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Shin et al.(10) **Pub. No.: US 2010/0110337 A1**(43) **Pub. Date: May 6, 2010**(54) **BACKLIGHT ASSEMBLY AND LIQUID
CRYSTAL DISPLAY HAVING THE SAME**(76) Inventors: **Taek-Sun Shin**, Asan-si (KR);
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WOODBURY, NY 11797 (US)(21) Appl. No.: **12/612,429**(22) Filed: **Nov. 4, 2009**(30) **Foreign Application Priority Data**

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G09F 13/04 (2006.01)
(52) **U.S. Cl.** **349/64; 362/97.4**(57) **ABSTRACT**

A backlight assembly including direct-type lamps and an edge-type lamp and a liquid crystal display having the backlight assembly. The direct-type lamps are arranged with a predetermined interval to emit light, and the edge-type lamp is provided at a side portion of a light guide plate provided above or below the direct-type lamps. The light guide plate and a light guide pattern output light, which is emitted from the edge-type lamp, through a space between two adjacent direct-type lamps. The backlight assembly supplies light to the light receiving region such that brightness is uniformly distributed throughout the light receiving region regardless of the position of the direct-type lamps.

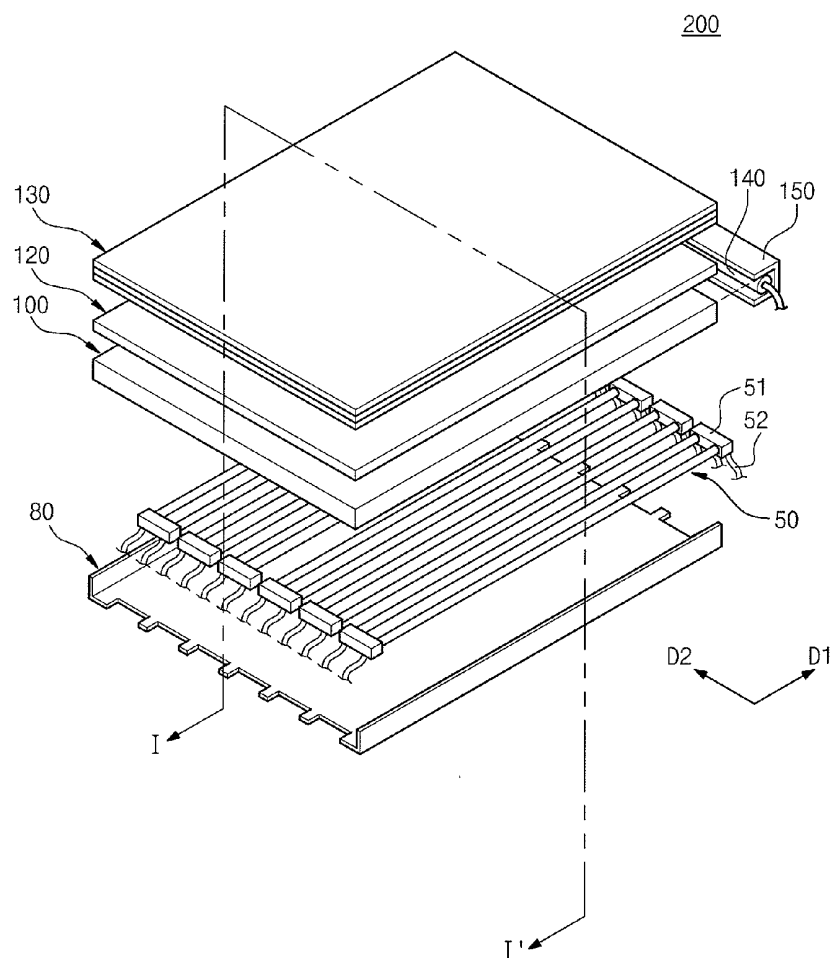
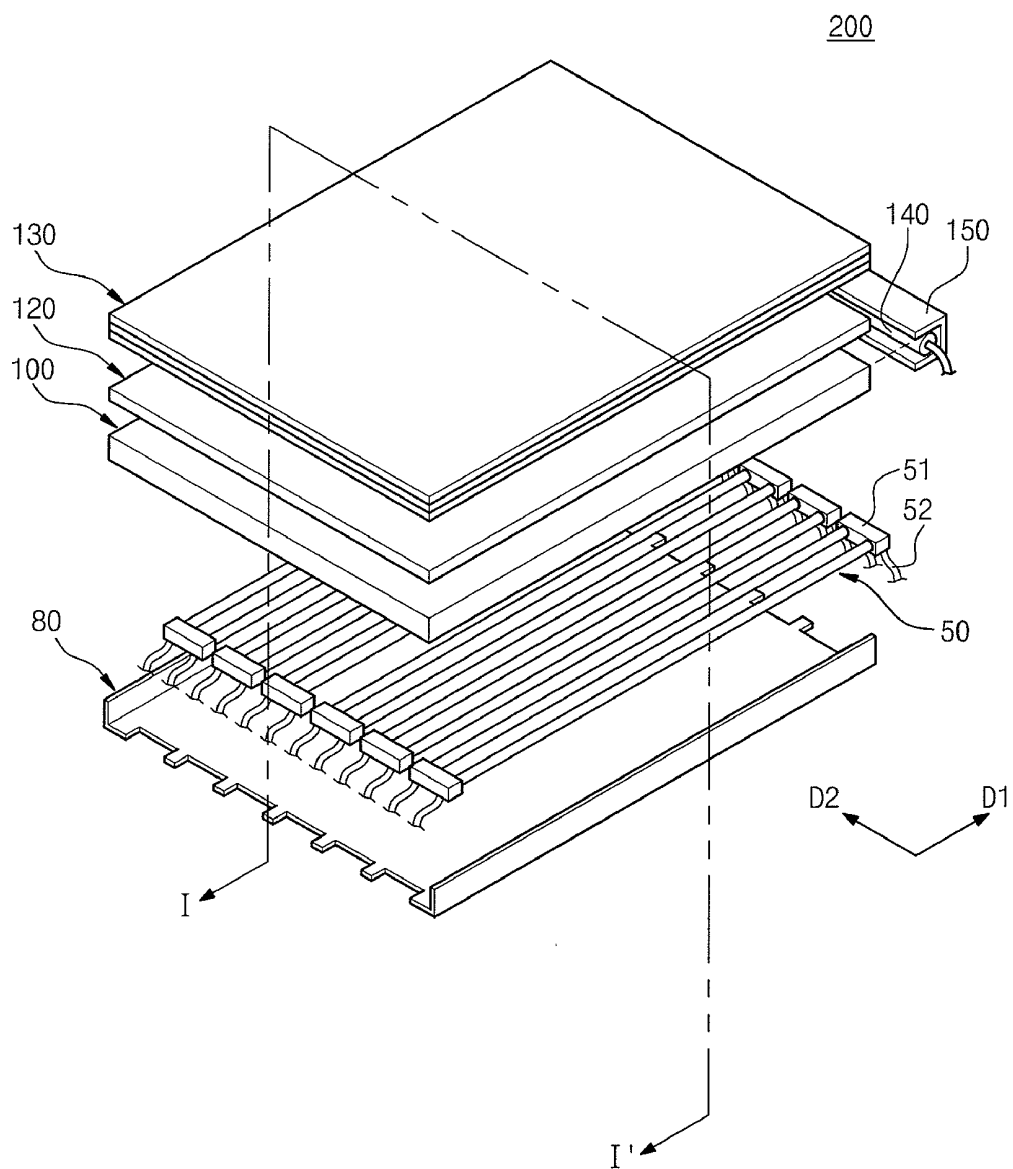


Fig. 1



Fi.^o
2

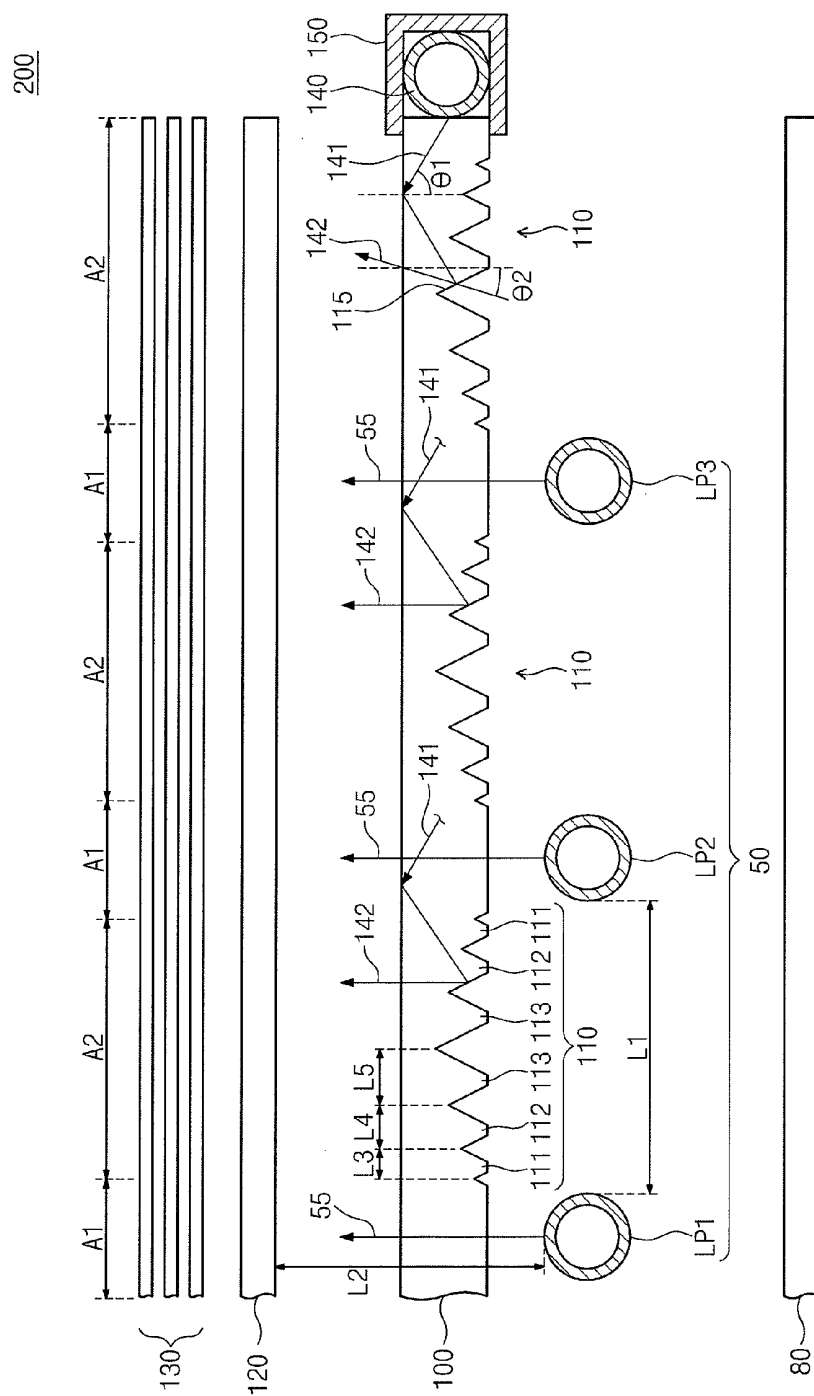


Fig. 3A

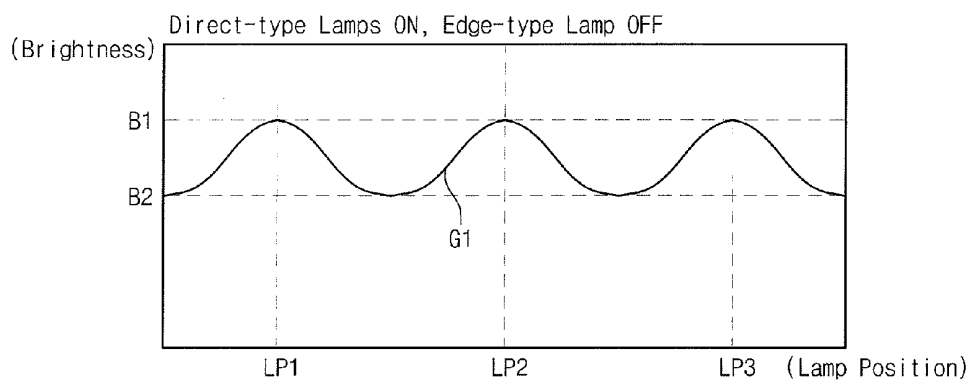


Fig. 3B

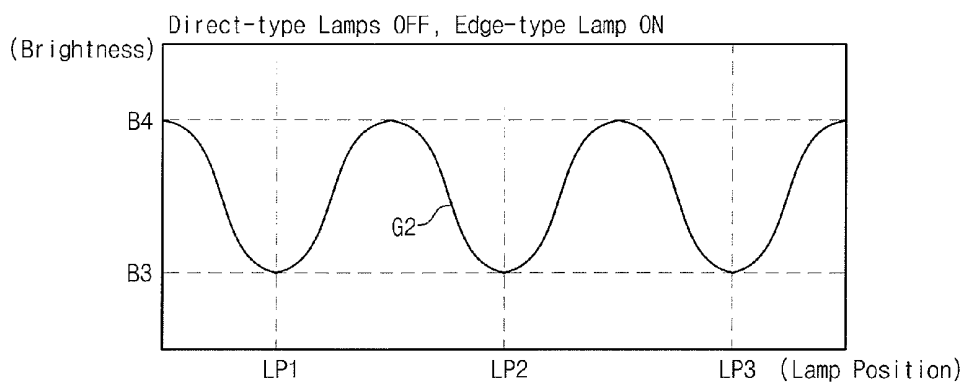


Fig. 3C

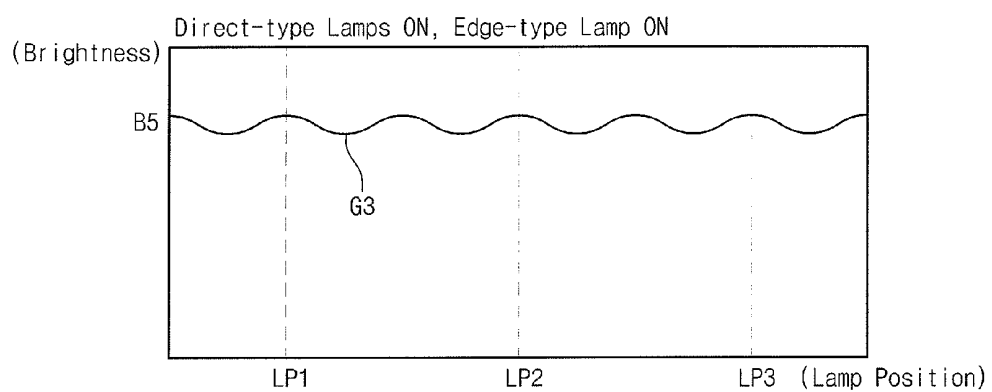


Fig. 4

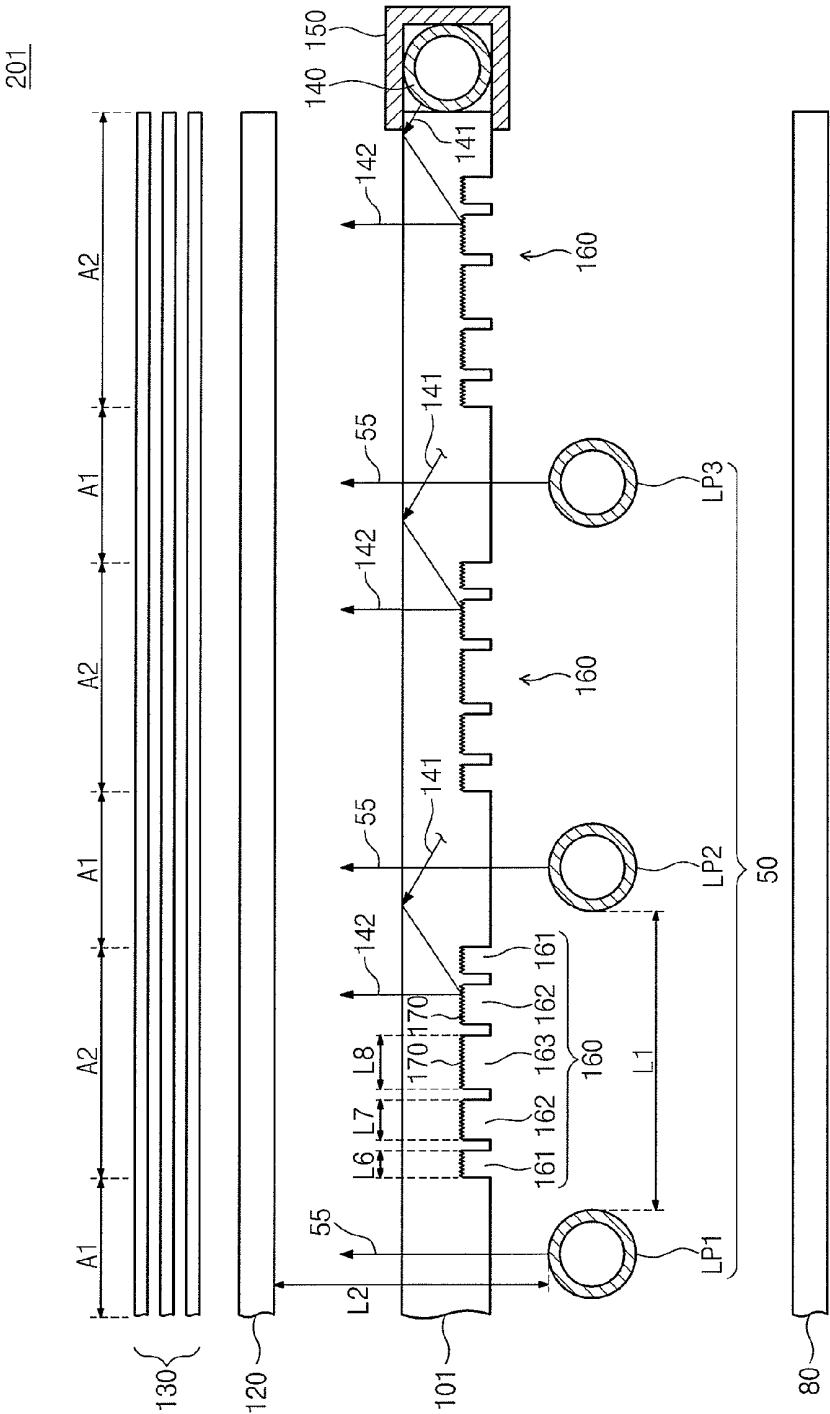


Fig. 5

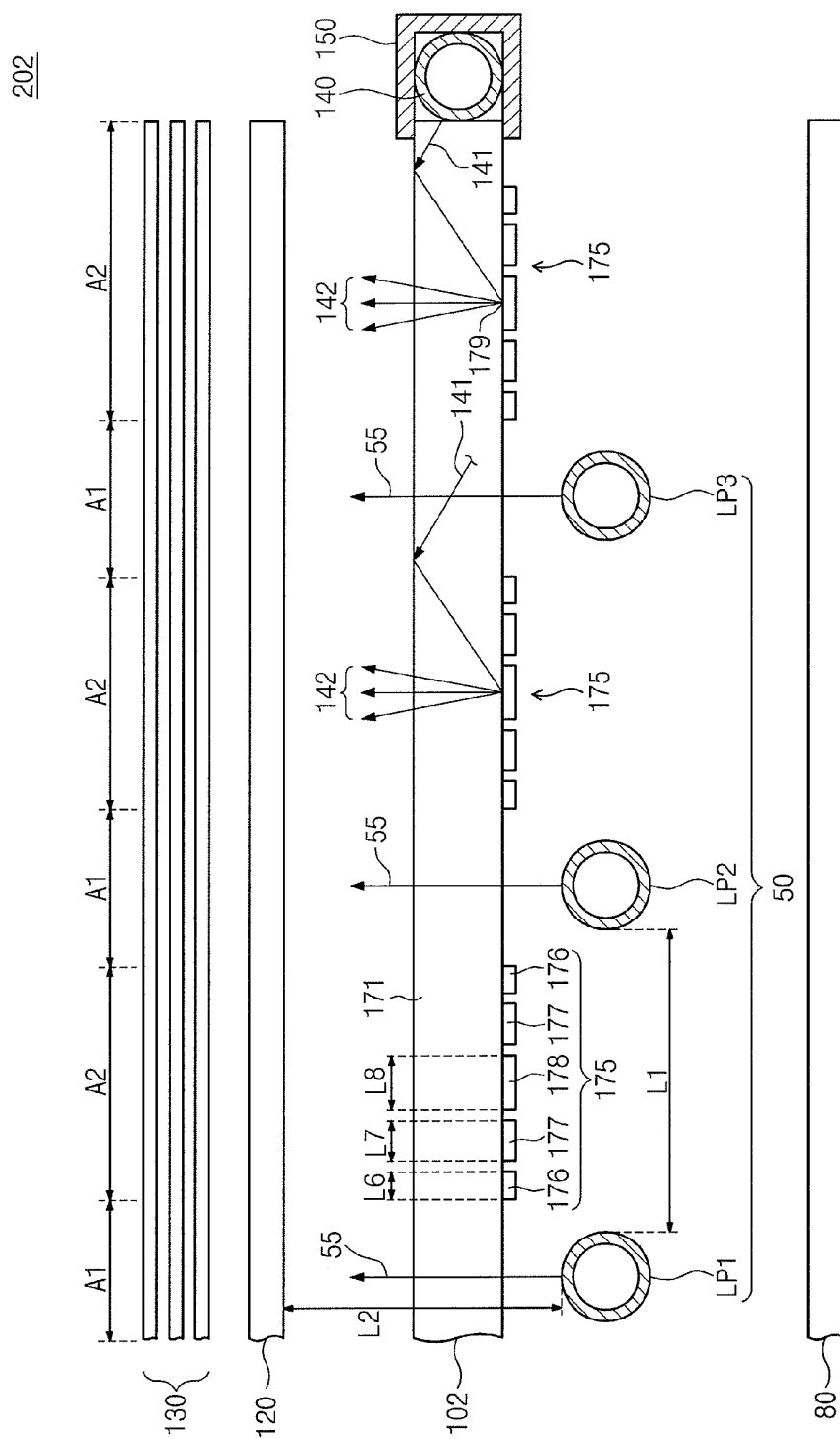


Fig. 6

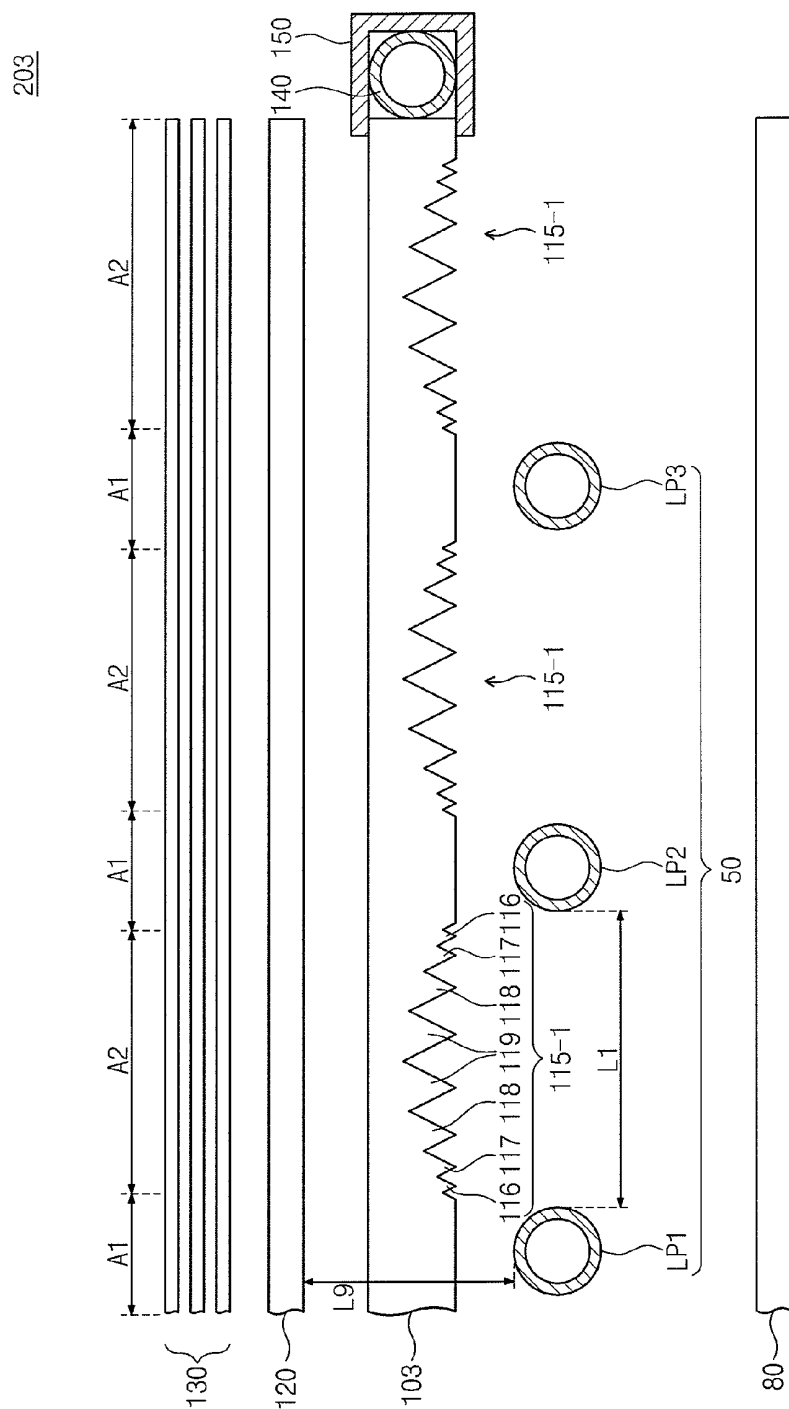


Fig. 7

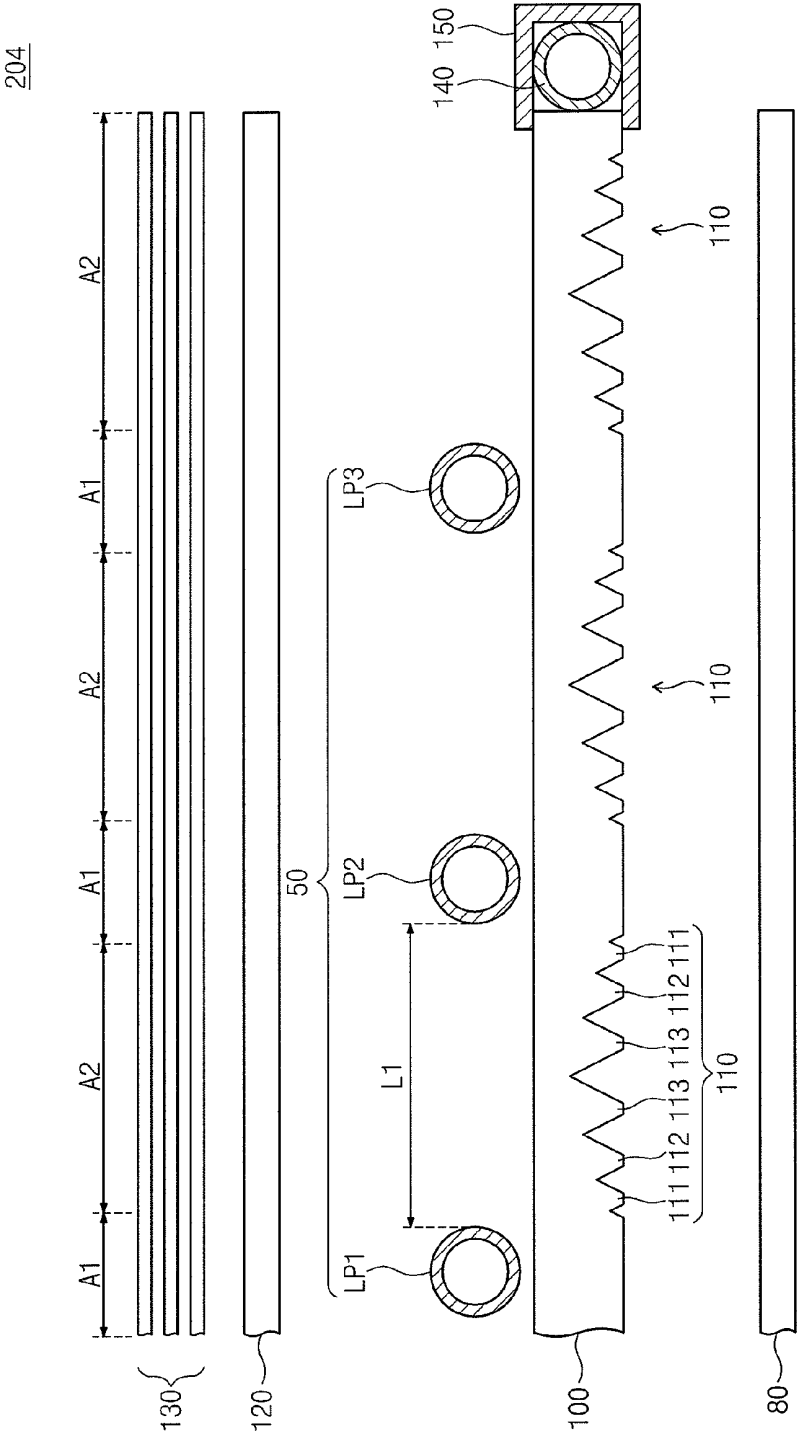


Fig. 8

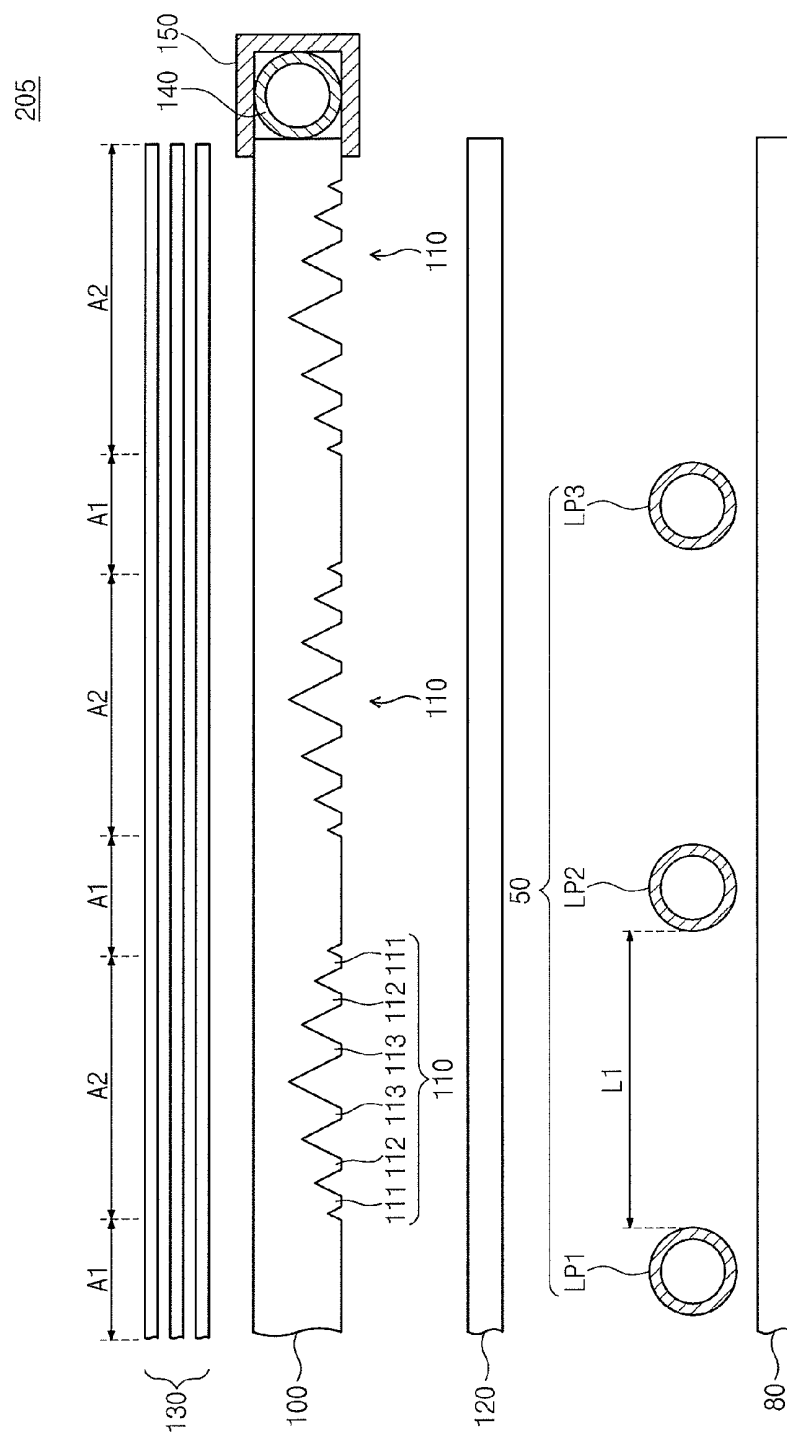


Fig. 9

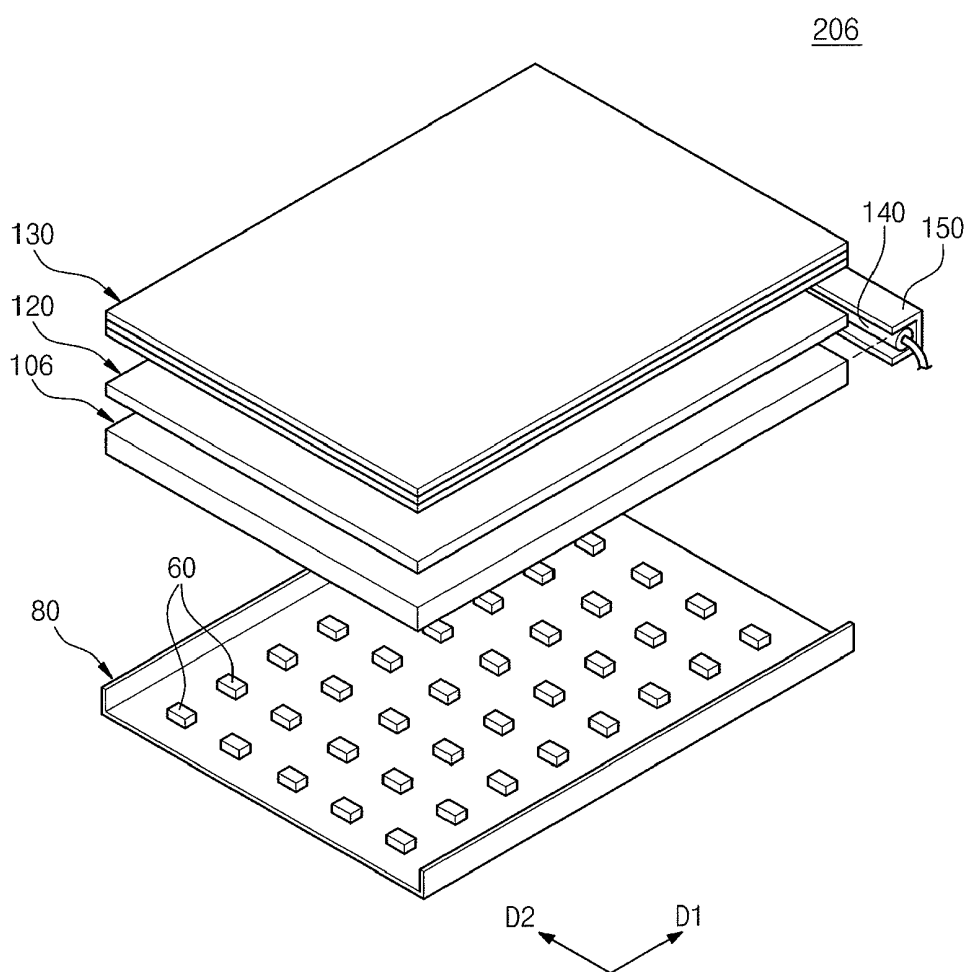


Fig. 11

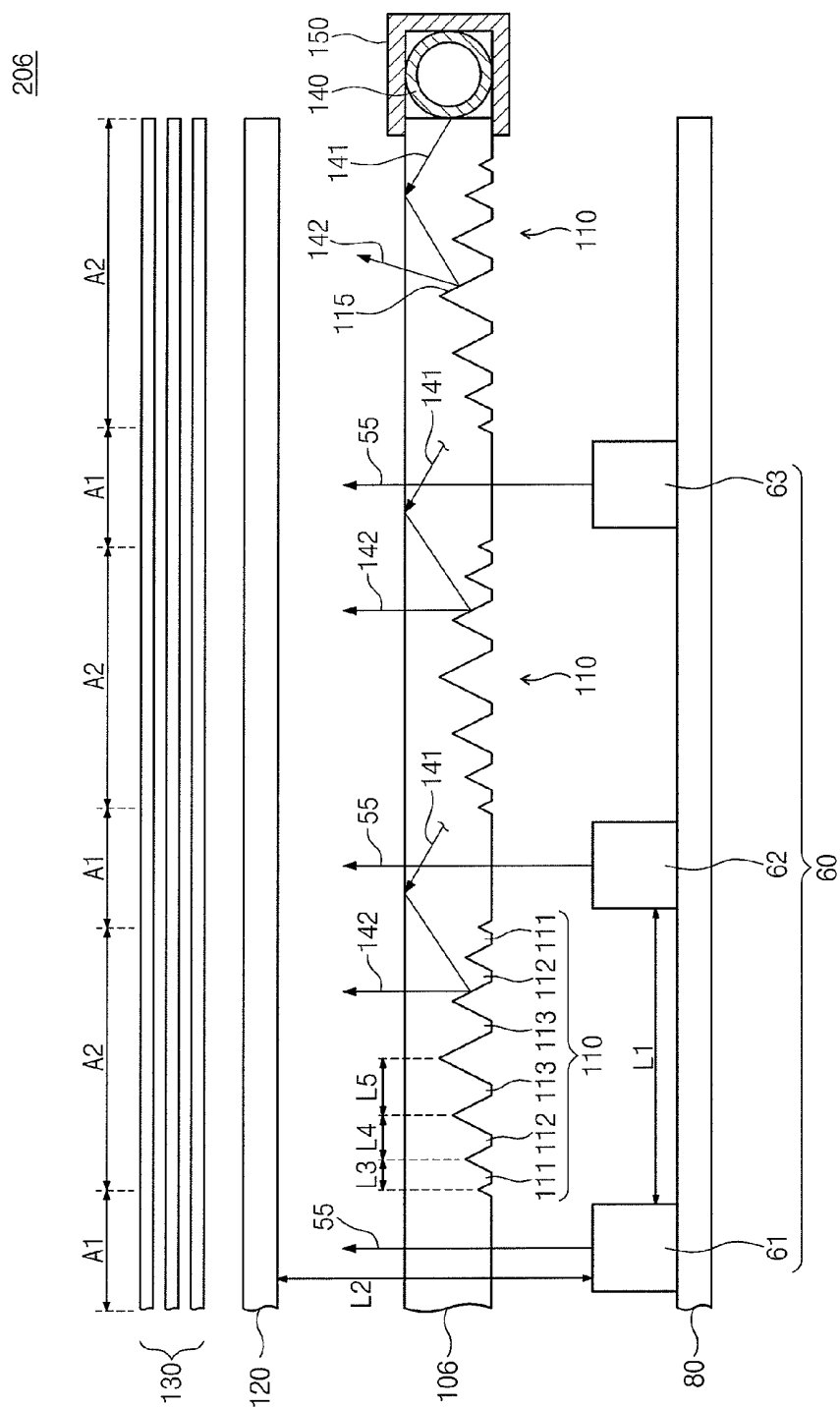


Fig. 13

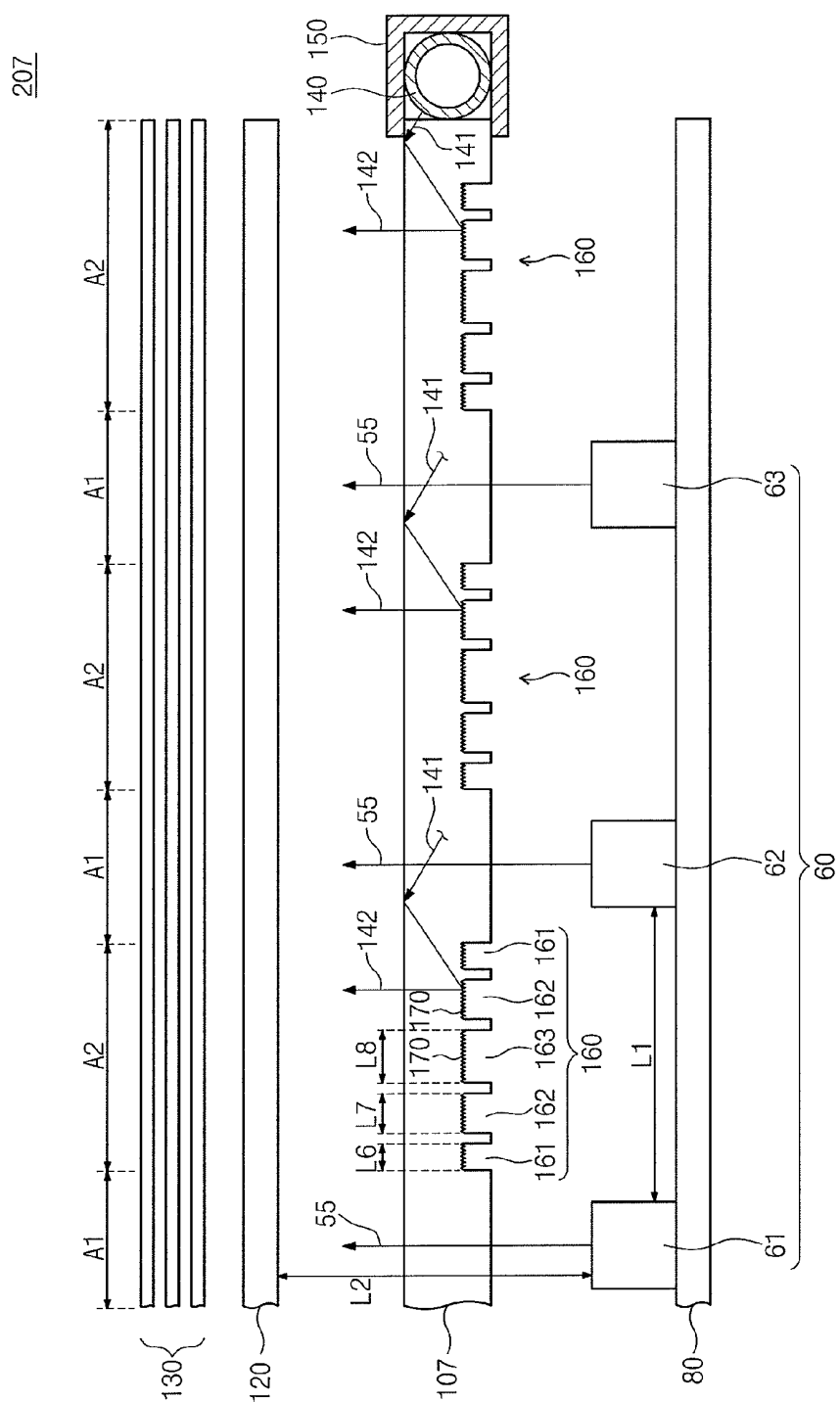
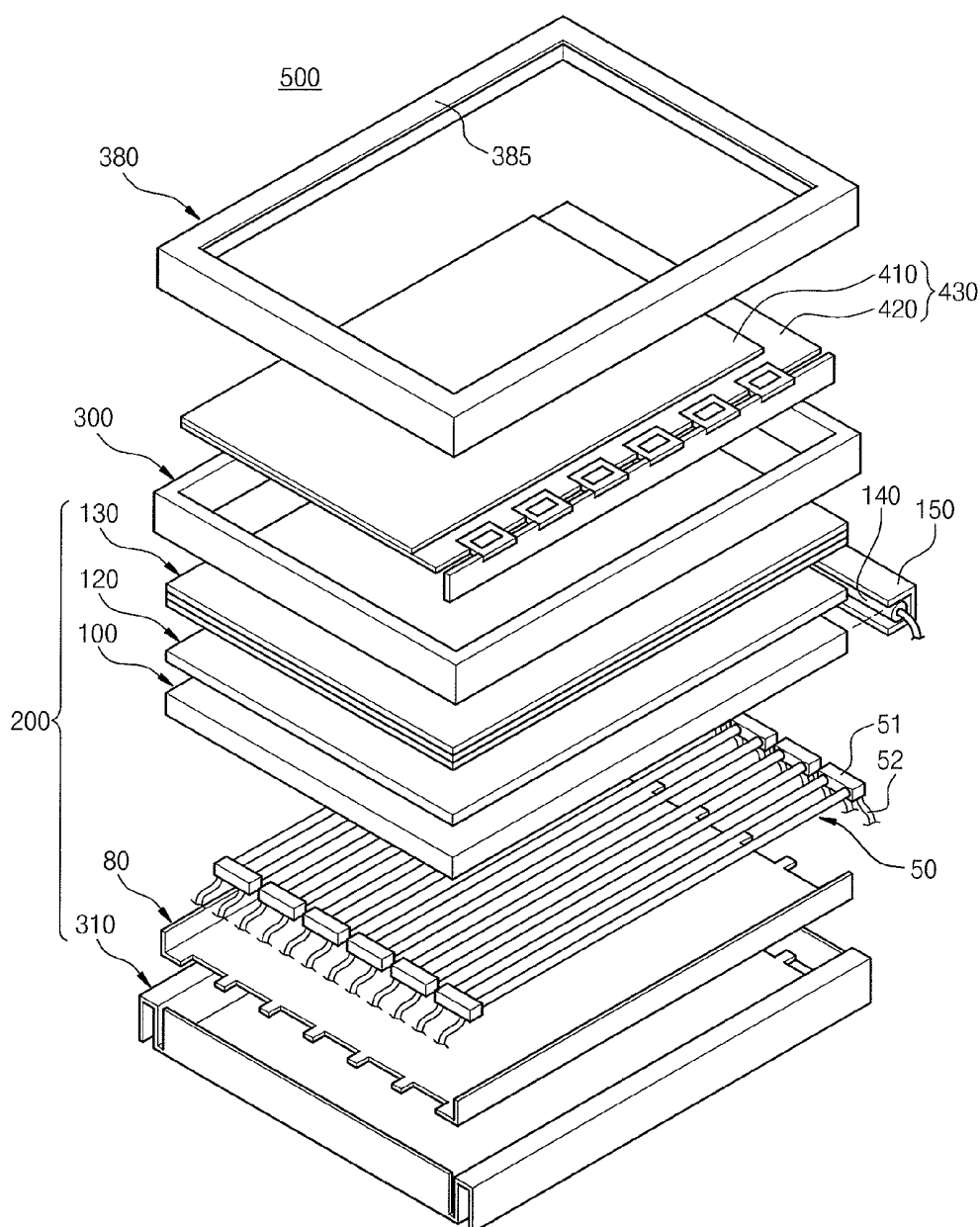


Fig. 14



BACKLIGHT ASSEMBLY AND LIQUID CRYSTAL DISPLAY HAVING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application relies for priority upon Korean Patent Application No. 2008-109492 filed on Nov. 5, 2008, the contents of which are herein incorporated by reference in their entirety.

BACKGROUND

[0002] 1. Technical Field

[0003] The present invention relates to a backlight assembly and, more particularly, to a backlight assembly capable of supplying light to a light receiving region such that brightness is uniformly distributed throughout the whole light receiving region and a liquid crystal display having the backlight assembly.

[0004] 2. Discussion of the Related Art

[0005] Liquid crystal displays, which are kinds of flat-panel displays, include a liquid crystal panel and a backlight assembly supplying light to the liquid crystal panel. The backlight assembly may be classified into a direct-type backlight assembly and an edge-type backlight assembly according to the position of a lamp and schemes to collect light from the lamp. The direct-type backlight assembly has been employed for a large-size liquid crystal display such as a TV, and the edge-type backlight assembly has been employed for a small-size liquid crystal display such as a mobile device and a note-book computer.

[0006] When the liquid crystal display is equipped with the direct-type backlight assembly and the liquid crystal display panel, the direct-type backlight assembly includes a plurality of lamps and a diffusion plate interposed between the lamps and the liquid crystal panel. The diffusion plate diffuses light emitted from the lamps, so that the liquid crystal display panel can uniformly receive light throughout the whole display region.

[0007] In order to reduce the volume of the liquid crystal display, reducing the volume of the backlight assembly has been suggested. For example, shortening a distance between the lamps and the diffusion plate has been suggested to reduce the thickness of the liquid crystal display. However, as the distance between the lamps and the diffusion plate is reduced, light emitted from the lamps is not sufficiently diffused by the diffusion plate. Accordingly, the brightness of light supplied to the liquid crystal panel through the diffusion plate varies depending on regions.

SUMMARY

[0008] Exemplary embodiments of the present invention provide a backlight assembly capable of supplying light to a light receiving region such that brightness is uniformly distributed throughout the whole light receiving region, and a liquid crystal display including the backlight assembly.

[0009] In an exemplary embodiment of the present invention, a backlight assembly includes at least one first light source, a light guide plate, at least one second light source, and a light guide pattern. The first light source emits light. The light guide plate is provided above the first light source and has a first region corresponding to a position of the first light source and a second region corresponding to a space between two adjacent first light sources. The second light source is

provided at a side portion of the light guide plate to supply the light to the light guide plate. The light guide pattern is positioned on the light guide plate at the second region to output the light emitted from the second light source to an exterior of the light guide plate.

[0010] In an exemplary embodiment of the present invention, a liquid crystal display includes a liquid crystal panel and a backlight assembly. The liquid crystal panel receives light to display an image. The backlight assembly supplies the light to the liquid crystal panel. The backlight assembly includes at least one first light source, a light guide plate, at least one second light source, and a light guide pattern. The first light source emits a portion of the light. The light guide plate is provided above the first light source and has a first region corresponding to a position of the first light source and a second region corresponding to a space between two adjacent first light sources. The second light source is provided at a side portion of the light guide plate to supply light to the light guide plate. The light guide pattern is positioned on the light guide plate at the second region to output the light emitted from the second light source to an exterior of the light guide plate.

[0011] According to the embodiments of the present invention, the backlight assembly can output the light between two adjacent direct-type lamps by using the light guide plate, the edge-type lamp, and the light guide pattern. Accordingly, the backlight assembly can supply the light to the light receiving region such that brightness is uniformly distributed throughout the whole light receiving region regardless of the position of the direct-type lamps.

[0012] In addition, when the backlight assembly includes the diffusion plate diffusing the light emitted from the direct-type lamps, the volume of the backlight assembly may be reduced by shortening the distance between the direct-type lamps and the diffusion plate since an amount of the light of the edge-type lamp guided by the light guide pattern is increased.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Exemplary embodiments of the present invention will become readily apparent by reference to the following detailed description when considered in conjunction with the accompanying drawings wherein:

[0014] FIG. 1 is an exploded perspective view showing a backlight assembly according to an embodiment of the present invention;

[0015] FIG. 2 is a sectional view taken along line I-I' of FIG. 1;

[0016] FIGS. 3A to 3C are graphs showing light brightness as a function of the position of lamps according to the operational state of the lamps of the backlight assembly shown in FIG. 2;

[0017] FIG. 4 is a sectional view showing a backlight assembly according to an embodiment of the present invention;

[0018] FIG. 5 is a sectional view showing a backlight assembly according to an embodiment of the present invention;

[0019] FIG. 6 is a sectional view showing a backlight assembly according to an embodiment of the present invention;

[0020] FIG. 7 is a sectional view showing a backlight assembly according to an embodiment of the present invention;

[0021] FIG. 8 is a sectional view showing a backlight assembly according to an embodiment of the present invention;

[0022] FIG. 9 is an exploded perspective view showing a backlight assembly according to an embodiment of the present invention;

[0023] FIG. 10 is a plan view showing the backlight assembly shown in FIG. 9;

[0024] FIG. 11 is a sectional view taken along line II-II' of FIG. 10;

[0025] FIG. 12 is a plan view showing a backlight assembly according to an embodiment of the present invention;

[0026] FIG. 13 is a sectional view taken along line III-III' of FIG. 12; and

[0027] FIG. 14 is an exploded perspective view showing a liquid crystal display according to an embodiment of the present invention.

DESCRIPTION OF THE EMBODIMENTS

[0028] It will be understood that when an element or layer is referred to as being "on", "connected to" or "coupled to" another element or layer, it can be directly on, connected or coupled to the other element or layer or intervening elements or layers may be present.

[0029] FIG. 1 is an exploded perspective view showing a backlight assembly according to an embodiment of the present invention.

[0030] Referring to FIG. 1, a backlight assembly 200 includes a plurality of direct-type lamps 50, a reflective plate 80, a light guide plate 100, an edge-type lamp 140, a lamp cover 150, a diffusion plate 120, and a plurality of optical sheets 130.

[0031] The direct-type lamps 50 are formed as line light sources extending in a first direction D1, and are arranged at predetermined intervals therebetween on the reflective plate 80 in a second direction D2 substantially perpendicular to the first direction D1. The direct-type lamps 50 are cold cathode fluorescent lamps (CCFLs), and include lamp electrode lines 52, respectively. The direct-type lamps 50 are coupled with a plurality of lamp holders 51. The lamp electrode lines 52 are electrically connected to an inverter (not shown), so that the direct-type lamps 50 can receive power from the inverter.

[0032] The reflective plate 80 is provided below the direct-type lamps 50 to reflect light emitted from the direct-type lamps 50. Accordingly, the backlight assembly 200 can supply a greater amount of light in an upward direction from the direct-type lamps 50 due to the reflective plate 80.

[0033] The light guide plate 100 is provided above the direct-type lamps 50, and the edge-type lamp 140 is provided at one side of the light guide plate 100. The edge-type lamp 140 may include a CCFL, and is formed as a line light source extending in the second direction D2. The lamp cover 150 is coupled with the edge-type lamp 140 to cover edge-type lamp 140.

[0034] Although the edge-type lamp 140 is the CCFL, in an alternative embodiment, the edge-type lamp 140 may include light emitting diodes. When the edge-type lamp 140 includes light emitting diodes, the edge-type lamp 140 may include a plurality of light emitting diodes as point light sources.

[0035] The light guide plate 100 has a light guide pattern 110 (see FIG. 2). Light emitted from the edge-type lamp 140 is supplied to the light guide plate 100, and the light supplied to the light guide plate 100 is transmitted in an upward direction through the light guide plate 100 due to the light guide

pattern 110. The light guide pattern 110 is formed on the light guide plate 100 at a position corresponding to the space between two adjacent direct-type lamps 50.

[0036] The diffusion plate 120 is provided above the light guide plate 100 to diffuse light. The light supplied to the diffusion plate 120 includes light emitted from the edge-type lamp 140, as well as light emitted from the direct-type lamps 50. Accordingly, the backlight assembly 200 can supply light with uniform brightness in an upward direction through the diffusion plate 120.

[0037] The optical sheets 130 are provided above the diffusion plate 120. The optical sheets 130 may be flexible. The optical sheets 130 may include prism sheets, which collect light that has passed through the diffusion plate 120 to improve front brightness, and diffusion sheets that diffuse light output from the diffusion plate 120.

[0038] FIG. 2 is a sectional view taken along line I-I' of FIG. 1.

[0039] Referring to FIG. 2, the direct-type lamps 50 include a first direct-type lamp LP1, a second direct-type lamp LP2, and a third direct-type lamp LP3. Two adjacent direct-type lamps 50 are spaced apart from each other by a first length L1, and each direct-type lamp 50 is spaced apart from the diffusion plate 120 by a second length L2.

[0040] The light guide plate 100 is interposed between the diffusion plate 120 and the direct-type lamps 50. The light guide plate 100 includes first regions A1 and second regions A2. The first regions A1 are placed corresponding to the first to third direct-type lamps LP1, LP2, and LP3, and the second regions A2 are placed in a space between two adjacent direct-type lamps 50. In addition, the edge-type lamp 140 is provided at one side of the light guide plate 100, and light emitted from the edge-type lamp 140 is supplied to the light guide plate 100.

[0041] The light guide plate 100 includes resin such as polymethylmethacrylate (PMMA), polycarbonate (PC), or polystyrene (PS). The resin has a refractive index of about 1.4 to about 1.6, which is greater than that of air.

[0042] When light is transmitted from a first material to a second material having a refractive index smaller than that of the first material, that is, when an incident angle of the light is greater than a critical angle thereof, the light is totally reflected from an interfacial surface between the first and second materials. This is referred to as total reflection of light. Accordingly, since the light guide plate 100 includes a material having a refractive index greater than that of air and the light guide plate 100 is surrounded by an air layer, light transmitted from the edge-type lamp 140 to the light guide plate 100 is totally reflected in the light guide plate 100 due to an incident angle of the light.

[0043] The light guide plate 100 includes the light guide pattern 110. The light guide pattern 110 is provided in each second region A2. According to an embodiment of the present invention, the light guide pattern 110 has a plurality of convex parts. The convex parts include first, second and third convex parts 111, 112 and 113. The first to third convex parts 111 to 113 reflect light by using a reflective surface 115 thereof, which is inclined relative to a surface of the light guide plate 100.

[0044] With respect to the light supplied to the light guide plate 100 from the edge-type lamp 140, light having a first incident angle θ_1 , which is greater than the critical angle so that the light is totally reflected in the light guide plate 100, is referred to as first light 141. The first to third convex parts 111

to **113** reflect the first light **141** from the reflective surface **115**. Accordingly, the first light **141** is changed into second light **142** having a second incident angle θ_2 smaller than the critical angle to be output to an exterior through the light guide plate **100**.

[0045] In other words, the light supplied to the light guide plate **100** from the edge-type lamp **140** is output to an exterior through the light guide pattern **110**. Accordingly, the light emitted from the edge-type lamp **140** is output from the light guide plate **100** at a position corresponding to the light guide pattern **110**.

[0046] When a backlight assembly employs direct-type lamps as a light source, brightness of the backlight assembly between the two adjacent direct-type lamps may be lower than brightness of the backlight assembly at the position of each direct-type lamp. However, according to the an embodiment of the present invention, since the backlight assembly **200** also includes the light guide plate **100** and the edge-type lamp **140** outputting light through the second region **A2** as well as the direct-type lamps **50**, the brightness of the backlight assembly **100** between two adjacent direct-type lamps **50** can be improved to correspond to the brightness of the backlight assembly **100** at the position of each direct-type lamp **50**. Further details of this feature will be described with reference to graphs of FIGS. 3A, 3B, and 3C.

[0047] The sizes of the convex parts defining the light guide pattern **110** are gradually reduced toward the boundary of the second region **A2** from the center of the second region **A2**. In more detail, the third convex parts **113** are positioned in the central portion of the second region **A2**, and the first convex parts **111** are positioned at the boundary portion of the second region **A2**. Each second convex part **112** is positioned between one of the first convex parts **111** and one of the third convex parts **113**. Each first convex part **111** has a width **L3**, each second convex part **112** has a width **L4**, and each third convex part **113** has a width **L5**, where **L4** is greater than **L3**, and **L5** is greater than **L4**.

[0048] As the size of the convex parts defining the light guide pattern **110** is increased, the area of the reflective surface **115** reflecting the first light **141** is increased. Accordingly, an amount of the first light **141** reflected by the convex parts is increased as the size of the convex parts increases. Therefore, when amounts of the first light **114** reflected by the first convex parts **111**, the second convex parts **112**, and the third convex parts **113**, respectively, are referred to as a first light amount, a second light amount, and a third light amount, the third light amount has the greatest value, and the first light amount has the smallest value. In other words, an amount of light output from the second convex parts **112** is greater than an amount of light output from the first convex parts **111**, and an amount of light output from the third convex parts **113** is greater than an amount of the light output from the second convex parts **112**.

[0049] As described above, even though light is output from the light guide plate **100** through the whole second region **A2**, an amount of light output from the light guide plate **100** through a central portion of the second region **A2** is greater than an amount of light output from the light guide plate **100** through a boundary portion of the second region **A2**. This is because the brightness of the backlight assembly **200** at the position of each direct-type lamp **50** is lower than that of the backlight assembly **200** between the two adjacent direct-type lamps **50** when the backlight assembly **200** employs the direct-type lamps **50** as a light source.

[0050] According to an embodiment of the present invention, the backlight assembly **200** includes the diffusion sheet **120** and the optical sheets **130** that are sequentially arranged above the light guide plate **100**. The diffusion sheet **120** and the optical sheets **130** diffuse light emitted from the direct-type lamps **50** to supply the light to the whole light receiving region with uniform brightness. According to the an embodiment of the present invention, since the backlight assembly **200** includes the edge-type lamp **140** and the light guide plate **100** used to improve light brightness between the direct-type lamps **50**, the backlight assembly **200** can supply light to the light receiving region with uniform brightness even if the backlight assembly **200** does not include the diffusion plate **120** or the optical sheets **130**. Accordingly, at least one of the diffusion plate **120** and the optical sheets **130** may be omitted in the backlight assembly **200**.

[0051] FIGS. 3A to 3C are graphs showing the brightness of the backlight assembly **200** as a function of positions of the above lamps according to the operational state of the lamps of the backlight assembly **200** shown in FIG. 2. FIG. 3A shows the brightness of the backlight assembly **200** as a function of the positions of the lamps LP1, LP2 and LP3, when the direct-type lamps **50** are on, and the edge-type lamp **140** is off. FIG. 3B shows the brightness of the backlight assembly **200** as a function of the positions of the lamps LP1, LP2 and LP3 when the direct-type lamps **50** are off, and the edge-type lamp **140** is on. FIG. 3C shows the brightness of the backlight assembly **200** as a function of the positions of the lamps LP1, LP2 and LP3 when all of the direct-type lamps **50** and the edge-type lamp **140** are on.

[0052] Referring to a first curve (G1) of FIG. 3A, when the direct-type lamps **50** are on and the edge-type lamp **140** is off, the backlight assembly **200** has first brightness **B1** corresponding to each position of the first to third direct-type lamps LP1 to LP3, and has second brightness **B2** lower than the first brightness **B1** between the two adjacent direct-type lamps **50**.

[0053] Referring to a second curve (G2) of FIG. 3B, when the direct-type lamps **50** are off and the edge-type lamp **140** is on, the backlight assembly **200** has third brightness **B3** corresponding to each position of the first to third direct-type lamps LP1 to LP3, and has fourth brightness **B4** higher than the third brightness **B3** between the two adjacent direct-type lamps **50**.

[0054] Referring to a third curve (G3) of FIG. 3C, when all of the direct-type lamps **50** and the edge-type lamp **140** are on, the backlight assembly **200** outputs light having fifth brightness **B5** throughout the whole light receiving region regardless of the position of the first to third direct-type lamps **50**. In other words, if all of the direct-type lamps **50** and the edge-type lamp **140** are operating, the brightness shown in FIG. 3A and the brightness shown in FIG. 3B are combined with each other. Accordingly, the backlight assembly can output light having uniform brightness throughout the light emitting region without degrading brightness in a specific region.

[0055] FIG. 4 is a sectional view showing a backlight assembly according to an embodiment of the present invention. Referring to FIG. 4, a backlight assembly **201** includes a light guide plate **101** having a light guide pattern **160**. The light guide pattern **160** includes first concave parts **161**, second concave parts **162** having the size greater than that of the first concave parts **161**, and third concave parts **163** having the size greater than that of the second concave parts **162**. In more detail, the first concave parts **161** have a width **L6**, and the

second concave parts **162** have a width $L7$ greater than $L6$. The third concave parts **163** have a width $L8$ greater than $L7$.

[0056] The first to third concave parts **161**, **162**, and **163** are positioned at the second region **A2**. In detail, the third concave parts **163** are positioned at the central portion of the second region **A2**, and the first concave parts **161** are positioned at the boundary portion of the second region **A2**. Each second concave part **162** is interposed between one of the first concave parts **161** and one of the third concave parts **163**.

[0057] In addition, each of the first to third concave parts **161**, **162**, and **163** has a reflective surface **170**. The reflective surface **170** is formed at bottom surfaces of the first to third concave parts **161**, **162**, and **163**, and the reflective surface **170** has a concave-convex shape. The first to third concave parts **161**, **162**, and **163** reflect the first light **141** to an exterior similarly to the first to third convex parts **111**, **112**, and **113** of the light guide plate **100**.

[0058] As the size of the reflective surface **170** of the first to third concave parts **161**, **162**, and **163** is increased, an amount of the first light **141** reflected from the reflective surface **170** is increased. Accordingly, assuming that amounts of the first light **141** reflected from the first concave parts **161**, the second concave parts **162**, or the third concave parts **163** are referred to as a first light amount, a second light amount, or a third light amount, respectively, the third amount is the greatest value, and the first amount is the smallest value. An amount of light output from the second concave parts **162** is greater than an amount of light output from the first concave parts **161**, and an amount of light output from the third concave parts **163** is greater than an amount of the light output from the second concave parts **162**.

[0059] The backlight assembly **201** includes the diffusion plate **120** and the optical sheets **130**, which are sequentially arranged above the light guide plate **101**. According to an embodiment of the present invention, since the backlight assembly **201** includes the edge-type lamp **140** and the light guide plate **101** used to improve light brightness between the direct-type lamps **50**, even if the backlight assembly **201** does not include the diffusion plate **120** or the optical sheets **130**, light having uniform brightness can be supplied to the whole light receiving region. Accordingly, at least one of the diffusion plate **120** and the optical sheets **130** can be omitted in the backlight assembly **201**.

[0060] FIG. 5 is a sectional view showing a backlight assembly according to an embodiment of the present invention. Referring to FIG. 5, a backlight assembly **202** includes a light guide plate **102** having a light guide pattern **175**, and the light guide pattern **175** includes a plurality of printed patterns. In more detail, the light guide plate **102** includes a base part **171** having a plate shape and first, second and third printed patterns **176**, **177** and **178** provided on the base part **171**.

[0061] The first to third printed patterns **176** to **178** include a material (e.g., titanium dioxide (TiO_2)) reflecting light. Accordingly, the first to third printed patterns **176** to **178** change the path of light, which is emitted from the edge-type lamp **140** and then totally reflected in the light guide plate **102**, similar to the first to third convex parts **111**, **112**, and **113** and the first to third concave parts **161**, **162**, and **163**. Assuming that light totally reflected in the light guide plate **102** is referred to as the first light **141**, and light, which is output to an exterior with the optical path changed by the first to third printed patterns **176**, **177**, and **178**, is referred to as the second light **142**, the first to third printed patterns **176**, **177**, and **178** change the first light **141** into the second light **142**.

[0062] The first printed patterns **176** have a width $L6$, and the second printed patterns **177** have a width $L7$ greater than $L6$. The third printed patterns **178** have a width $L8$ greater than $L7$. The third printed patterns **178** are positioned at the central portion of the second region **A2**, and the first printed patterns **176** are positioned at the boundary portion of the second region **A2**. Each second printed pattern **177** is positioned between one of the first printed patterns **176** and one of the third printed patterns **178**.

[0063] As the size of a reflective surface **179** of the first to third printed patterns **176**, **177**, and **178** is increased, an amount of the first light **141** reflected from the reflective surface **179** is increased. Accordingly, assuming that amounts of light reflected from the first printed patterns **176**, the second printed patterns **177**, or the third printed patterns **178** are referred to as the first light amount, the second light amount, and the third light amount, respectively, the third light amount is the greatest value, and the first light amount is the smallest value. This means that an amount of light output from the second printed patterns **177** is greater than an amount of light output from the first printed patterns **176**, and an amount of light output from the third printed patterns **178** is greater than an amount of the light output from the second printed patterns **177** even though light is output from the whole second region **A2** of the light guide plate **102**.

[0064] FIG. 6 is a sectional view showing a backlight assembly according to an embodiment of the present invention.

[0065] Referring to FIG. 6, a backlight assembly **203** includes the light guide plate **103**, the direct-type lamps **50**, the edge-type lamp **140**, the diffusion plate **120**, and the optical sheets **130**. The light guide plate **103** includes a light guide pattern **115-1** formed in the second region **A2**.

[0066] The light guide pattern **115-1** includes first to fourth convex parts **116**, **117**, **118**, and **119** having different sizes. In more detail, the size of the second convex parts **117** is greater than the size of the first convex parts **116**, and the size of the third convex parts **118** is greater than the size of the second convex parts **117**. In addition, the size of the fourth convex parts **119** is greater than the size of the third convex parts **118**.

[0067] The direct-type lamps **50** include the first to third direct-type lamps **LP1**, **LP2**, and **LP3**. The distance between the first direct-type lamp **LP1** and the second direct-type lamp **LP2** is the first length $L1$, and the distance between each direct-type lamp **50** and the diffusion plate **120** is a ninth length $L9$.

[0068] The ninth length $L9$ is shorter than the second length $L2$ (see FIG. 2). In other words, the distance between the light guide plate **103** and the diffusion plate **120** provided in the backlight assembly **203** is shorter than the distance between the light guide plate **100** and the diffusion plate **120** (see FIG. 2) provided in the backlight assembly **200** (see FIG. 2). In addition, the light guide pattern **110** (see FIG. 2) in the backlight assembly **200** (see FIG. 2) includes the first to third convex parts **111**, **112**, and **113**, and the light guide pattern **115-1** in the backlight assembly **203** includes the first to fourth convex parts **116**, **117**, **118**, and **119**. In other words, the light guide pattern **115-1** in the backlight assembly **203** has more convex parts per unit area than the light guide pattern **110** in the backlight assembly **200** (see FIG. 2).

[0069] As described above with reference to FIG. 2, as the number of convex parts of the light guide pattern **115-1** is increased, an amount of light emitted from the edge-type lamp **140** and reflected from the light guide pattern **115** is

increased. Accordingly, the backlight assembly 203 can output a greater amount of light to an exterior in the second region A2, as compared with the backlight assembly 200.

[0070] In a backlight assembly including direct-type lamps and a diffusion plate, as the distance between each direct-type lamp and the diffusion plate is shortened, the whole volume of the backlight assembly can be reduced. However, as the distance between each direct-type lamp and the diffusion plate is shortened, less light emitted from the direct-type lamps is diffused by the diffusion plate. Accordingly, the brightness of the backlight assembly may be reduced between two adjacent direct-type lamps. However, according to an embodiment of the present invention, the number of convex parts of the light guide pattern 115-1 is increased, thereby increasing an amount of light between two adjacent direct-type lamps. Accordingly, the backlight assembly 203 can supply light to the whole light receiving region with uniform brightness. In other words, if the number of the convex parts of the light guide pattern 115-1 is increased, the distance between the diffusion plate 120 and each direct-type lamp 50 may be reduced. As a result, the whole volume of the backlight assembly 203 can be reduced.

[0071] FIG. 7 is a sectional view showing a backlight assembly 204 according to an embodiment of the present invention.

[0072] The backlight assembly 204 includes the reflective plate 80, the light guide plate 100 provided above the reflective plate 80, the edge-type lamp 140 provided at a side portion of the light guide plate 100, the lamp cover 150 coupled with the edge-type lamp 140, the direct-type lamps 50 provided above the light guide plate 100, the diffusion plate 120 provided above the direct-type lamps 50, and the optical sheets 130 provided above the diffusion plate 120. Unlike the embodiment described in connection with FIG. 2, the light guide plate 100 is interposed between the reflective plate 80 and the direct-type lamps 50.

[0073] Accordingly, after light that has been supplied to the light guide plate 100 from the edge-type lamp 140 is output through the second region A2 by the light guide pattern 110 of the light guide plate 100, the light sequentially passes through the diffusion plate 120 and the optical sheets 130 and then is output to an exterior.

[0074] FIG. 8 is a sectional view showing a backlight assembly 205 according to an embodiment of the present invention. Referring to FIG. 8, the backlight assembly 205 includes the reflective plate 80, the direct-type lamps 50 provided above the reflective plate 80, the diffusion plate 120 provided above the direct-type lamps 50, the light guide plate 100 provided above the diffusion plate 120, the edge-type lamp 140 provided at a side portion of the light guide plate 100, the lamp cover 150 coupled with the edge-type lamp 140, and the optical sheets 130 provided above the light guide plate 100. In other words, unlike the embodiment described in connection with FIG. 2, the light guide plate 100 is interposed between the diffusion plate 120 and the optical sheets 130.

[0075] Accordingly, after light that has been supplied to the light guide plate 100 from the edge-type lamp 140 is output through the second region A2 by the light guide pattern 110, the light is output to an exterior through the optical sheets 130.

[0076] FIG. 9 is an exploded perspective view showing a backlight assembly 206 according to an embodiment of the present invention. Referring to FIG. 9, the backlight assembly 206 includes direct-type lamps 60 having the form of point light sources. The direct-type lamps 60 may include light

emitting diodes (LEDs). The direct-type lamps 60 are arranged on the reflective plate 80 with the same interval in the first and second directions D1 and D2.

[0077] Similar to the embodiment described in connection with FIGS. 1 and 2, the edge-type lamp 140 includes a cold cathode fluorescent lamp (CCFL) having the form of a line light source. Alternatively, the edge-type lamp 140 may include a light emitting diode. When the edge-type lamp 140 includes the light emitting diode, the edge-type lamp 140 may include a plurality of light emitting diodes having the form of point light sources.

[0078] FIG. 10 is a plan view showing the backlight assembly 206 of FIG. 9, and FIG. 11 is a sectional view taken along line II-II' of FIG. 10. Referring to FIGS. 10 and 11, the direct-type lamps 60 are arranged at predetermined intervals in the first and second directions D1 and D2. For example, the first, second and third direct-type lamps 61, 62, and 63 are sequentially arranged with a predetermined interval in the second direction D2, and the third and fourth direct-type lamps 63 and 64 are arranged with a predetermined interval in the first direction D1.

[0079] The light guide plate 106 is provided above the direct-type lamps 60, and has the light guide pattern 110. As described above with reference to FIG. 2, the light guide pattern 110 includes the first to third convex parts/protrusions 111, 112, and 113 having different sizes.

[0080] A portion of the light guide pattern 110 extends in the first direction D1 to cross the space between two adjacent direct-type lamps, for example, the space between the first and second direct-type lamps 61 and 62. In addition, another portion of the light guide pattern 110 extends in the second direction D2 to cross the space between the two adjacent direct-type lamps, for example, the space between the third and fourth direct-type lamps 63 and 64.

[0081] Similar to the light guide plate 100 (see FIG. 2), the light guide plate 106 has the light guide pattern 110 provided between two adjacent direct-type lamps. However, unlike the direct-type lamps 50 (see FIG. 2) having the form of a line light source, since the direct-type lamps 60 are point light sources arranged in a matrix or lattice form on a plane, the light guide pattern 110 extends in the first and second directions D1 and D2 to surround the direct-type lamps 60.

[0082] FIG. 12 is a plan view showing a backlight assembly 207 according to an embodiment of the present invention, and FIG. 13 is a sectional view taken along line III-III' of FIG. 12. Referring to FIGS. 12 and 13, a plurality of the direct-type lamps 60 having the form of point light sources are arranged at predetermined intervals in the first and second directions D1 and D2. For example, the first, second and third direct-type lamps 61, 62, and 63 are sequentially arranged with a predetermined interval in the second direction D2. The third and fourth direct-type lamps 63 and 64 are arranged with a predetermined interval in the first direction D1.

[0083] The light guide plate 107 is provided above the direct-type lamps 60, and the light guide plate 107 has the light guide pattern 160. As described with reference to FIG. 4, the light guide pattern 160 has the first concave parts 161, the second concave parts 162 having a greater width than the first concave parts 161, and the third concave parts 163 having a greater width than the second concave parts 162.

[0084] In addition, similar to the light guide plate 106, the light guide plate 107 has the light guide pattern 160 between two adjacent direct-type lamps 60. However, unlike the direct-type lamps 50 having the form of a line light source,

since the direct-type lamps **60** are point light sources arranged in a matrix or lattice form on a plane, the light guide pattern **160** surrounds the direct-type lamps **60** on the plane.

[0085] FIG. **14** is an exploded perspective view showing a liquid crystal display **500** according to an embodiment of the present invention. The liquid crystal display **500** includes the backlight assembly **200** (see FIG. **1**). Referring to FIG. **14**, the liquid crystal display **500** includes the backlight assembly **200** to emit light, a bottom chassis **310** having a receiving space, a top chassis **380** coupled with the bottom chassis **310**, and a liquid crystal display panel **430** receiving light from the backlight assembly **200** to display an image.

[0086] In the liquid crystal display **500**, the liquid crystal display panel **430** is provided above the backlight assembly **200** to receive light from the backlight assembly **200**, thereby displaying an image. The liquid crystal display panel **430** includes a color filter substrate **410**, a thin film transistor substrate **420**, and a liquid crystal layer (not shown) interposed between the color filter substrate **410** and the thin film transistor substrate **420**.

[0087] The thin film transistor substrate **420** includes pixels. The thin film transistor substrate **420** includes a plurality of thin film transistors (not shown) formed in a one-to-one relation with the pixels, and pixel electrodes (not shown) electrically connected to the thin film transistors in a one-to-one relation with the thin film transistors. The color filter substrate **410** includes one of a red color filter, a green color filter, and a blue color filter provided in a one-to-one relation with the pixels. The color filter substrate **410** includes a common electrode facing the pixel electrodes. A director of liquid crystal is changed by an electric field formed by the pixel electrodes and the common electrode, thereby adjusting an amount of light transmitted through the liquid crystal display panel **430**.

[0088] The bottom chassis **310** includes a bottom part and sidewalls extending from the bottom part to provide the receiving space, and the backlight assembly **200** is received in the receiving space. The top chassis **380** is coupled with the bottom chassis **310** through the coupling with the sidewalls of the bottom chassis **310**. The liquid crystal display **500** further includes a middle mold **300** interposed between the bottom chassis **310** and the top chassis **380**, and the middle mold **300** stably fixes the liquid crystal display panel **430** into the liquid crystal display **500**.

[0089] As described with reference to FIGS. **1**, **2**, **3A**, **3B**, and **3C**, the liquid crystal display **500** can receive light having uniform brightness from the backlight assembly **200** throughout the whole light receiving region. Accordingly, image display quality of the liquid crystal display **500** can be improved.

[0090] In addition, the liquid crystal display **500** may include the backlight assemblies according to the other embodiments of the present invention in addition to the backlight assembly **200**. For example, if the liquid crystal display **500** includes the backlight assembly **203** (see FIG. **6**), the liquid crystal display **500** receives light having uniform brightness throughout the whole light receiving region, thereby improving image display quality. In addition, the volume of the liquid crystal display **500** can be reduced.

[0091] Although the exemplary embodiments of the present invention have been described, it is understood that the present invention should not be limited to these exemplary embodiments but various changes and modifications can be made by one ordinary skilled in the art within the spirit and scope of the present invention as hereinafter claimed.

What is claimed is:

1. A backlight assembly comprising:

a first light source emitting a light;

a light guide plate above the first light source and having a first region corresponding to a position of the first light source and a second region corresponding to a space between two adjacent first light sources;

a second light source emitting a light and provided at a side portion of the light guide plate; and

a light guide pattern positioned on the light guide plate at the second region to output the light emitted from the second light source to an exterior of the light guide plate.

2. The backlight assembly of claim 1, wherein the light guide pattern comprises reflective surfaces formed at a lower surface of the light guide plate to reflect the light emitted from the second light source to an upper surface of the light guide plate.

3. The backlight assembly of claim 2, wherein the light guide pattern comprises a plurality of convex parts, and each convex part comprises at least one of the reflective surfaces.

4. The backlight assembly of claim 3, wherein a size of each convex part is reduced as each convex part is positioned closer to the first region.

5. The backlight assembly of claim 2, wherein the light guide pattern comprises concave-convex surfaces, and each concave-convex surface comprises at least one of the reflective surfaces.

6. The backlight assembly of claim 5, wherein a size of each concave-convex surface is reduced as each concave-convex surface is positioned closer to the first region.

7. The backlight assembly of claim 2, wherein the light guide pattern comprises printed patterns on the light guide plate, wherein the printed patterns include the reflective surfaces thereon.

8. The backlight assembly of claim 7, wherein a size of each printed pattern is reduced as each printed pattern is positioned closer to the first region.

9. The backlight assembly of claim 2, further comprising a diffusion plate, wherein the light guide plate is interposed between the diffusion plate and the first light source to diffuse the light emitted from the first and second light sources.

10. The backlight assembly of claim 9, wherein a number of the reflective surfaces is increased as a distance between the first light source and the diffusion plate is reduced.

11. The backlight assembly of claim 1, further comprising: a diffusion plate, wherein the light guide plate is interposed between the diffusion plate and the first light source to diffuse the light from the first and second light sources; and

optical sheets, wherein the diffusion plate is interposed between the optical sheets and the light guide plate.

12. The backlight assembly of claim 1, further comprising: a diffusion plate, wherein the first light source is interposed between the diffusion plate and the light guide plate; and optical sheets, wherein the diffusion plate is interposed between the optical sheets and the first light source.

13. The backlight assembly of claim 1, further comprising: a diffusion plate interposed between the first light source and the light guide plate; and

optical sheets, wherein the light guide plate is interposed between the diffusion plate and the optical sheets.

14. A liquid crystal display comprising:

a liquid crystal display panel receiving a light to display an image; and

a backlight assembly supplying the light to the liquid crystal display panel,

wherein the backlight assembly comprises:

- a first light source emitting a portion of the light;
- a light guide plate provided above the first light source and having a first region corresponding to a position of the first light source and a second region corresponding to a space between two adjacent first light sources;
- a second light source emitting another portion of the light and provided at a side portion of the light guide plate; and
- a light guide pattern positioned on the light guide plate at the second region to output the light emitted from the second light source to an exterior of the light guide plate.

15. The liquid crystal display of claim **14**, wherein the light guide pattern comprises reflective surfaces formed at a lower surface of the light guide plate to reflect the light emitted from the second light source to an upper surface of the light guide plate.

16. The liquid crystal display of claim **15**, wherein the light guide pattern comprises a plurality of convex parts, and each convex part comprises at least one of the reflective surfaces.

17. The liquid crystal display of claim **16**, wherein a size of each convex part is reduced as each convex part is positioned closer to the first region.

18. The liquid crystal display of claim **15**, wherein the light guide pattern comprises concave-convex patterns, and each concave-convex pattern comprises at least one of the reflective surfaces.

19. The liquid crystal display of claim **15**, wherein the light guide pattern comprises printed patterns on the light guide plate, the printed patterns having the reflective surfaces thereon.

20. The liquid crystal display of claim **15**, wherein the backlight assembly further comprises a diffusion plate interposed between the first light source and the liquid crystal panel, and a number of the reflective surfaces is increased as a distance between the first light source and the diffusion plate is reduced.

* * * * *

专利名称(译)	背光组件和具有该背光组件的液晶显示器		
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摘要(译)

一种包括直下式灯和边缘型灯的背光组件和具有该背光组件的液晶显示器。直下型灯以预定间隔布置以发光，并且边缘型灯设置在设置在直下型灯上方或下方的导光板的侧部。导光板和光导图案输出光从边缘型灯发出，通过两个相邻的直接型灯之间的空间。背光组件向光接收区域提供光，使得亮度均匀地分布在整個光接收区域，而不管直下型灯的位置如何。

