



US 20040080925A1

(19) **United States**

(12) **Patent Application Publication**
Moon

(10) **Pub. No.: US 2004/0080925 A1**
(43) **Pub. Date: Apr. 29, 2004**

(54) **LAMP ASSEMBLY AND LIQUID CRYSTAL
DISPLAY DEVICE HAVING THE SAME**

Publication Classification

(51) **Int. Cl. 7** **G01D 11/28**
(52) **U.S. Cl.** **362/29; 362/223; 362/225**

(76) Inventor: **Seung-Hwan Moon, Yongin-si (KR)**

(57) **ABSTRACT**

Correspondence Address:
CANTOR COLBURN LLP
55 Griffin Road South
Bloomfield, CT 06002 (US)

(21) Appl. No.: **10/456,909**

(22) Filed: **Jun. 5, 2003**

(30) **Foreign Application Priority Data**

Oct. 25, 2002 (KR) 2002-65550

A lamp assembly includes at least one lamp for generating light, a reflecting layer, and a conductive supporting member. The reflective layer reflects a part of the light traveling in a first direction toward a second direction opposite to the first direction. The conductive supporting member includes a supporting sheet for supporting the reflecting layer and a plurality of penetrating holes formed in the supporting sheet. The penetrating holes reduce the overlapping area between the lamp and the supporting sheet. The reflective layer and the conductive supporting member are disposed on a rear side of the lamp.

400

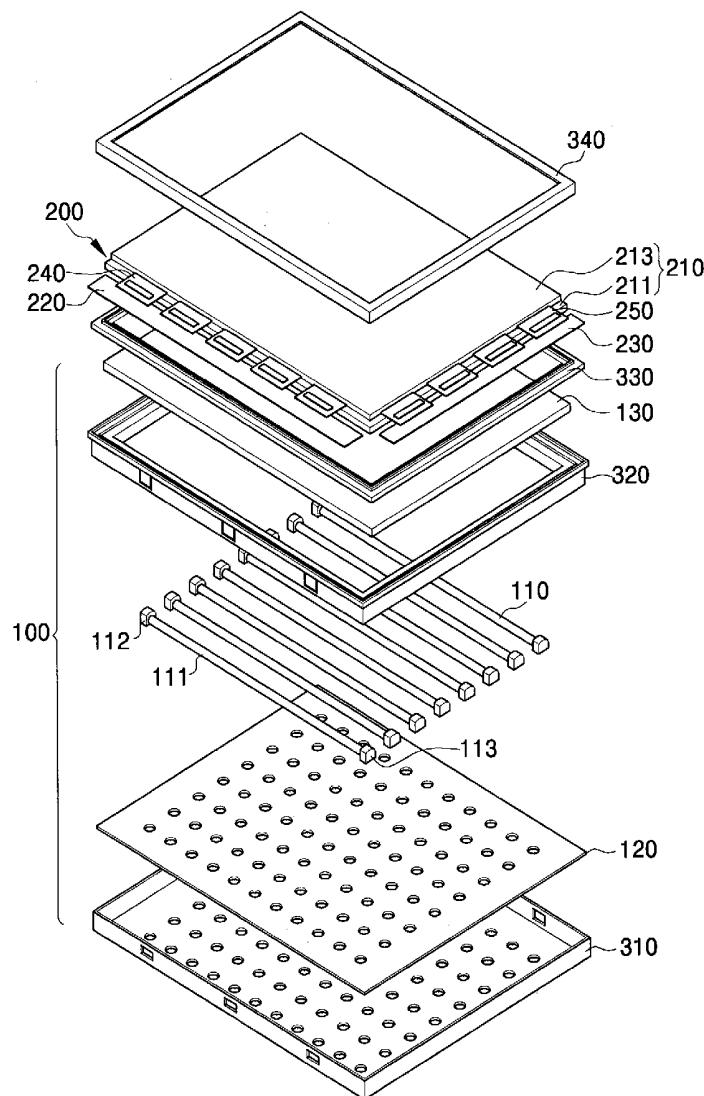


FIG. 1
(PRIOR ART)

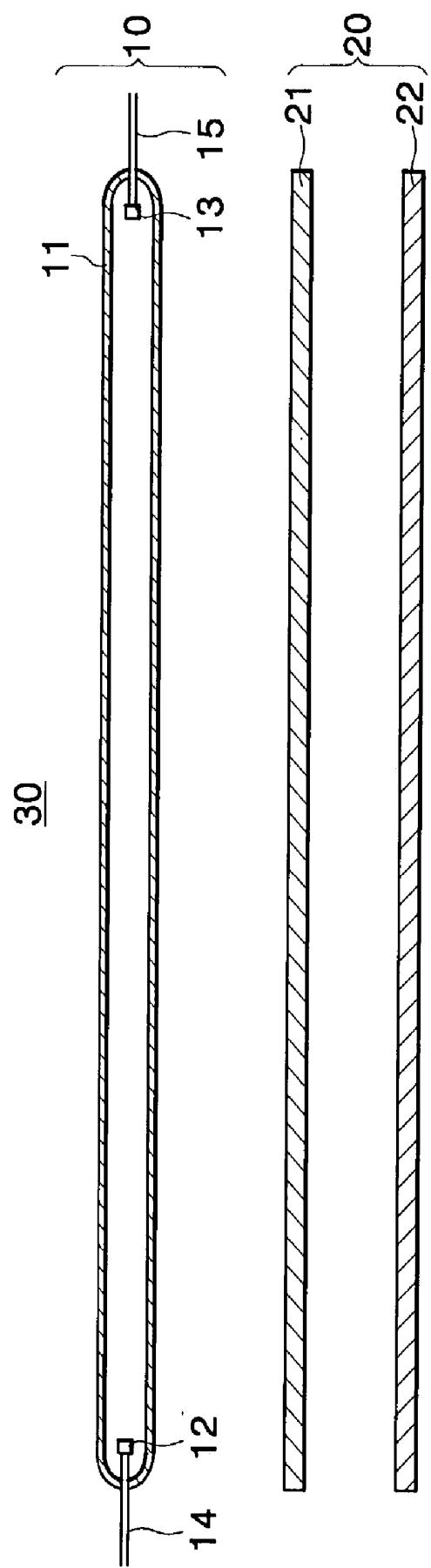


FIG. 2

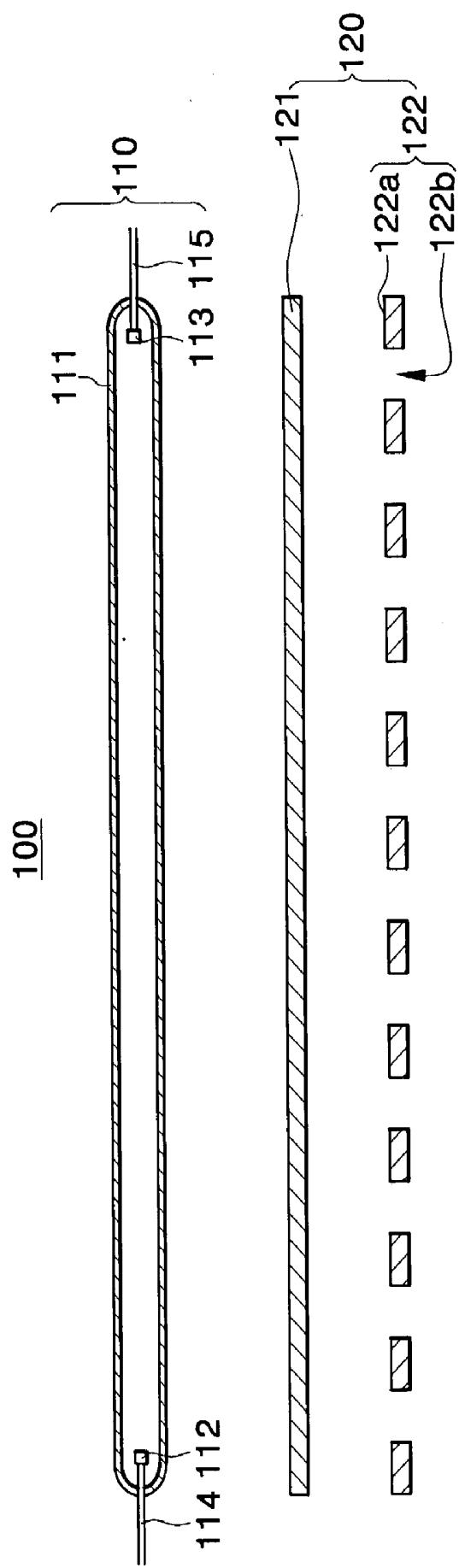


FIG. 3

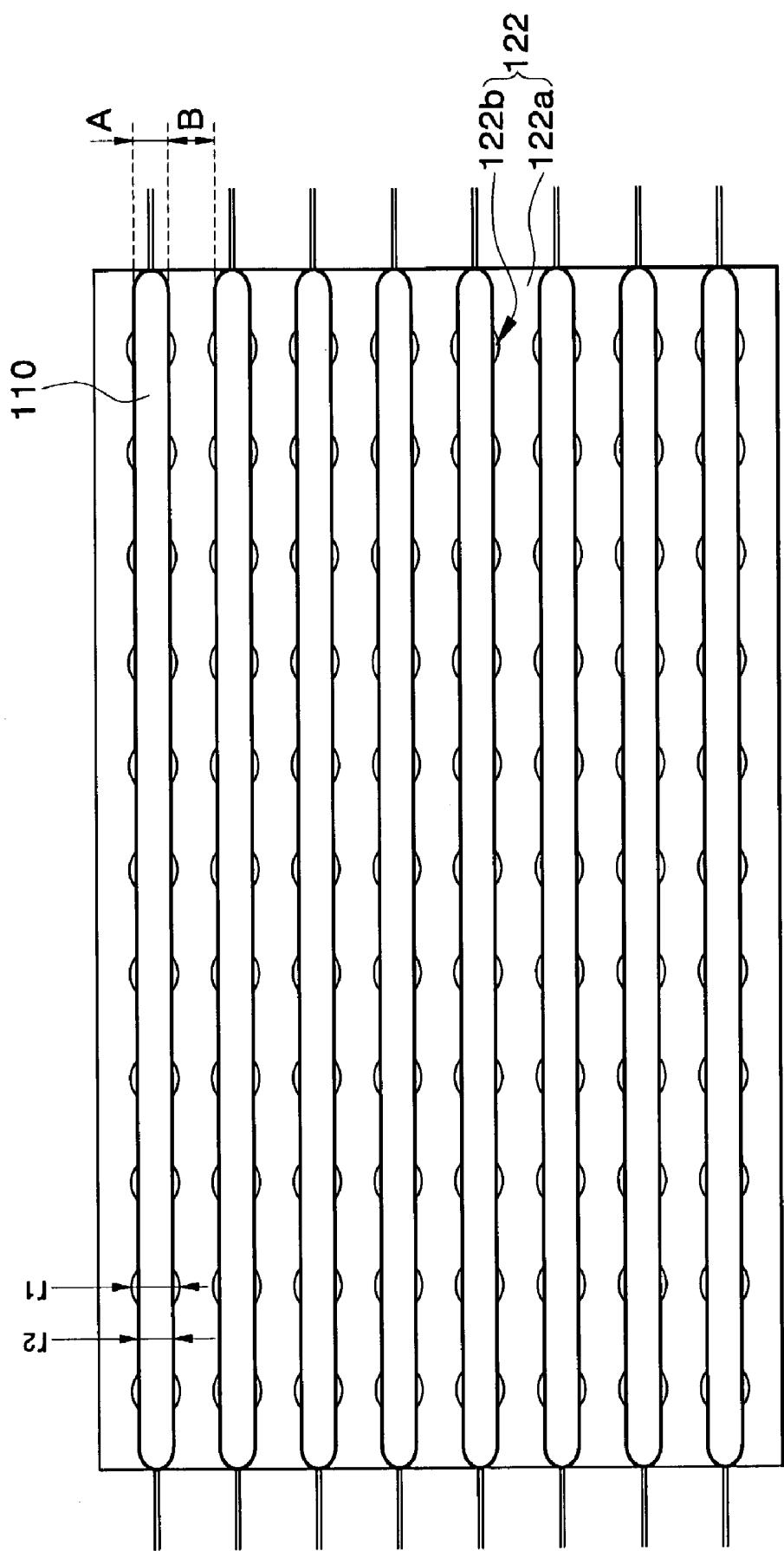


FIG. 4

122

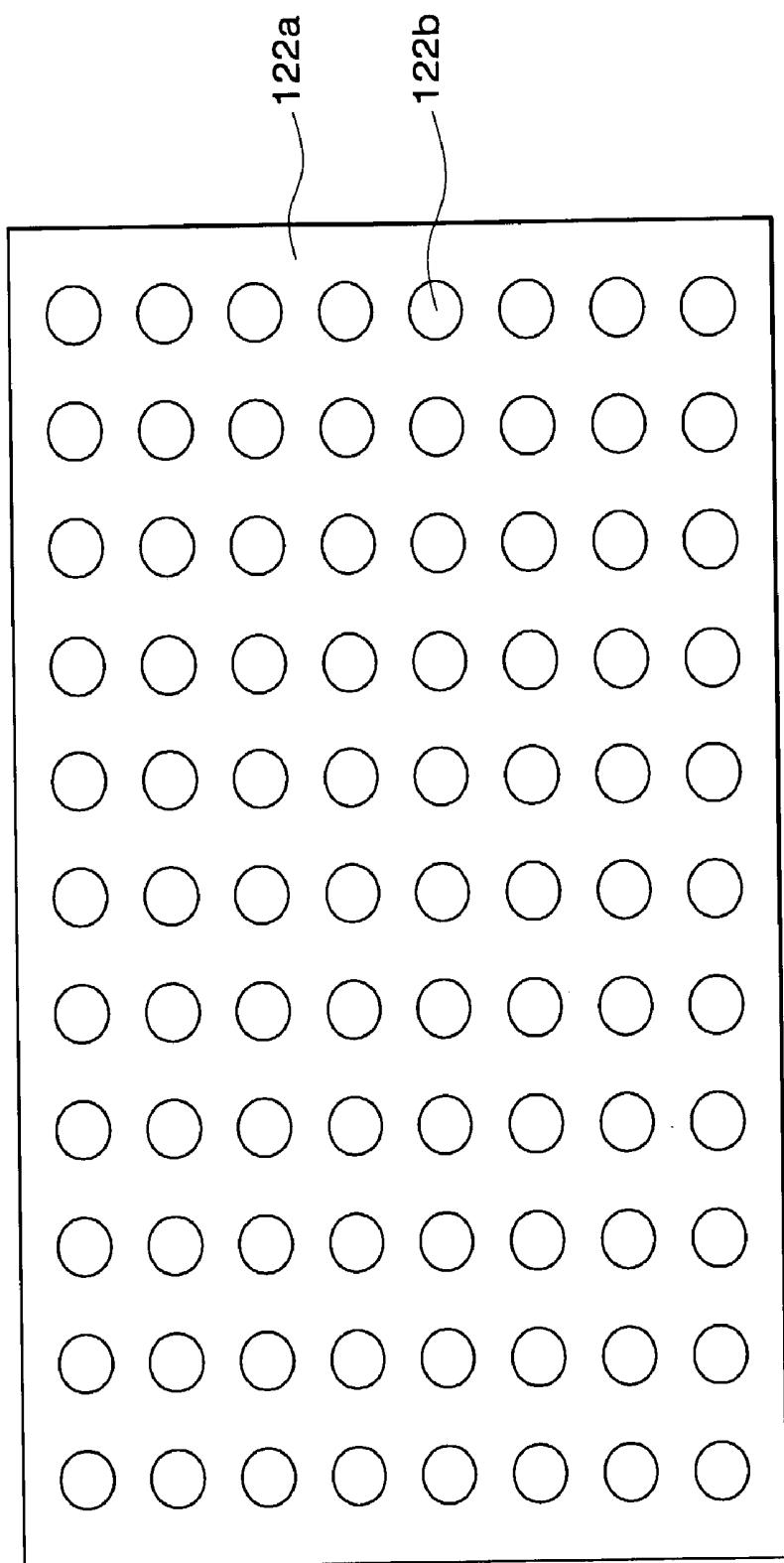


FIG. 5

123

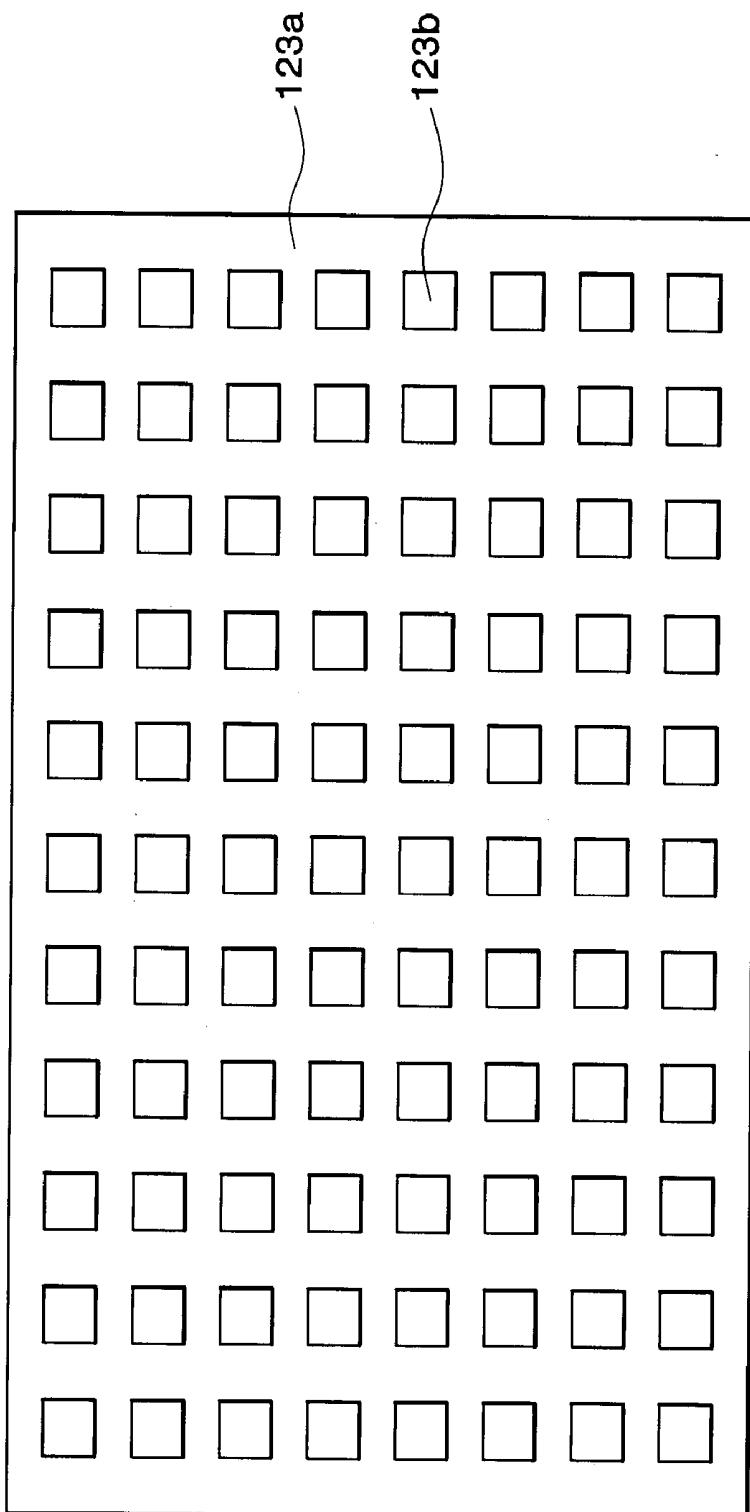


FIG. 6

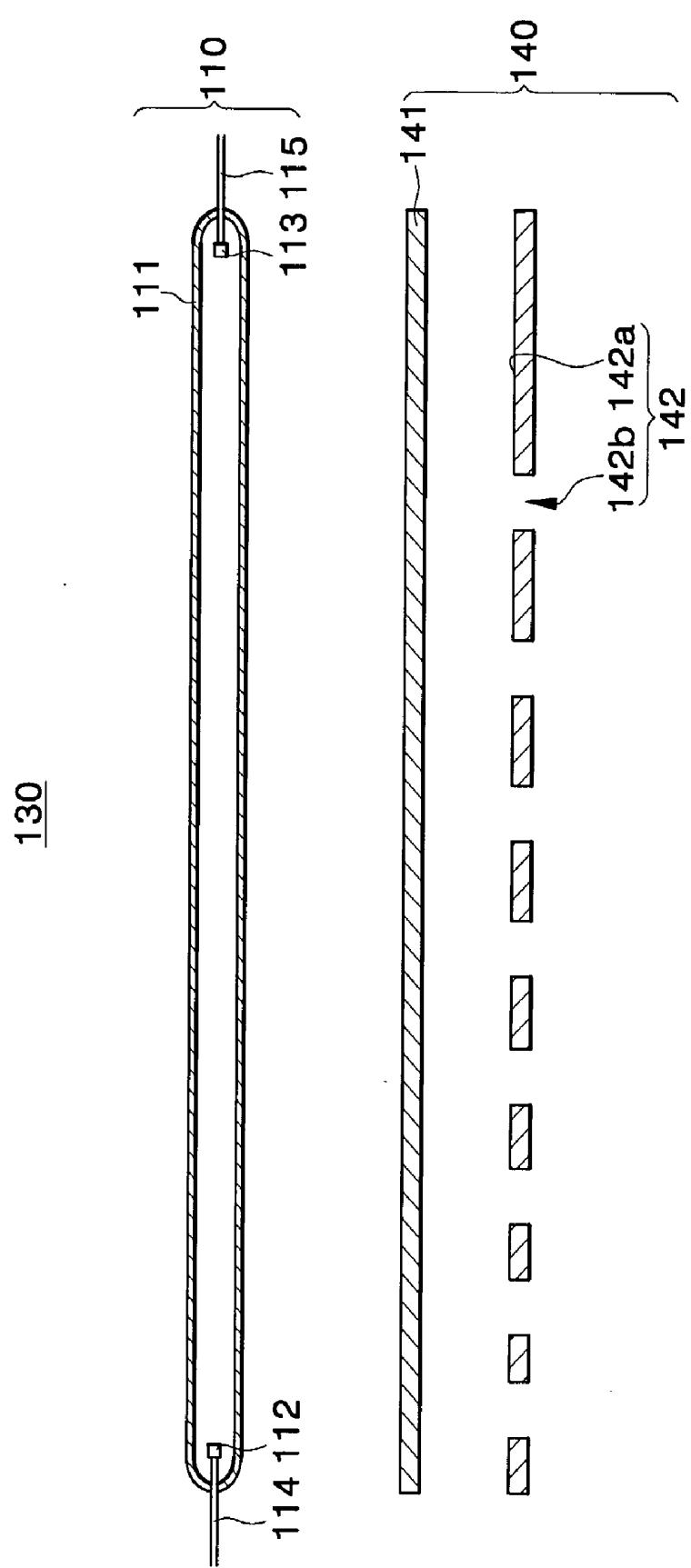


FIG. 7

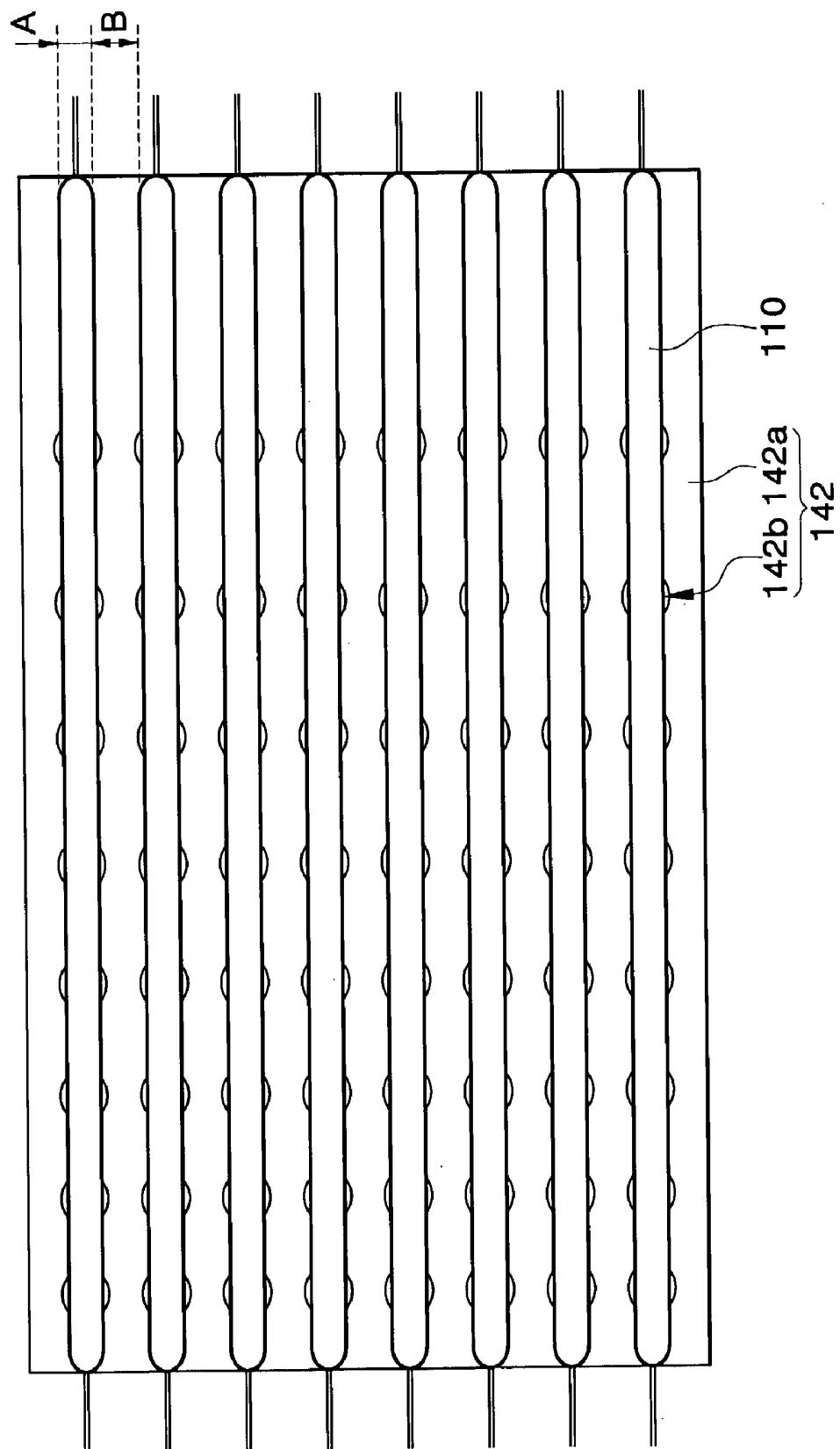
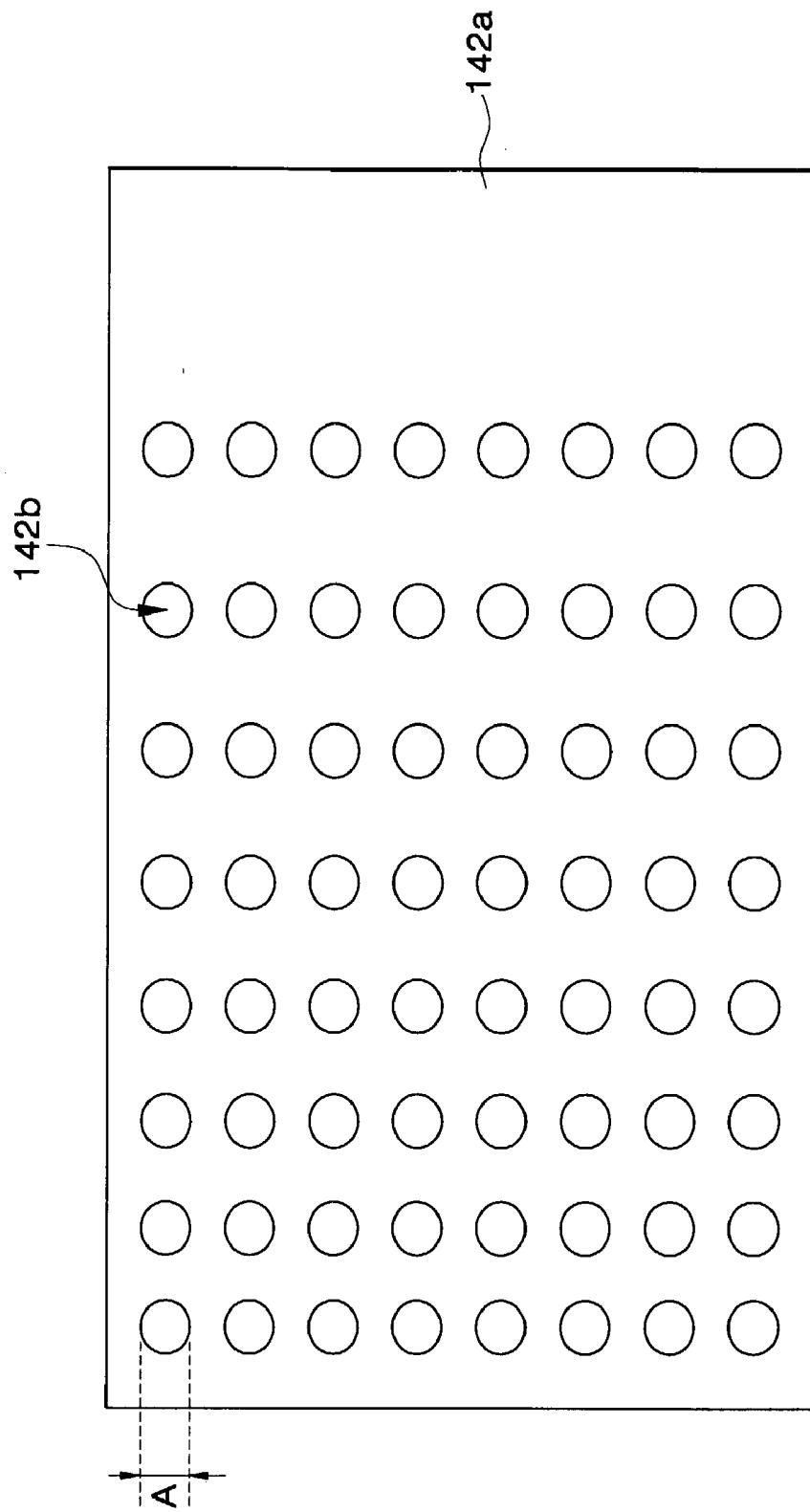


FIG. 8



6
EIGEN

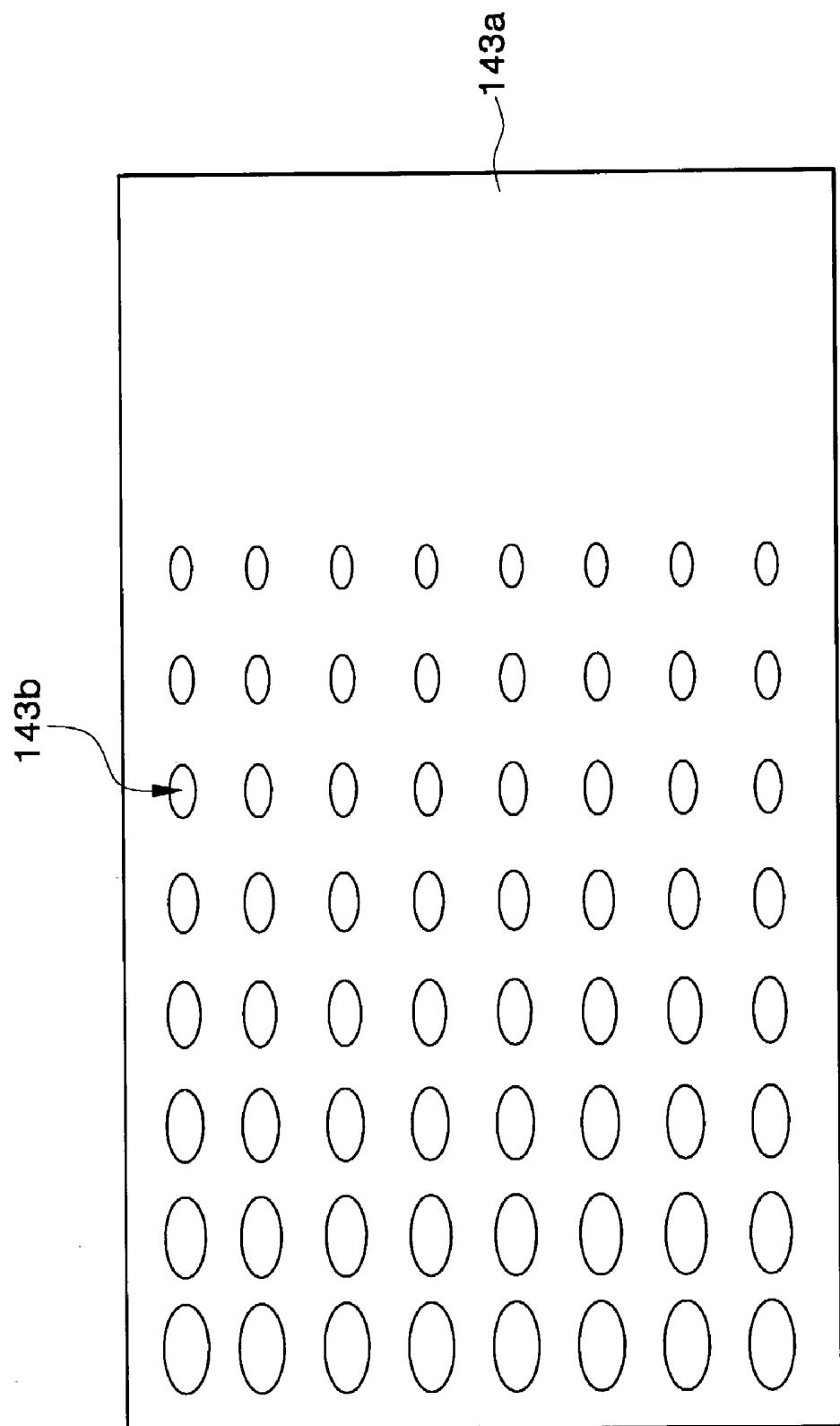


FIG. 10

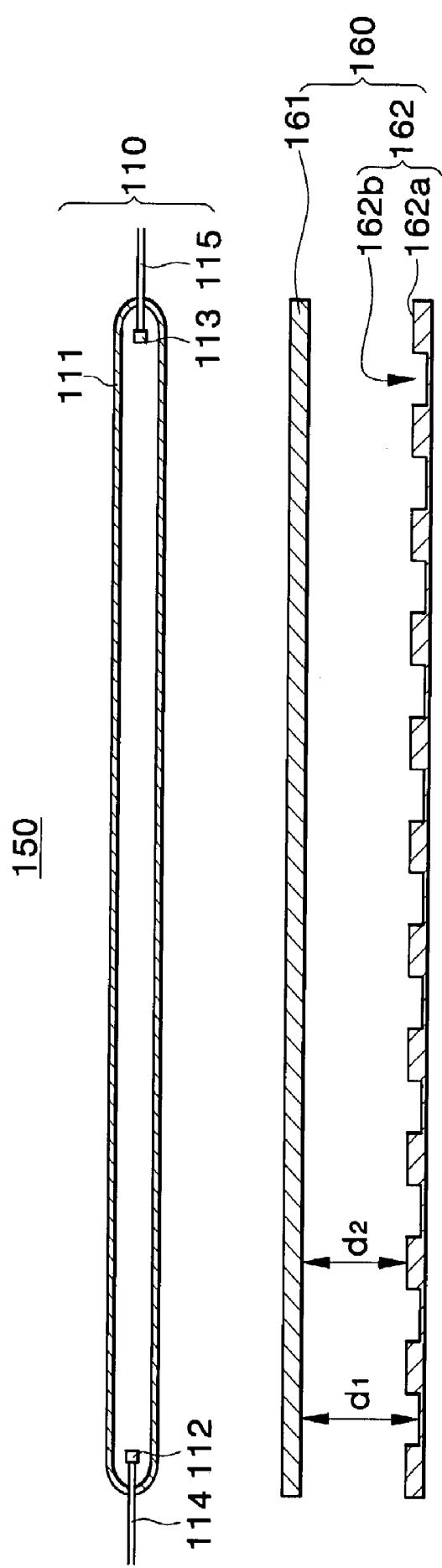


FIG. 11

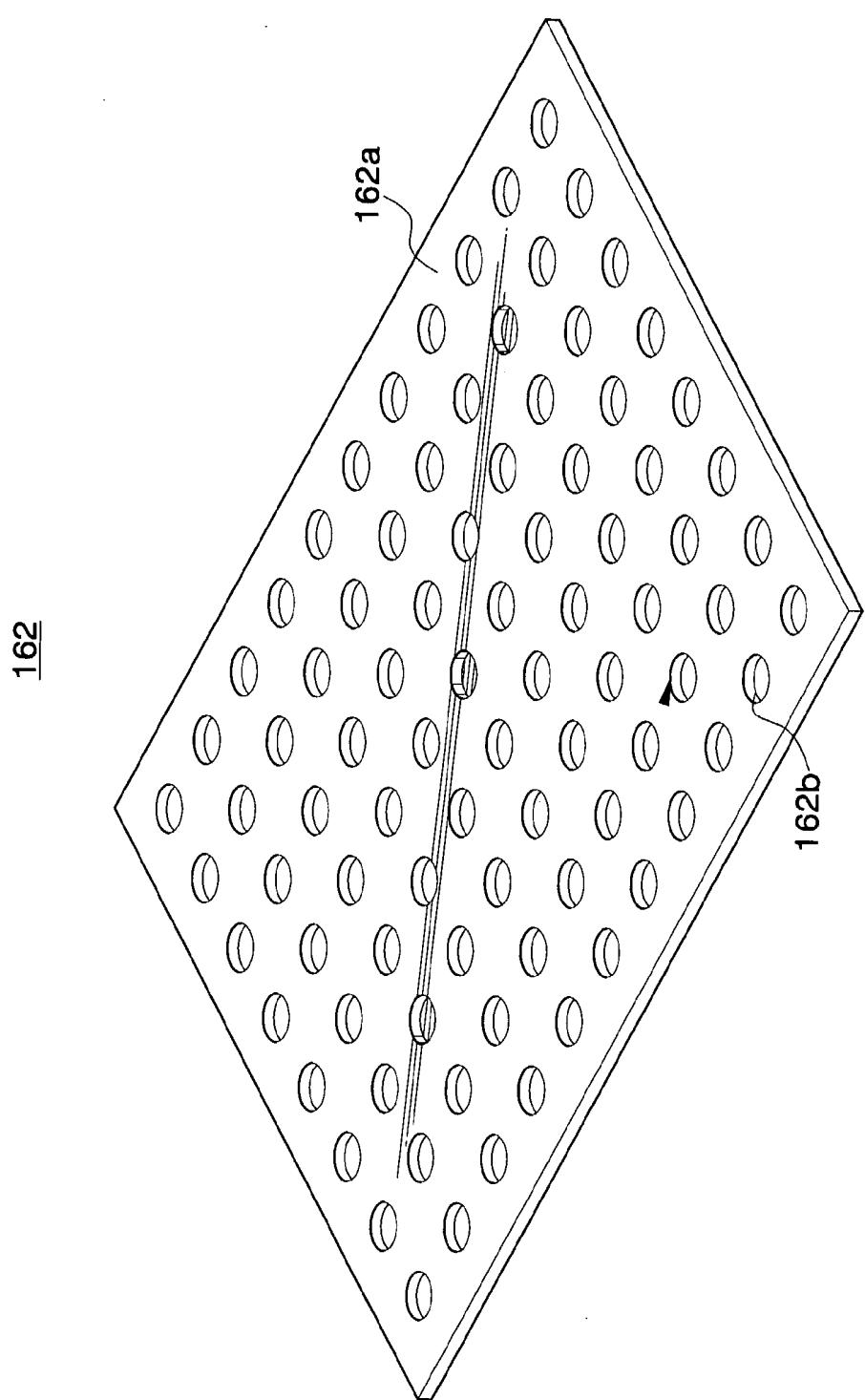


FIG.12

400

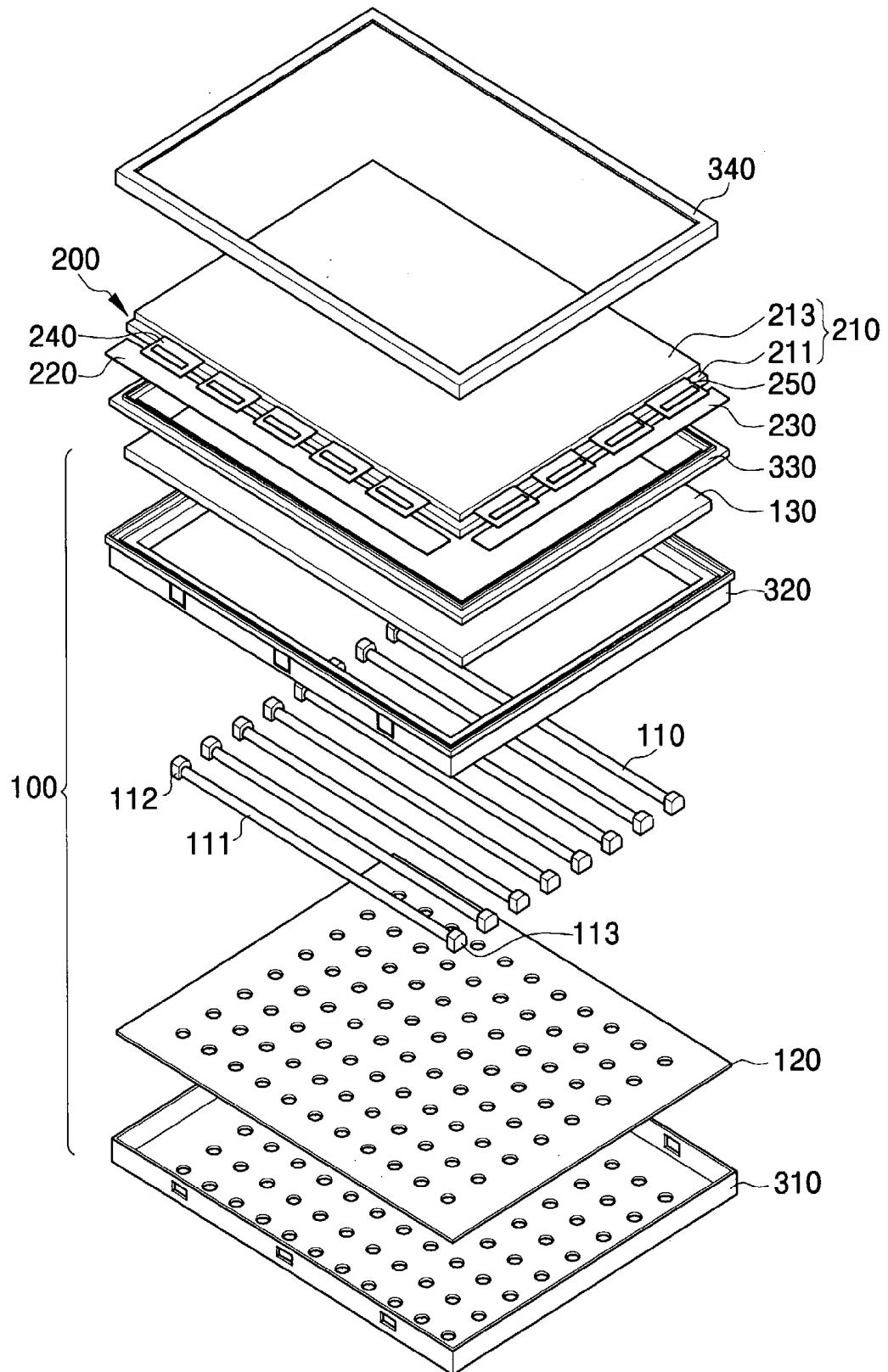


FIG. 13

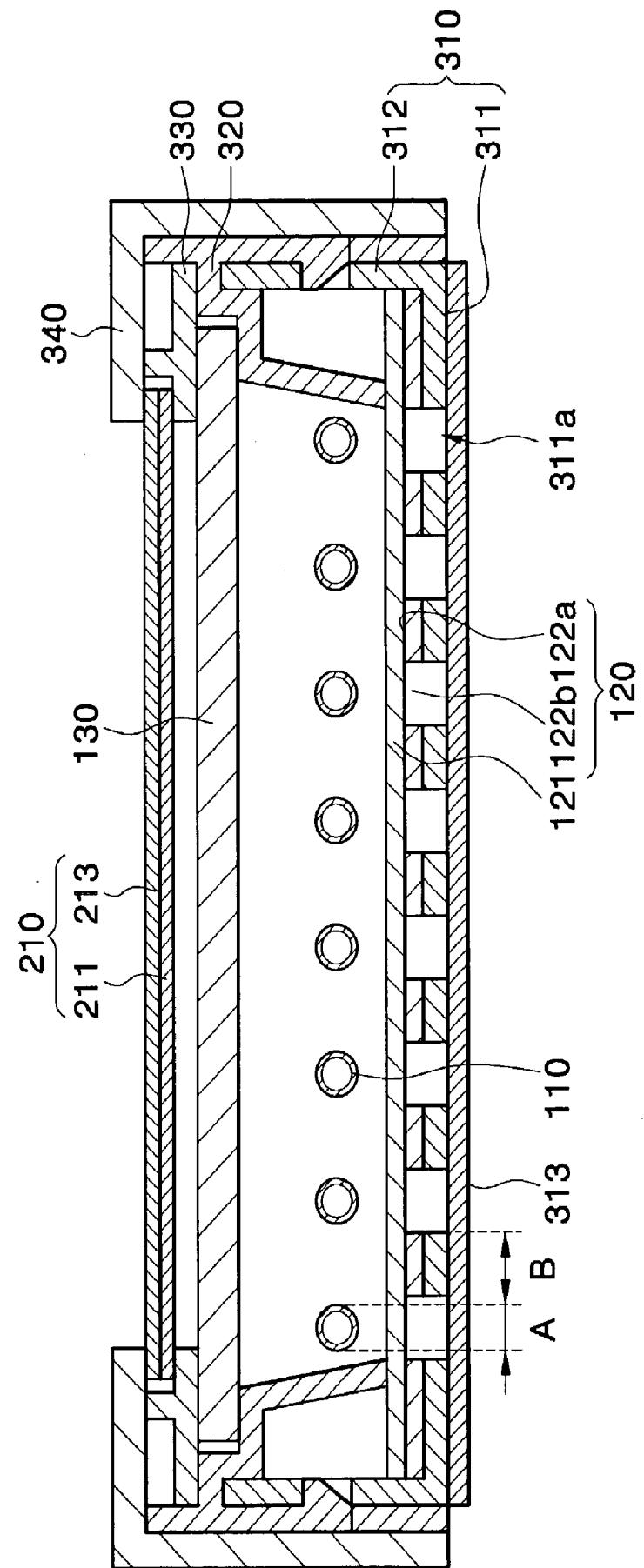
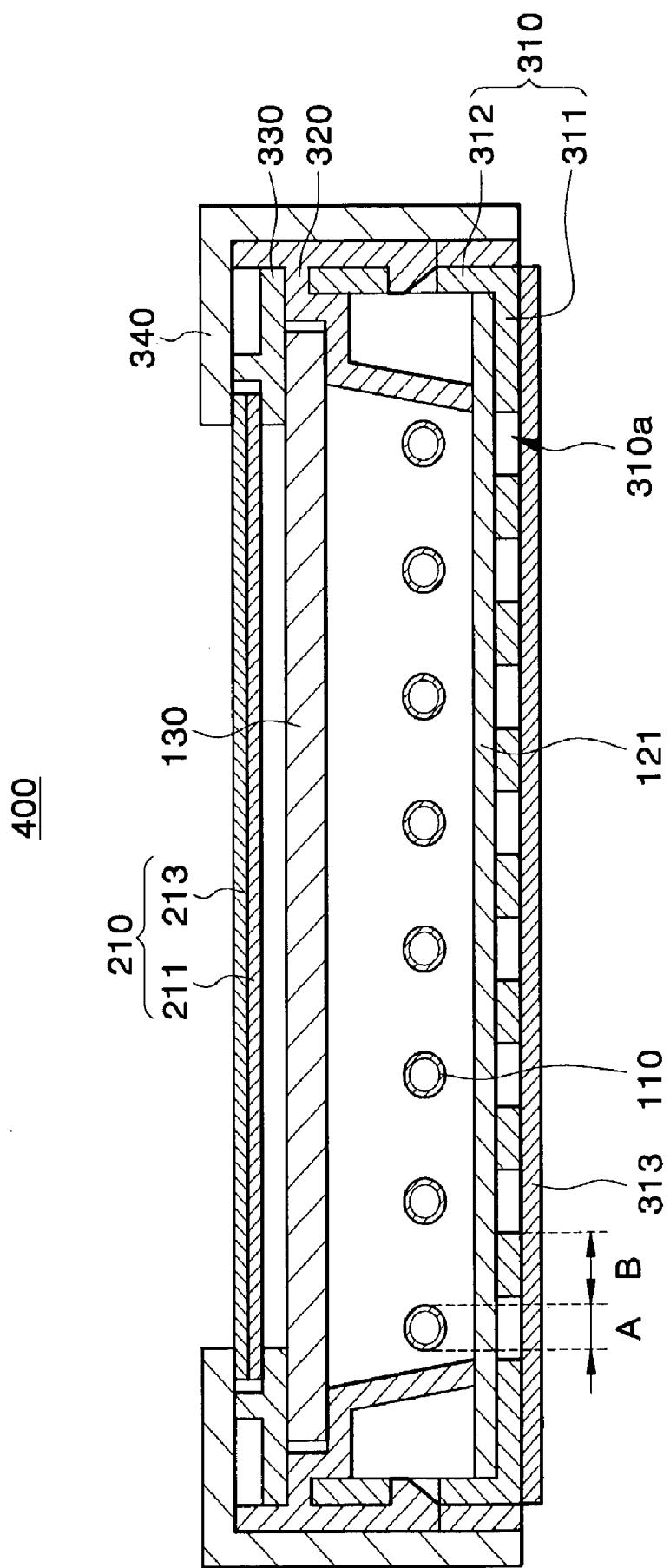


FIG. 14



LAMP ASSEMBLY AND LIQUID CRYSTAL DISPLAY DEVICE HAVING THE SAME

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The disclosure relates to a lamp assembly and a liquid crystal display device having the same, and more particularly to a lamp assembly for enhancing light efficiency as well as display quality and a liquid crystal display device having the lamp assembly.

[0003] 2. Description of the Related Art

[0004] In general, an information processing device is associated with an interfacing device, such as a display device, for displaying information processed by the information processing device so that users may view images displayed on the display device in accordance with the processed information. Recently, a liquid crystal display (LCD) device is widely used as a display device.

[0005] The LCD device displays information by using the optical property of liquid crystal molecules which varies in response to a change in their alignment. In more detail, when electric field is applied to liquid crystal disposed between two transparent substrates, an alignment of the liquid crystal molecules is transformed into other molecular alignment. As a result, the optical property, such as double refractivity, dichroism and light scattering of a liquid crystal cell, is changed, and information can be displayed on an LCD panel by using the change of the optical property of the liquid crystal molecules.

[0006] The LCD panel comprises a thin film transistor (TFT) substrate, a color filter substrate opposite to the TFT substrate, and the liquid crystal disposed between the TFT substrate and the color filter substrate. The liquid crystal cannot emit light by itself, but can control transmittance of light incident thereonto. Therefore, the LCD devices using such liquid crystal require light to display images. The light is usually supplied from a separate light source such as a backlight assembly. Consequently, display quality and power consumption of an LCD device having the liquid crystal is mainly influenced by the backlight assembly.

[0007] FIG. 1 is a cross sectional view showing a conventional backlight assembly for an LCD device.

[0008] Referring to FIG. 1, the conventional backlight assembly 30 includes at least one lamp 10 and lamp reflector 20. The lamp 10 includes a light emitting portion 11, a first electrode 12 and a second electrode 13 formed at both ends of the light emitting portion 11, respectively, and a first electrical wire 14 and a second electrical wire 15 connected to the first and second electrodes 12 and 13, respectively. A first voltage, relatively high voltage, is applied to the first electrode 12 through the first electrical wire 14. A second voltage, relatively low voltage, is applied to the second electrode 13 through the second electrical wire 15. As a result, the lamp 10 radiates light through the light emitting portion 11.

[0009] The lamp reflector 20 includes a reflecting layer 21 for reflecting a part of the light proceeding in a first direction to a second direction opposite to the first direction, and a supporting member 22 for supporting the reflecting layer 21

and the lamp 10. Therefore, the lamp reflector 20 improves light efficiency of the lamp 10.

[0010] Generally, the reflecting layer 21 is made of polyethylene terephthalate (PET), and the supporting member 22 is made of metal such as aluminum (Al).

[0011] However, when the reflecting layer 21 is contacted on an entire surface of the supporting member 22, the heat generated from the lamp 10 due to the current applied to the lamp 10, is transmitted through the reflecting layer 21 to the supporting member 22. Accordingly, luminance saturation time increases due to the heat loss. It takes longer than usual to acquire the maximum luminance of the LCD device.

[0012] In addition, a leakage current is generated due to a parasitic capacitance between the supporting member 22 and the lamp 10.

$$C = \epsilon \frac{A}{d}$$

<Expression 1>

[0013] As shown in Expression 1, the capacitance 'C' is generally proportional to an overlapped area 'A' between two conductors and a dielectric ratio 'ε' of the dielectric substance between the two conductors, and inversely proportional to a distance 'd' between the two conductors. Therefore, the parasitic capacitance 'C' is proportional to a surface area 'A' of the supporting member 22 overlapped with the lamp 10, and inversely proportional to a distance 'd' between the lamp 10 and the supporting member 22.

[0014] According to a recent LCD technology, the distance between the lamp 10 and the lamp reflector 20 has a tendency to decrease for slimness of the LCD device. The parasitic capacitance between the lamp 10 and the supporting member 22 increases since the distance 'd' between the lamp 10 and the supporting member 22 decreases. Therefore, an amount of the leakage current also increases according as the parasitic capacitance increases.

[0015] A current supplied to the first electrode 12 is referred as a first current, a current exiting from the second electrode 13 is referred as a second current, and a leakage current leaked from the lamp 10 is referred as, a third current. An amount of the first current is equal to the sum of the second current and the third current. The larger the amount of the third current is, the smaller the amount of the second current is. Use efficiency of the first current may be reduced due to existence of the third current. The leakage current reduces not only the efficiency of the lamp 10 but also overall luminance of the LCD device.

[0016] Furthermore, an increase of the leakage current causes an increase of the heat generated from the lamp 10. The heat also deteriorates the liquid crystal and various sheets adjacent to the lamp 10, which also lowers display quality of the LCD device.

SUMMARY OF THE INVENTION

[0017] The present invention provides a lamp assembly for improving display quality as well as light efficiency thereof.

[0018] The present invention also provides a liquid crystal display device having the lamp assembly.

[0019] In an aspect of the present invention, there is provided a lamp assembly comprising: at least one lamp for generating light; a reflecting layer disposed on one side of the lamp, for reflecting a part of the light; and a conductive supporting member including a supporting sheet for supporting the reflecting layer and a plurality of penetrating holes formed in the supporting sheet.

[0020] In another aspect of the present invention, there is provided a lamp assembly comprising: at least one lamp for generating light; a reflecting layer disposed on one side of the lamp, for reflecting a part of the light; and a conductive supporting member including a supporting sheet for supporting the reflecting layer and a plurality of grooves formed in the supporting sheet.

[0021] In another aspect of the present invention, there is provided a liquid crystal display device comprising: a backlight assembly including at least one lamp for generating light, a reflecting layer for reflecting a part of the light and being disposed on one side of the lamp, and a conductive supporting member having a supporting sheet for supporting the reflecting layer and a plurality of penetrating holes formed in the supporting sheet; a liquid crystal display panel for displaying images by using liquid crystal onto which the light is incident; a first container for receiving the backlight assembly and the liquid crystal display panel; and a second container oppositely coupled with the first container, for fixing the backlight assembly and the liquid crystal display panel into the first container.

[0022] In another aspect of the present invention, there is provided a liquid crystal display device comprising: a backlight assembly including at least one lamp for generating light, and a reflecting layer for reflecting a part of the light and being disposed on one side of the lamp; a liquid crystal display panel for displaying images by using liquid crystal onto which the light is incident; and a conductive receiving container for receiving the backlight assembly and the liquid crystal display panel, the conductive receiving container including a bottom surface for supporting the reflecting layer and a plurality of openings formed in the bottom surface.

[0023] The supporting member may be disposed on the rear side of at least one lamp for generating light. The supporting member may include a supporting sheet for supporting a reflecting layer and a plurality of penetrating holes formed on the supporting sheet along the longitudinal direction of the lamp so as to reduce the overlapping area between the supporting sheet and the lamp.

[0024] Accordingly, the leakage current leaked from the lamp can be decreased, the light efficiency of the backlight assembly can be improved, the heat radiated from the lamp can also be reduced, and the display quality of the LCD device can be enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The above and other objects and advantages of the present invention will become readily apparent by reference to the following detailed description when considered in conjunction with the accompanying drawings, in which:

[0026] FIG. 1 is a cross sectional view showing a conventional backlight assembly of an LCD device;

[0027] FIG. 2 is a cross sectional view showing a backlight assembly according to a first exemplary embodiment of the present invention;

[0028] FIG. 3 is a plan view showing the backlight assembly of FIG. 2;

[0029] FIG. 4 is a plan view showing a supporting member of FIG. 3;

[0030] FIG. 5 is a plan view showing the supporting member of FIG. 3 according to another exemplary embodiment of the present invention;

[0031] FIG. 6 is a cross sectional view showing a backlight assembly according to a second exemplary embodiment of the present invention;

[0032] FIG. 7 is a plan view shown the backlight assembly of FIG. 6;

[0033] FIG. 8 is a plan view showing a supporting member of FIG. 7;

[0034] FIG. 9 is a plan view showing the supporting member of FIG. 7 according to another exemplary embodiment of the present invention;

[0035] FIG. 10 is a cross sectional view showing a backlight assembly according to a third exemplary embodiment of the present invention;

[0036] FIG. 11 is a perspective view shown a supporting member of FIG. 10;

[0037] FIG. 12 is an exploded perspective view showing a liquid crystal display device according to a fourth exemplary embodiment of the present invention;

[0038] FIG. 13 is a cross sectional view showing the liquid crystal display device of FIG. 12; and

[0039] FIG. 14 is a cross sectional view showing an LCD device according to a fifth exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0040] The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred exemplary embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein.

[0041] FIG. 2 is a cross sectional view showing a backlight assembly according to a first exemplary embodiment of the present invention, and FIG. 3 is a plan view showing the backlight assembly of FIG. 2. In FIG. 3, a reflecting layer disposed between lamps 110 and a supporting member 122 is not shown for a better view of the structure.

[0042] Referring to FIG. 2 and FIG. 3, a backlight assembly 100 according to a preferred exemplary embodiment of the present invention includes at least one lamp 110 for generating light and a lamp reflector 120 for reflecting the light from the lamps 110 to a predetermined direction. The lamp reflector 120 includes a reflecting layer 121 and a supporting member 122 for supporting the reflecting layer 121.

[0043] The reflecting layer 121 reflects the light that is generated from the lamp 110 and is incident onto the reflecting layer 121 to a predetermined direction. The supporting member 122 includes a supporting sheet 122a for

supporting the reflecting layer 121 and a plurality of penetrating holes 122b for reducing an overlapping area between the supporting sheet 122a and the lamps 110. Here, the “overlapping area” indicates an area of the supporting sheet 122a above which the lamps 110 are placed. The penetrating holes 122b are formed in the supporting sheet 122a and arranged in the longitudinal direction of the lamp 110.

[0044] For example, the reflective layer 121 is made of poly ethylene terephthalate (PET), and the supporting member 122 is made of metal substance, such as aluminum (Al). Also, the supporting member 122 may be coated with the reflective layer 121 in the form of a thin film. The supporting member 122 may further include an adhesive on the supporting sheet 122a to facilitate the coating of the reflective layer 121 on the supporting sheet 122a.

[0045] The adhesive (e.g., an adhesive tape) is adhered to the surface of the supporting sheet 122a and helps the reflecting layer 121 be coated on the supporting member 122 independent of the plurality of penetrating hole 122b. The adhesive may be made of insulating material so that a parasitic capacitance may be prevented from being formed between the adhesive tape and the lamp 110.

[0046] The lamp 110 includes a light emitting portion 111, a first electrode 112 that is formed at a first end of the light emitting portion 111 and receives a first voltage, a second electrode 113 that is formed at a second end of the light emitting portion 111 opposite to the first end and receives a second voltage lower than the first voltage, a first electrical wire 114 for transmitting the first voltage to the first electrode 112, and a second electrical wire 115 for transmitting the second voltage to the second electrode 113. The first and second voltages are supplied from an inverter (not shown), which can convert a DC (direct current) power, which is supplied from an exterior power source so as to drive the lamp, into an AC (alternative current) power.

[0047] As shown in FIG. 3, the supporting member 122 is divided into a first region ‘A’ on which a plurality of the lamps 110 are disposed and a second region ‘B’ that is between the lamps 110. The plurality of penetrating holes 122b is formed on the first region ‘A’ to reduce the overlapping area of the supporting sheet 122a. For example, the plurality of penetrating holes 122b are formed in the supporting sheet 122a with a uniform density. In other words, the penetrating holes 122b may be formed uniformly in the entire area of the supporting sheet 122a.

[0048] When the entire area of the supporting sheet 122a is referred as a first area a1 when the plurality of penetrating holes 122b are not formed thereon, the entire surface area of the supporting sheet 122a is referred as a second area a2 when the plurality of penetrating holes 122b are formed thereon, and the total area of the plurality of penetrating holes 122b is referred as a third area a3, the second area a2 is equal to the difference between the first area a1 and the third area a3, which indicates that the overlapping area between the lamps 110 and the supporting sheet 122a is reduced by the third area a3.

[0049] A parasitic capacitance ‘C’ exists between the lamps 110 and the supporting member 122 between which air and the reflecting layer 121 are disposed. The parasitic capacitance ‘C’ is determined according to the above Expression 1.

[0050] The parasitic capacitance ‘C’ is proportional to a dielectric constant ‘ ϵ ’ of dielectric material between the lamps 110 and the supporting member 122, and to the surface area of the supporting sheet 122b facing the lamps 110. The parasitic capacitance ‘C’ is inversely proportional to the distance between the lamps 110 and the supporting member 122.

[0051] It is not desirable for slimness of an LCD device that the distance ‘d’ between the lamps 110 and the supporting member 122 be increased. Therefore, the parasitic capacitance ‘C’ may be decreased by reducing the overlapping area between the lamps 110 and the supporting member 122. The plurality of penetrating holes 122b formed in the supporting sheet 122a reduce the overlapping area between the lamps 110 and the supporting sheet 122a by the area of the penetrating holes 122b, so that the parasitic capacitance ‘C’ is reduced.

[0052] Accordingly, the leakage current leaked from the first and second electrodes (112, 113) of the lamp 110 is also reduced because the parasitic capacitance ‘C’ is reduced.

[0053] In the exemplary embodiment of FIG. 2, the current flowed into the first electrode 112 is referred as a first current, the current flowed out of the second electrode 113 is referred as a second current, and the leakage current leaked from the lamp 110 is referred as a third current. Then, the third current is equal to the difference between the first current and the second current. According to the present embodiment of the present invention, since the parasitic capacitance ‘C’ is reduced owing to the plurality of penetrating holes 122b, the difference between the first current and the second current decreases. As a result, the third current is reduced. Therefore, the light efficiency of the lamp 110 can be improved.

[0054] Referring to FIG. 3, the diameter r1 of a penetrating hole 122b is equal to or larger than the width r2 of a lamp 110. Thus, the overlapping area between the lamps 110 and the supporting sheet 122a is reduced. Furthermore, the overlapping area between the lamp 110 and the supporting sheet 122a is still reduced even though the center of each lamp 110 and the corresponding penetrating holes 122b are not exactly aligned, because the diameter r1 of the penetrating hole 122b is larger than the diameter r2 of the lamp 110.

[0055] In case of the penetrating holes 122b each having a circular shape as shown in FIG. 3, the diameter r1 of the penetrating hole 122b is compared with the diameter r2 of the lamp 110. In case that the penetrating hole 122b has a rectangular or square shape in another embodiment, a width of the penetrating hole is equal to or larger than the diameter r2 of the lamp 110. The width of the penetrating hole is defined as a distance between two sides facing each other of the penetrating hole having a rectangular or square shape.

[0056] Although the above exemplary embodiments discuss a backlight assembly embodied in a direct illuminating type backlight assembly for LCD devices, the backlight assembly could also be applied to other display devices and illuminating devices, such as a fluorescent lamp, known to one of the ordinary skill in the art.

[0057] FIG. 4 is a plan view showing the supporting member 122 as shown in FIG. 3, and FIG. 5 is a plan view showing the supporting member according to another exemplary embodiment of the present invention.

[0058] Referring to **FIG. 4** and **FIG. 5**, the plurality of penetrating holes (122b, 123b) each have a circular or rectangular shape. Although the above embodiments have been described as including penetrating holes having a circular or rectangular shape, other shapes, such as a polygonal shape, of the penetrating holes may be utilized in conjunction with or in place of the circular or rectangular shape of the penetrating holes. In addition, the penetrating holes each may have an elliptical shape, a trapezoid shape, or the like.

[0059] Furthermore, although a penetrating hole (122b or 123b) corresponds to only one lamp in the embodiment shown in **FIG. 3**, a penetrating hole may correspond to two or more lamps in other embodiments (not shown).

[0060] **FIG. 6** is a cross sectional view showing a back-light assembly according to a second exemplary embodiment of the present invention, and **FIG. 7** is a plan view shown the back-light assembly as shown in **FIG. 6**. In **FIG. 7**, a reflecting layer 141 (referring to **FIG. 6**) disposed between lamps 110 and a supporting member 142 is not shown for a better view of the structure.

[0061] Referring to **FIG. 6** and **FIG. 7**, a back-light assembly 130 according to second exemplary embodiment of the present invention includes at least one lamp 110 for generating light and a lamp reflector 140 for reflecting the light from the lamp 110 to a predetermined direction. The lamp reflector 140 includes a reflecting layer 141 and a supporting member 142 for supporting the reflecting layer 141.

[0062] The reflecting layer 141 reflects the light that is generated from the lamp 110 and incident onto the reflecting layer 141 in a predetermined direction. The supporting member 142 includes a supporting sheet 142a for supporting the reflecting layer 141 and a plurality of penetrating holes 142b for reducing overlapping area between the supporting sheet 142a and the lamp 110. The penetrating holes 142b are formed in the supporting sheet 142a and arranged in the longitudinal direction of the lamp 110.

[0063] The lamp 110 includes a light emitting portion 111, a first electrode 112 that is formed at a first end of the light emitting portion 111 and receives a first voltage, a second electrode 113 that is formed at a second end of the light emitting portion 111 opposite to the first end and receives a second voltage lower than the first voltage, a first electrical wire 114 for transmitting the first voltage to the first electrode 112, and a second electrical wire 115 for transmitting the second voltage to the second electrode 113.

[0064] As shown in **FIG. 7**, the supporting member 142 is divided into a first region 'A' in which the plurality of the lamps 110 are disposed, and a second region 'B' between the lamps 110. The plurality of penetrating holes 142b are formed along the first region 'A'. The penetrating holes 142b reduce the overlapping area between the supporting member 142 and the lamps 110.

[0065] In this embodiment, the plurality of penetrating holes 142b are formed in the supporting sheet 142a along the first region 'A' in such a manner that a decrease in the overlapping area between the lamps 110 and the supporting sheet 142a varies in proportion to a distance between a penetrating hole and the second electrode. In other words, a density of the penetrating holes 142b is higher at an area

close to the first electrode 112 than at an area close to the second electrode 113. Since a relatively high voltage is applied to the first electrode 112 and a relatively low voltage is applied to the second electrode 113, more amount of current is leaked from the first electrode 112 than from the second electrode 113. Thus, the plurality of penetrating holes 142b are formed in such a manner that there are more penetrating holes 142b around the first electrode 112 than around the second electrode 113. Accordingly, the parasitic capacitance 'C' around the first electrode 112 is reduced to thereby decrease the leakage current leaked from the lamps 110.

[0066] **FIG. 8** is a plan view showing the supporting member of **FIG. 7**, and **FIG. 9** is a plan view showing the supporting member according to another exemplary embodiment of the present invention.

[0067] Referring to **FIG. 8**, the plurality of penetrating holes 142b are formed at the supporting sheet 142a in the first region 'A' in such a manner that a density of the plurality of penetrating holes 142b gradually increases in proportion to a distance between a penetrating hole and the second electrode 113. In the embodiment shown in **FIG. 9**, the penetrating holes 143b are formed at the supporting sheet 143a in the first region 'A' in such a manner that the size of the plurality of penetrating holes 143b gradually increases in proportion to a distance between a penetrating hole and the second electrode 113. Therefore, a decrease in the overlapping area between the supporting sheet 143a and the lamps 110 gradually varies in proportion to a distance between a penetrating hole and the second electrode 113.

[0068] The supporting member (142 or 143) can be variously modified to reduce the overlapping area between the lamps 110 and the supporting sheet (142a or 143a).

[0069] **FIG. 10** is a cross sectional view showing a back-light assembly according to a third exemplary embodiment of the present invention, and **FIG. 11** is a perspective view showing a supporting member of **FIG. 10**.

[0070] Referring to **FIG. 10** and **FIG. 11**, a back-light assembly 150 according to a third exemplary embodiment of the present invention includes at least one lamp 110 for generating light and a lamp reflector 160 for reflecting the light from the lamp 110 in a predetermined direction. The lamp reflector 160 includes a reflecting layer 161 and a supporting member 162 for supporting the reflecting layer 161.

[0071] The reflecting layer 161 reflects the light that is generated from the lamp 110 and incident onto the reflecting layer 161 in a predetermined direction. The supporting member 162 includes a supporting sheet 162a for supporting the reflecting layer 161 and a plurality of grooves 162b that are formed in the supporting sheet 162a and arranged in the longitudinal direction of the lamp 110 so as to reduce an overlapping area between the supporting sheet 162a and the lamp 110.

[0072] The grooves 162b are formed in a region corresponding to the lamp 110 with a predetermined depth measured from the surface of the supporting sheet 162a and may be elongated in the longitudinal direction of the lamp 110. The distance between the lamp 110 and the supporting member 162 is longer in the grooved area than in the non-grooved area as much as the depth of the groove.

[0073] For example, the interval between the lamp **110** and the bottom of the groove **162b** is referred as a first distance **d1**, and the interval between the lamp **110** and the surface of the non-grooved area of the supporting sheet **162a** is referred as a second distance **d2**, and the second distance **d2** is smaller than the first distance **d1** by the depth of the groove **162b**.

[0074] According to the above Expression 1, the parasitic capacitance 'C' is inversely proportional to a distance between the lamp **110** and the supporting sheet **162a**. The distance between the lamp **110** and the supporting sheet **162a** increases as much as the depth of the groove **162** so that the parasitic capacitance 'C' is reduced and the leakage current leaked from the lamp **110** decreases.

[0075] FIG. 12 is an exploded perspective view showing a liquid crystal display device according to a fourth exemplary embodiment of the present invention, and FIG. 13 is cross sectional view showing the liquid crystal display device of FIG. 12.

[0076] Referring to FIG. 12 and FIG. 13, the LCD device **400** according to a fourth exemplary embodiment of the present invention includes a display unit **200** for displaying images, a backlight assembly **100** for providing light to the display unit **200**, and containers **310**, **320**, **330**, and **340** for receiving the display unit **200** and the backlight assembly **100**.

[0077] The display unit **200** includes an LCD panel **210** for displaying images by using the liquid crystal, a plurality of printed circuit boards (PCBs) for driving the LCD panel **210**, and a plurality of tape carrier packages (TCPs) for connecting the LCD panel **210** and the PCBs.

[0078] In detail, the LCD panel **210** includes a thin film transistor (TFT) substrate **211**, a color filter substrate **213**, and a liquid crystal layer (not shown) formed between the TFT substrate **211** and the color filter substrate **213**. The TFT substrate **211** includes many pixels formed in a matrix shape including TFTs, gate lines and data lines connected to the TFTs, and pixel electrodes connected to the TFTs. The color filter substrate **213** includes color filters and a common electrode facing the TFT substrate **211**.

[0079] The LCD panel **210** is connected with the PCBs **(220, 230)** for driving the TFT substrate **211** and the color filter substrate **213**. The PCBs includes a data PCB **220** for generating image signals supplied to the data lines and a gate PCB **230** for generating driving signals supplied to the gate lines.

[0080] The data PCB **220** is connected with a data TCP **240** adhered to a data peripheral portion of the TFT substrate **211** on which one ends of the data lines are arranged, and the gate PCB **230** is connected with a gate TCP **250** adhered to a gate peripheral portion of the TFT substrate **211** on which one ends of the gate lines are arranged.

[0081] The backlight assembly **100** includes at least one lamp **110** for generating light, a lamp reflector **120** for reflecting the light to the LCD panel **210**, and a diffusing sheet **130** for diffusing the light before the light reaches the LCD panel **210**.

[0082] The lamp **110** includes a light emitting portion **111**, a first electrode **112** that is formed at a first end of the light emitting portion **111** and receives a first voltage, a second

electrode **113** that is formed at a second end of the light emitting portion **111** opposite to the first end and receives a second voltage lower than the first voltage.

[0083] The lamp reflector **120** includes a reflecting layer **121** that reflects a part of the light traveling in a first direction and allows the light to travel in a second direction opposite to the first direction, and a supporting member **122** for supporting the reflecting layer **121**. The supporting member **122** includes a supporting sheet **122a** for supporting the reflecting layer **121** and a plurality of penetrating holes **122b** for reducing an overlapping area between the supporting sheet **122a** and the lamps **110**. The supporting sheet **122a** is divided into a first region 'A' in which a plurality of lamps are arranged and a second region 'B' between the lamps **110**. The plurality of penetrating holes **122b** are formed in the first region A.

[0084] The plurality of penetrating holes **122b** are formed in the supporting sheet **122a** and arranged in the longitudinal direction of the lamps **110** with a uniform density such that an overlapping area between the supporting sheet **122a** and each of the lamps **110** is reduced. As a result, the parasitic capacitance 'C' is reduced and the leakage current leaked from the lamps **110** decreases.

[0085] The plurality of penetrating holes **122b** can also be formed in such a manner that a decrease in the overlapping area between the lamps **110** and the supporting sheet **122a** gradually varies in inverse proportion to a distance between a penetrating hole and the first electrode **112**. In other words, the plurality of penetrating holes **122b** may be formed in such a manner that there are more penetrating holes around the second electrode **113** than around the first electrode **112**.

[0086] The receiving container includes a bottom chassis **310**, a low mold frame **320**, an upper mold frame **330** and a top chassis **340**. The bottom chassis **310** sequentially receives the backlight assembly **100** and the display unit **200**. The upper mold frame **330** is disposed on an upper stepped portion of the low mold frame **320**, receives the display unit **200** and fixes the backlight assembly **100** to the bottom chassis **310**. The top chassis **340** is coupled with the bottom chassis **310** to be opposite to the bottom chassis **310** and presses the display unit **200** toward the upper mold frame **330**.

[0087] The bottom chassis **310** includes a bottom surface **311** and sidewalls **312** vertically extended from the bottom surface **311** so that a receiving space for receiving the backlight assembly **100** is formed therein. A plurality of openings **311a** are formed at the bottom surface **311** corresponding to the plurality of penetrating holes **122b** formed on the supporting member **120**. In case that the bottom chassis **310** is made of metal-based material, the parasitic capacitance 'C' is generated between the bottom chassis **310** and the lamp **110**. In this case, the plurality of openings **311a** formed at the bottom surface **311** reduce the overlapping area between the lamps **110** and the bottom surface **311** so that the parasitic capacitance 'C' between the lamps **110** and the bottom chassis **310** is reduced.

[0088] For example, the plurality of openings **311a** are formed in such a manner that a decrease in the overlapping area between the bottom surface **311** and the lamps **100** gradually varies in inverse proportion to a distance between an opening and the first electrode **112** like the structure of the plurality of penetrating holes **122b**.

[0089] The above described structure of the plurality of openings **311a** and the plurality of penetrating holes **122a** provides a space for receiving additional parts of the LCD device between the bottom chassis **310** and the lamp reflector **120**. Namely, since the areal size of the plurality of openings **311a** and the plurality of penetrating holes **122a** is decreased around the second electrode **113**, the space between the bottom chassis **310** and the lamp reflector **120** is increased, so that additional parts such as circuit boards for driving the lamps **110** and the LCD panel **210** can be received in the enlarged space.

[0090] When the lamp reflector **120** is received on the bottom surface **311**, the lamps **110** are disposed above the reflective layer **121**, and the diffusing sheet **130** is mounted above the lamps **110**. The upper mold frame **330** is disposed on the diffusing sheet **130**, and the LCD panel **210** is received on a stepped portion of the upper mold frame **330**. Then, the top chassis **340** is coupled with the bottom chassis **310**.

[0091] In the embodiment of FIG. 13, a foreign-matter protecting layer **313** for preventing entrance of a foreign matter into the LCD device is further formed under the bottom surface **311**. Thus, no foreign matter may be entered into the LCD device through the plurality of openings **311a**. The foreign-matter protecting layer **313** may be made of, for example, insulating material so as to prevent the parasitic capacitance 'C' between the lamps **110** and the foreign-matter protecting layer **313** from being generated.

[0092] Accordingly, the leakage current leaked from the lamps **110** is decreased, the light efficiency of the backlight assembly **100** is improved, the heat radiated from the lamps **110** is also reduced, and the display quality of the LCD device **400** is enhanced.

[0093] FIG. 14 is a cross sectional view showing an LCD device according to a fifth exemplary embodiment of the present invention.

[0094] Referring to FIG. 14, the LCD device **400** according to a fifth exemplary embodiment of the present invention includes a display unit **200** for displaying images, a backlight assembly **100** for providing light to the display unit **200**, and a plurality of containers **310**, **320**, **330**, and **340** for receiving the display unit **200** and the backlight assembly **100**.

[0095] The backlight assembly **100** includes at least one lamp **110** for generating light, a lamp reflector for reflecting the light to an LCD panel **210** of the display unit **200**, and a diffusing sheet **130** for diffusing the light before the light reaches an LCD panel **210**. The lamp reflector includes a reflecting layer **121** that reflects a part of the light traveling in a first direction and allows the light to travel in a second direction opposite to the first direction.

[0096] The receiving container includes a bottom chassis **310**, a low mold frame **320**, an upper mold frame **330** and a top chassis **340**. The bottom chassis **310** sequentially receives the backlight assembly **100** and the LCD panel **210**. The upper mold frame **330** is disposed on an upper stepped portion of the low mold frame **320**, receives the LCD panel and fixes the backlight assembly **100** to the bottom chassis **310**. The top chassis **340** is oppositely coupled with the bottom chassis **310** and presses the LCD panel **210** toward the upper mold frame **330**.

[0097] The bottom chassis **310** includes a bottom surface **311** and sidewalls **312** vertically extended from the bottom surface **311** so that a receiving space for receiving the backlight assembly **100** is formed therein. A plurality of openings **310a** are formed at the bottom surface **311**. Specifically, the bottom surface **311** is divided into a first region 'A' in which the lamps **110** are arranged and a second region 'B' disposed between the lamps **110**. The plurality of openings **310a** are formed in the first region 'A'. The plurality of openings **310a** reduce the overlapping area between the bottom chassis **310** and the lamps **110** so that the parasitic capacitance 'C' existing between the bottom chassis **310** and the lamps **110** is reduced.

[0098] In this embodiment, a foreign-matter protecting layer **313** is formed under the bottom surface **311** of the bottom chassis **310** to prevent entrance of a foreign matter into the LCD device **400** through the openings **310a**, and to easily coat the reflecting layer. For example, the foreign-matter protecting layer **313** may be made of an insulating tape for preventing the parasitic capacitance 'C' between the foreign-matter protecting layer **313** and the lamp **110** from being generated.

[0099] According to the lamp assembly and LCD device of the exemplary embodiments of the present invention, a supporting member is disposed under at least one lamp generating light. The supporting member includes a supporting sheet for supporting a reflecting layer and a plurality of penetrating holes formed at the supporting sheet along the longitudinal direction of the lamp so as to reduce the overlapping area between the supporting sheet and the lamps.

[0100] Accordingly, the leakage current leaked from the lamps is decreased, the light efficiency of the backlight assembly is improved, the heat radiated from the lamp is reduced, and the display quality of the LCD device is enhanced.

[0101] Although the exemplary embodiments of the present invention have been described, it is understood that the present invention should not be limited to these embodiments but various changes and modifications can be made by one skilled in the art within the spirit and scope of the present invention as hereinafter claimed.

What is claimed is:

1. A lamp assembly comprising:
at least one lamp for generating light;
a reflecting layer for reflecting light from the lamp; and
a conductive supporting member including a supporting sheet for supporting the reflecting layer and a plurality of penetrating holes formed in the supporting sheet.
2. The lamp assembly of claim 1, wherein the penetrating holes are formed at area corresponding to the lamp and arranged in a longitudinal direction of the lamp.
3. The lamp assembly of claim 1, wherein the penetrating holes each have a circular or polygonal shape.
4. The lamp assembly of claim 1, wherein a width of each of the penetrating holes is equal to or greater than a width of the lamp.
5. The lamp assembly of claim 1, wherein the penetrating holes are formed in the supporting sheet with a uniform

density to reduce an overlapping area of the supporting sheet above which the lamp is placed.

6. The lamp assembly of claim 1, wherein the lamp includes a first electrode and a second electrode, the first electrode receives a first voltage and is disposed at a first end of the lamp, the second electrode receives a second voltage lower than the first voltage and is disposed at a second end of the lamp opposite to the first end, and a decrease in an overlapping area of the supporting sheet above which the lamp is placed varies in proportion to a distance between a penetrating hole and the second electrode.

7. The lamp assembly of claim 6, wherein a density of the penetrating holes at an area of the supporting sheet increases in proportion to a distance between the area and the second electrode.

8. The lamp assembly of claim 6, wherein a size of the penetrating holes at an area of the supporting sheet increases in proportion to a distance between the area and the second electrode.

9. The lamp assembly of claim 1, wherein the reflecting layer is comprised of poly ethylene terephthalate (PET), and the conductive supporting member is comprised of metal.

10. A lamp assembly comprising:

at least one lamp for generating light;

a reflecting layer for reflecting light from the lamp; and

a conductive supporting member including a supporting sheet for supporting the reflecting layer and a plurality of grooves formed in the supporting sheet.

11. The lamp assembly of claim 10, wherein the grooves are formed at an area corresponding to the lamp and each have a predetermined depth, the grooves being arranged in a longitudinal direction of the lamp.

12. A liquid crystal display device comprising:

a backlight assembly including:

at least one lamp for generating light;

a reflecting layer for reflecting light from the lamp; and

a conductive supporting member having a supporting sheet for supporting the reflecting layer and a plurality of penetrating holes formed in the supporting sheet;

a liquid crystal display panel for displaying images by using liquid crystal onto which the light is incident;

a first container for receiving the backlight assembly and the liquid crystal display panel; and

a second container coupled with the first container, for fixing the backlight assembly and the liquid crystal display panel into the first container.

13. The liquid crystal display device of claim 12, wherein the lamp includes a first electrode and a second electrode, the first electrode receives a first voltage and is disposed at a first end of the lamp, the second electrode receives a second voltage lower than the first voltage and is disposed at a second end of the lamp opposite to the first end, and a decrease in an overlapping area of the supporting sheet above which the lamp is placed varies in proportion to a distance between a penetrating hole and the second electrode.

14. The liquid crystal display device of claim 13, wherein a density of the plurality of penetrating holes at an area of the supporting sheet increases in proportion to a distance between the area and the second electrode.

15. The liquid crystal display device of claim 12, wherein a plurality of openings corresponding to the plurality of penetrating holes are formed in a bottom surface of the first container.

16. The liquid crystal display device of claim 15, wherein the first container further includes a foreign-matter protecting layer for preventing entrance of a foreign matter into the first container through the plurality of penetrating holes and the plurality of openings.

17. The liquid crystal display device of claim 16, wherein the foreign-matter protecting layer is disposed under the bottom surface of the first container.

18. A liquid crystal display device comprising:

a backlight assembly including:

at least one lamp for generating light; and

a reflecting layer for reflecting light from the lamp;

a liquid crystal display panel for displaying images by using liquid crystal onto which the light is incident; and

a conductive receiving container for receiving the backlight assembly and the liquid crystal display panel, the conductive receiving container including a bottom surface for supporting the reflecting layer and a plurality of openings formed in the bottom surface.

19. The liquid crystal display device of claim 18, wherein the conductive receiving container further includes a foreign-matter protecting layer for preventing entrance of a foreign matter into the conductive receiving container through the plurality of openings.

20. The liquid crystal display device of claim 18, wherein a density of the plurality of openings is higher at a first area than at a second area of the bottom surface, the first and second areas being close to first and second electrodes, respectively, of the lamp in which a voltage applied to the first electrode is higher than a voltage applied to the second electrode.

* * * * *

| | | | |
|----------------|--|---------|------------|
| 专利名称(译) | 灯组件和具有该灯组件的液晶显示装置 | | |
| 公开(公告)号 | US20040080925A1 | 公开(公告)日 | 2004-04-29 |
| 申请号 | US10/456909 | 申请日 | 2003-06-05 |
| [标]申请(专利权)人(译) | MOON SEUNG HWAN | | |
| 申请(专利权)人(译) | MOON SEUNG-HWAN | | |
| 当前申请(专利权)人(译) | 三星DISPLAY CO. , LTD. | | |
| [标]发明人 | MOON SEUNG HWAN | | |
| 发明人 | MOON, SEUNG-HWAN | | |
| IPC分类号 | G02F1/1333 F21S2/00 F21Y103/00 G02F1/13 G02F1/13357 G01D11/28 | | |
| CPC分类号 | G02F1/133308 G02F1/133604 G02F2201/36 G02F2001/133314 G02F1/133605 | | |
| 优先权 | 1020020065550 2002-10-25 KR | | |
| 其他公开文献 | US7044629 | | |
| 外部链接 | Espacenet USPTO | | |

摘要(译)

灯组件包括至少一个用于产生光的灯，反射层和导电支撑构件。反射层将沿第一方向行进的光的一部分朝向与第一方向相反的第二方向反射。导电支撑构件包括用于支撑反射层的支撑片和形成在支撑片中的多个穿透孔。穿透孔减少了灯和支撑板之间的重叠区域。反射层和导电支撑构件设置在灯的后侧。

