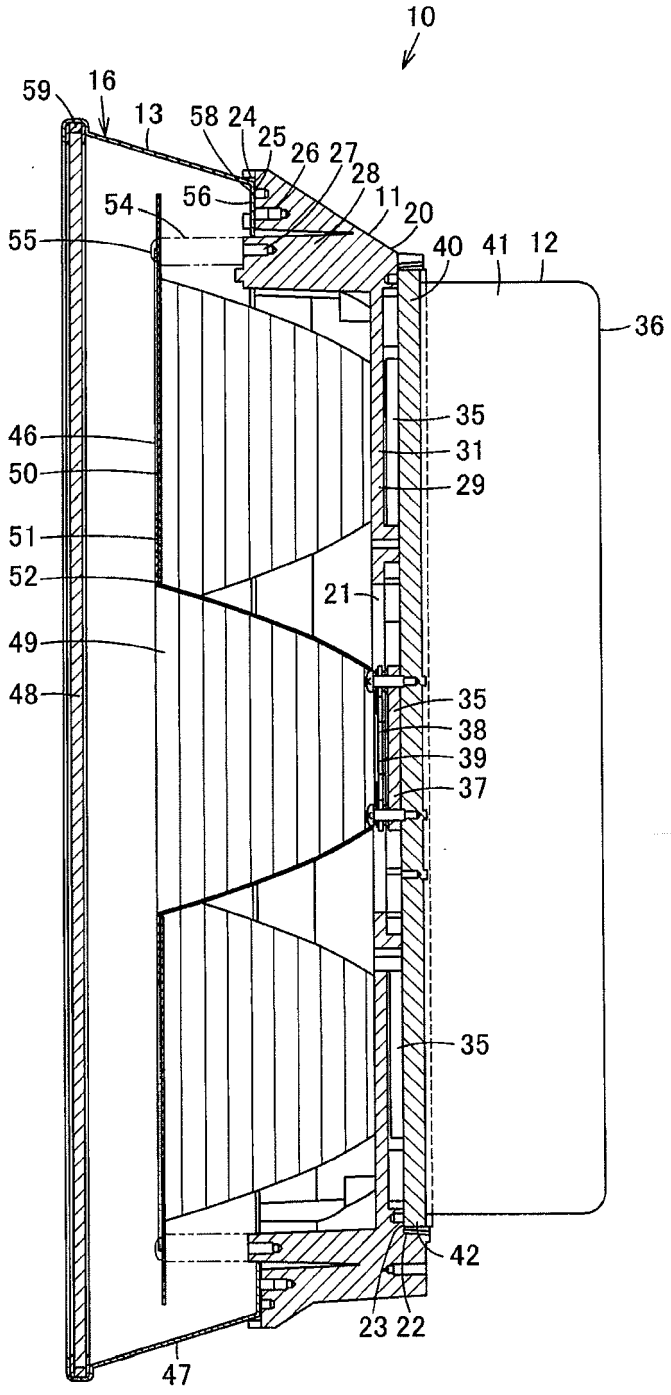
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FIG. 7

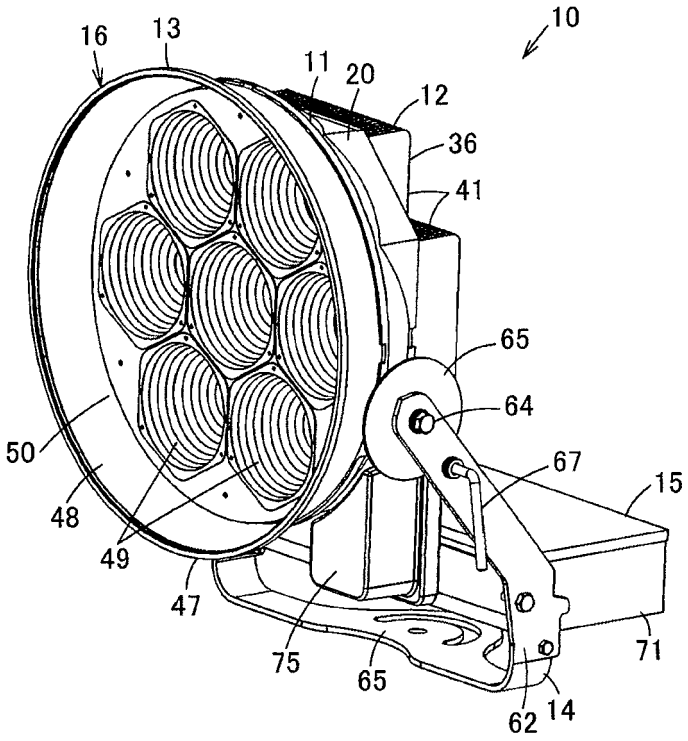

FIG. 8

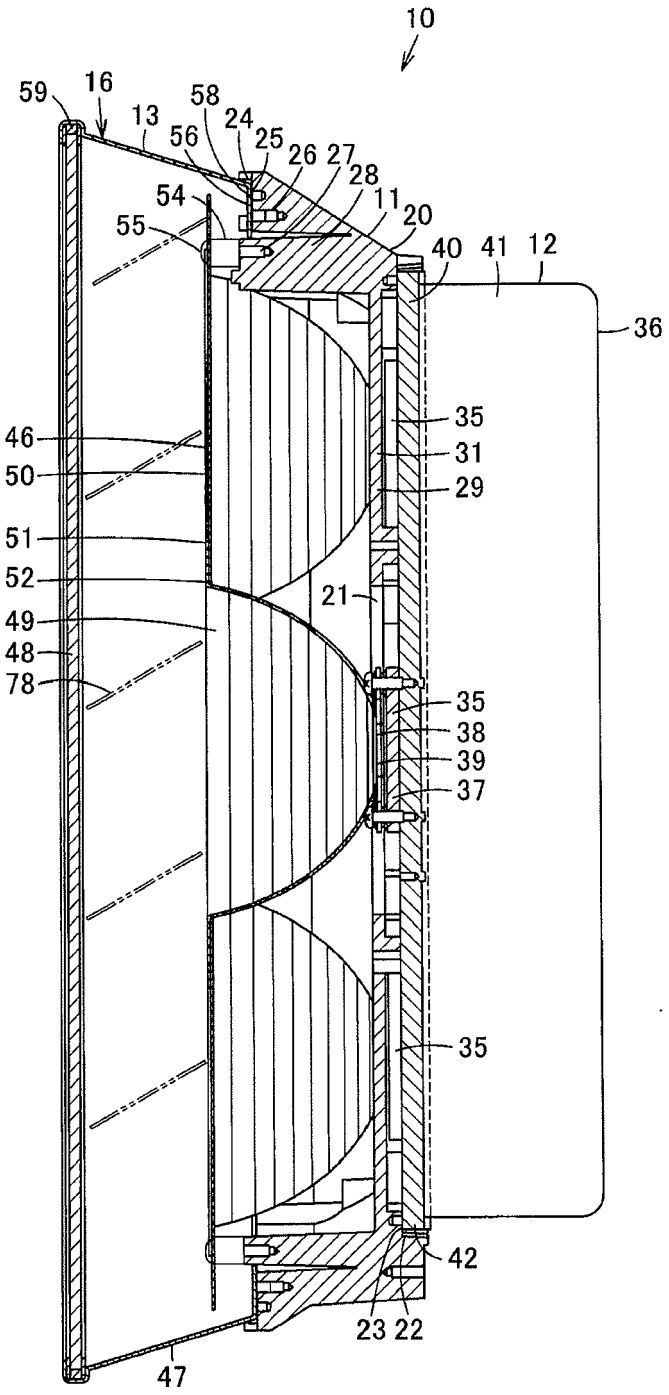
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FIG. 9

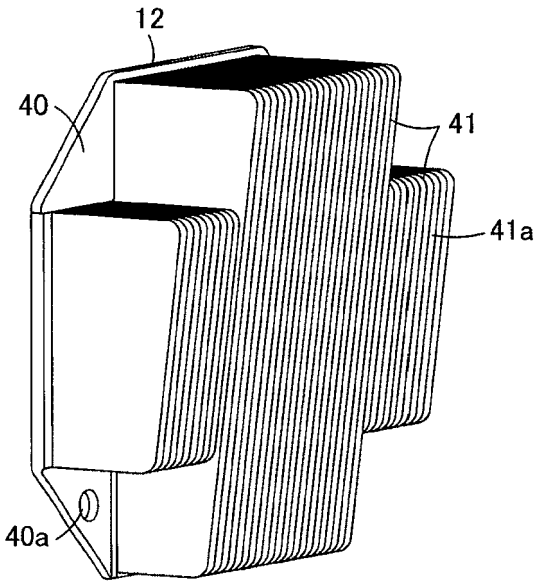
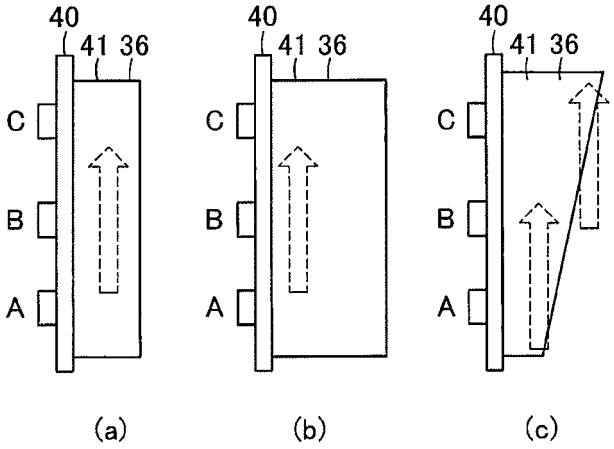


FIG. 10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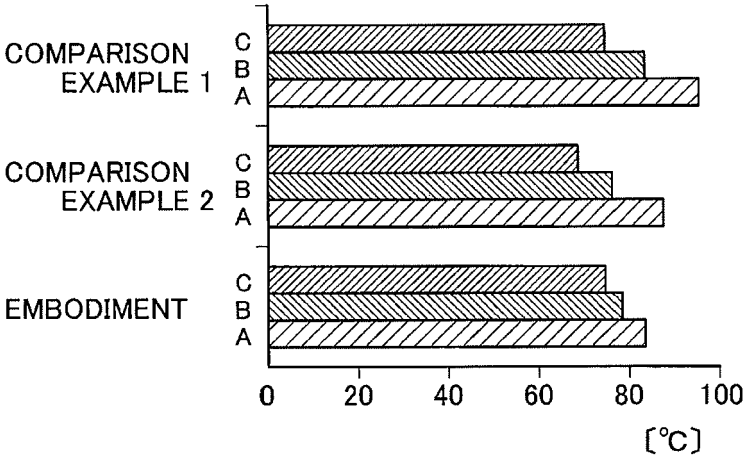
(a)
(b)
(c)

FIG. 11


COMPARISON EXAMPLE 1
COMPARISON EXAMPLE 2
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100
[°C]

FIG. 12

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EUROPEAN SEARCH REPORT

Application Number
EP 14 18 2986

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2011/075409 A1 (ZHENG SHI-SONG [CN]) 31 March 2011 (2011-03-31) * paragraph [0016] - paragraph [0020] * * figures 1-4 *	1-11	INV. F21V7/00 F21V15/01 F21V17/00
X	US 8 025 422 B1 (HUANG XING-GUI [CN] ET AL) 27 September 2011 (2011-09-27) * column 1, line 50 - line 59 * * figures 1-4 *	1,6-8,10	ADD. F21Y101/02 F21Y105/00 F21V21/30 F21V29/76
A	KR 101 284 156 B1 (KO IN HONG [KR]; VISION X ASIA CO LTD [KR]) 10 July 2013 (2013-07-10) * figures 1,2 * -& EP 2 743 576 A2 (VISION X ASIA CO LTD [KR]; KO IN-HONG [KR]) 18 June 2014 (2014-06-18) * paragraph [0039] - paragraph [0042] *	1,6-11	F21V23/02 F21V11/02 F21W131/107
A	KR 2009 0043215 A (WELL LIGHT INC [KR]) 6 May 2009 (2009-05-06) * figures 3,14 *	1,6-8, 10,11	TECHNICAL FIELDS SEARCHED (IPC)
A	EP 2 129 963 A1 (LYRACOM [FR]) 9 December 2009 (2009-12-09) * figure 15 *	1,4	F21V F21W F21Y F21S
A	CN 203 036 430 U (TOSHIBA LIGHTING & TECHNOLOGY) 3 July 2013 (2013-07-03) * figures 1,4,5 * -& EP 2 722 582 A1 (TOSHIBA LIGHTING & TECHNOLOGY [JP]) 23 April 2014 (2014-04-23) * paragraph [0023] - paragraph [0025] * * paragraph [0047] - paragraph [0049] *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 May 2015	Dinkla, Remko

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21-05-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011075409 A1	31-03-2011	CN 102032471 A	27-04-2011
		US 2011075409 A1	31-03-2011
US 8025422 B1	27-09-2011	CN 102261576 A	30-11-2011
		US 8025422 B1	27-09-2011
KR 101284156 B1	10-07-2013	AU 2013267063 A1	26-06-2014
		EP 2743576 A2	18-06-2014
		KR 101284156 B1	10-07-2013
EP 2743576 A2	18-06-2014	AU 2013267063 A1	26-06-2014
		EP 2743576 A2	18-06-2014
		KR 101284156 B1	10-07-2013
KR 20090043215 A	06-05-2009	NONE	
EP 2129963 A1	09-12-2009	AT 535757 T	15-12-2011
		EP 2129963 A1	09-12-2009
		ES 2378427 T3	12-04-2012
		PL 2129963 T3	31-07-2012
		WO 2008125772 A1	23-10-2008
CN 203036430 U	03-07-2013	CN 203036430 U	03-07-2013
		EP 2722582 A1	23-04-2014
		JP 2014086159 A	12-05-2014
		US 2014111986 A1	24-04-2014
EP 2722582 A1	23-04-2014	CN 203036430 U	03-07-2013
		EP 2722582 A1	23-04-2014
		JP 2014086159 A	12-05-2014
		US 2014111986 A1	24-04-2014

EPO FORM P0459

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