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(54) **LIQUID CRYSTAL DISPLAY DEVICE**

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(57) **ABSTRACT**

A liquid crystal display device includes a liquid crystal panel including first and second substrates and a liquid crystal layer between the first and second substrates; a backlight unit under the liquid crystal panel; a bottom frame including a horizontal surface and first, second, third, and fourth side surfaces, the first side surface corresponding to a first edge of the liquid crystal panel and being opposite to the second side surface, wherein the liquid crystal panel has a size larger than the bottom frame such that a side of the liquid crystal panel protrudes beyond the bottom frame; a main frame including a first guide portion corresponding to the first edge and a second guide portion corresponding a second edge of the liquid crystal panel opposite to the first edge; and an adhesive covering the side of the liquid crystal panel and an outer side of the third and fourth side surfaces.

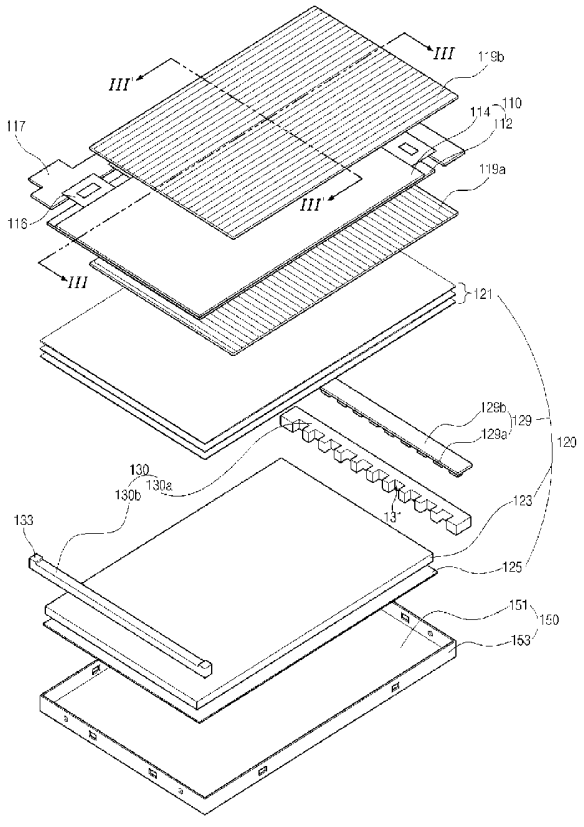


FIG. 1

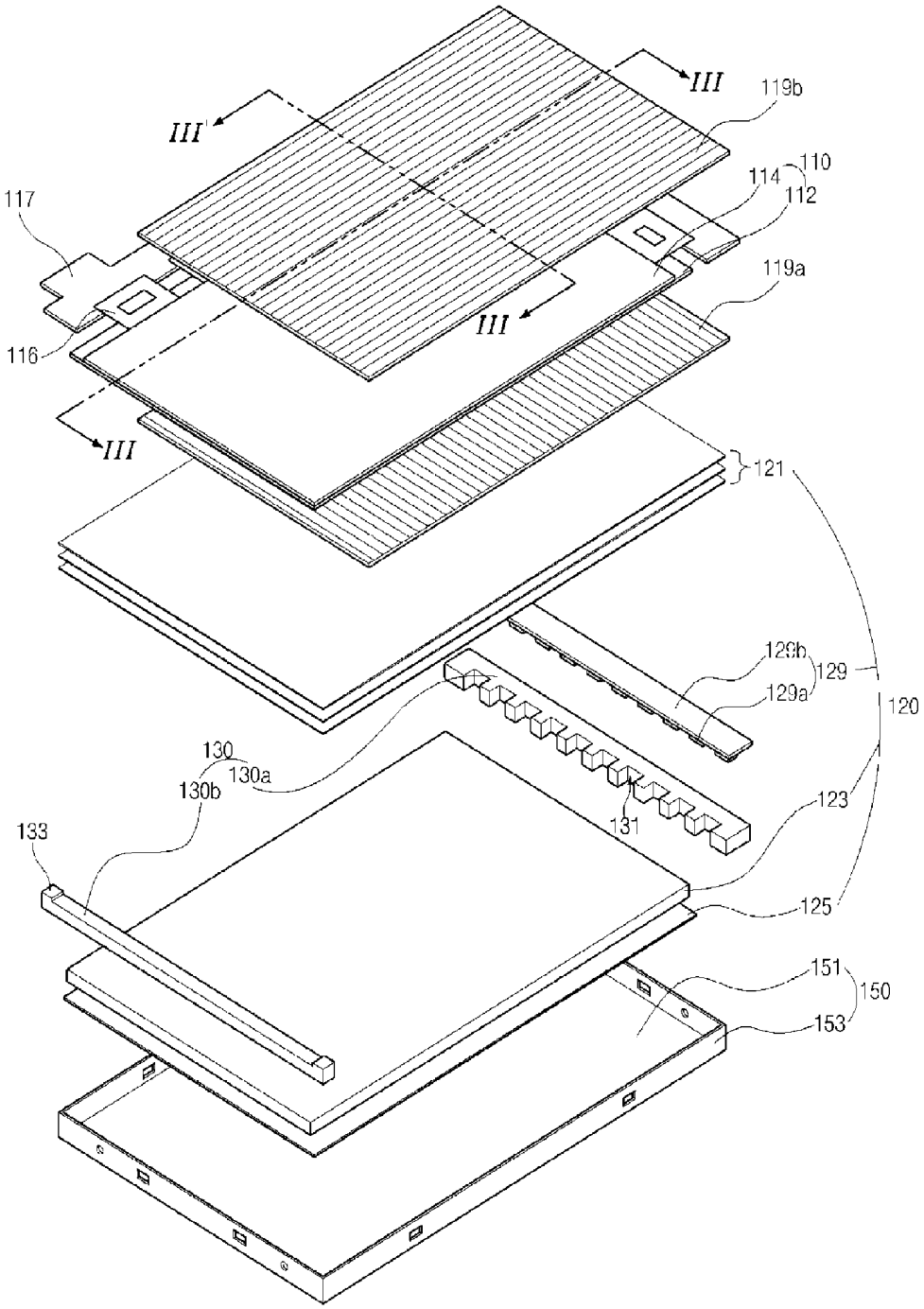

III
III
III
III
119b
110
114
112
117
119a
116
121
129b
129
129a
120
130
130a
130b
131
123
133
125
151
150
153

FIG. 2

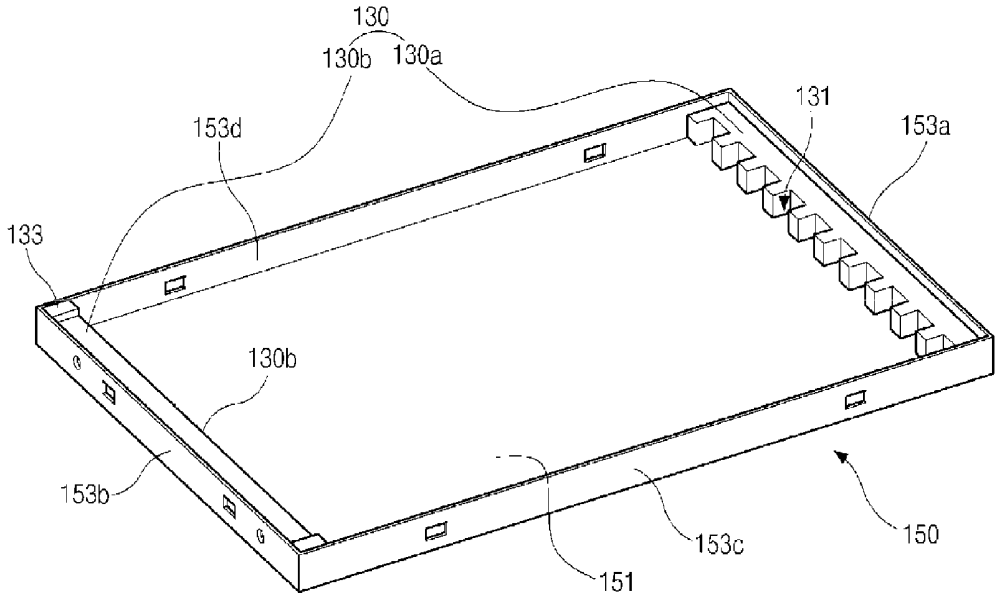


FIG. 3A

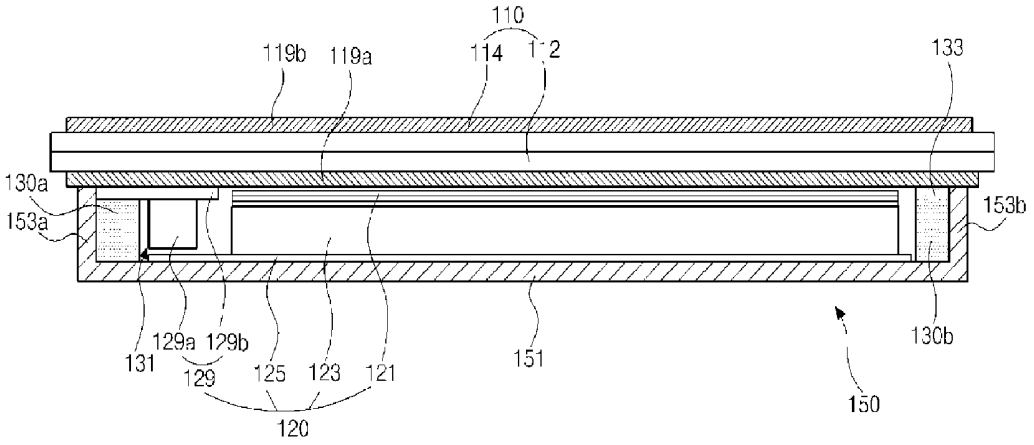

110
119b
119a
114
112
133
130a
153a
153b
131
129a
129b
129
125
123
121
151
130b
150
120

FIG. 3B

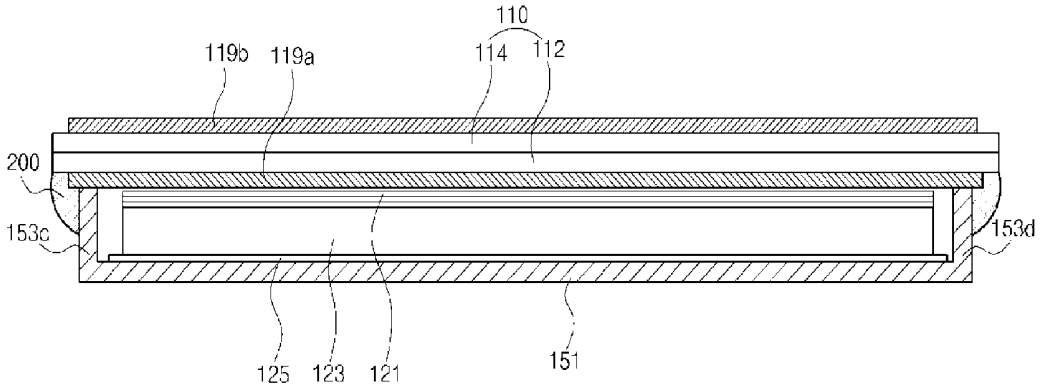

110
119b
119a
114
112
200
153c
153d
125
123
121
151

FIG. 4

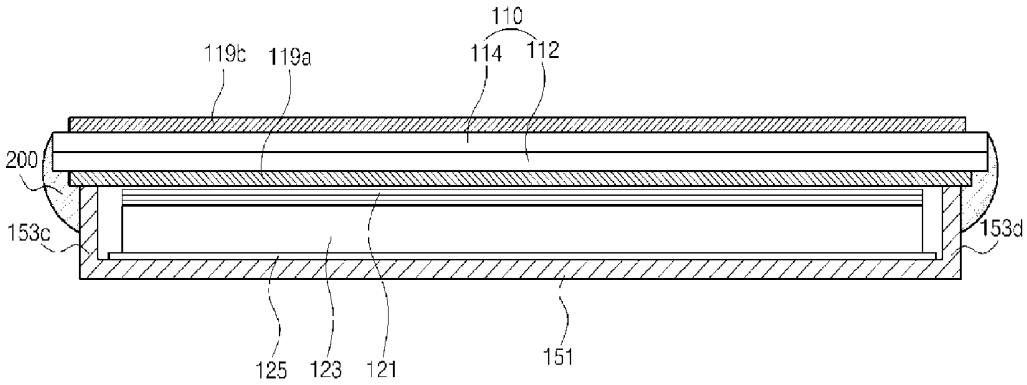
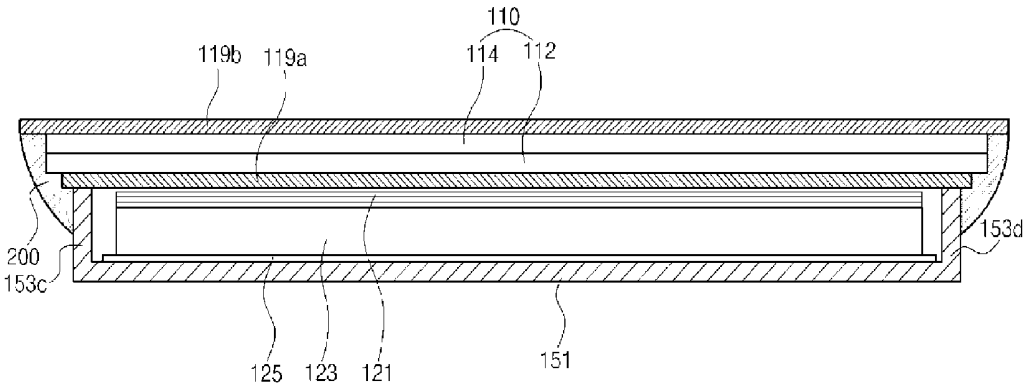

110
119b
119a
114
112
200
153c
153d
125
123
121
151

FIG. 5


110
119b
119a
114
112
200
153c
153d
125
123
121
151

LIQUID CRYSTAL DISPLAY DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a continuation under 35 U.S.C. §120 of U.S. patent application Ser. No. 14/451,720, filed Aug. 5, 2014, which claims the benefit of Korean Patent Application No. 10-2014-0023470, filed in Korea on Feb. 27, 2014, both of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a liquid crystal display (LCD) device, and more particularly, to a low-weight LCD device having a thin profile and a narrow bezel.

[0004] 2. Discussion of the Related Art

[0005] Display devices represent electrical signals as visual images. Particularly, LCD devices and organic light emitting diode (OLED) display devices are flat panel display devices having characteristics of light weight, thin profile, and low power consumption relative to cathode-ray tube display devices.

[0006] Among these devices, since LCD devices display moving images with a high contrast ratio, LCD devices have been widely used.

[0007] An LCD device includes a liquid crystal panel. Two substrates with a liquid crystal layer therebetween are attached to form the liquid crystal panel. The alignment of the liquid crystal molecules is changed by an electric field generated in the liquid crystal panel such that images can be displayed by controlling light transmissivity.

[0008] Since the liquid crystal panel does not include a light source, the LCD device includes a light source. As a result, a backlight unit including the light source is disposed under the liquid crystal panel.

[0009] A main frame surrounds side surfaces of the liquid crystal panel and the backlight unit, and a top frame covers a front edge of the liquid crystal panel. A bottom frame covers a rear surface of the backlight unit. The main frame, the top frame, and the bottom frame are combined for assembly.

[0010] Recently, the LCD device has been used as the monitor of desktop computers and portable computers as well as a wall-mounted television. It is beneficial to develop LCD devices having a large display area, low weight, and low volume.

[0011] However, the many elements in the LCD device limit the device's lightness and slimness. In addition, the complex assembly process increases assembly time. Large display areas are limited, particularly in narrow-bezel-type LCD devices.

SUMMARY OF THE INVENTION

[0012] Accordingly, the present invention is directed to an LCD device that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

[0013] The present invention provides an LCD device having a narrow bezel.

[0014] The present invention also provides for more secure assembly of an LCD device.

[0015] Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0016] To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, the present invention provides a liquid crystal display device with a liquid crystal panel including first and second substrates and a liquid crystal layer between the first and second substrates; a backlight unit under the liquid crystal panel; a bottom frame including a horizontal surface and first, second, third, and fourth side surfaces, the first side surface corresponding to a first edge of the liquid crystal panel and being opposite to the second side surface, wherein the liquid crystal panel has a size larger than the bottom frame such that a side of the liquid crystal panel protrudes beyond the bottom frame; a main frame including a first guide portion corresponding to the first edge and a second guide portion corresponding a second edge of the liquid crystal panel opposite to the first edge; and an adhesive covering the side of the liquid crystal panel and an outer side of the third and fourth side surfaces.

[0017] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

[0019] FIG. **1** is an exploded perspective view of an LCD device according to a first embodiment of the present invention.

[0020] FIG. **2** is a schematic perspective view of a main frame with a bottom frame.

[0021] FIGS. **3**A and **3**B are cross-sectional views along the lines and III'-III' in FIG. **1**, respectively.

[0022] FIG. **4** is a cross-sectional view along the line III'-III' in FIG. **1** of an LCD device according to a second embodiment of the present invention.

[0023] FIG. **5** is a cross-sectional view along the line III'-III' in FIG. **1** of an LCD device according to a third embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0024] Reference will now be made in detail to the preferred embodiments, examples of which are illustrated in the accompanying drawings.

[0025] FIG. **1** is an exploded perspective view of an LCD device according to a first embodiment of the present invention.

[0026] As shown in FIG. **1**, an LCD device includes a liquid crystal panel **110**, a backlight unit **120**, a main frame **130**, and a bottom frame **150**.

[0027] The liquid crystal panel **110** includes first and second substrates **112** and **114** facing each other and a liquid crystal layer (not shown) therebetween.

[0028] In an active matrix type, array elements, for example, a gate line (not shown), a data line (not shown), a thin film transistor (not shown), and a pixel electrode (not shown), are formed on the first substrate **112**. The gate and data lines cross each other to define a pixel region, and the thin film transistor is formed at a crossing point of the gate and data lines. The pixel electrode is disposed in the pixel region and is connected to the thin film transistor.

[0029] In addition, a black matrix (not shown) corresponding to the gate line, the data line, and the thin film transistor to block light and a color filter layer (not shown) having red, green and blue colors are formed on the second substrate **114**. A common electrode (not shown) is also formed on the second substrate **114** to generate an electric field with the pixel electrode on the first substrate **112**.

[0030] Moreover, first and second polarizing plates **119***a* and **119***b* for selectively transmitting light are positioned on outer sides of the first and second substrates **112** and **114**, respectively.

[0031] The liquid crystal panel **110** is connected to a printed circuit board (PCB) **117** through a connection member **116**, such as a flexible circuit board or a tape carrier package (TCP), and the printed circuit board **117** extends along a side surface of the main frame **130** or a rear surface of the bottom frame **150**.

[0032] When a thin film transistor is in an ON state (trigged by a scanning signal from the gate driving circuit), an image signal is applied to the pixel electrode through the data line to produce an electric field between the pixel electrode and the common electrode. As a result, as the intensity or direction of the electric field is changed, the alignment of the liquid crystal molecules in the liquid crystal layer also changes such that light transmissivity is controlled.

[0033] To display images using controlled light transmissivity, the backlight unit **120** provides light to the liquid crystal panel **110** and is disposed at a rear side of the liquid crystal panel **110**.

[0034] The backlight unit **110** includes a light emitting diode (LED) assembly **129** as a light source, a reflective sheet **125** of white or silver color, a light guide plate **123** on the reflective sheet **125** and an optical sheet **121** on or over the light guide plate **123**.

[0035] The LED assembly **129** is positioned at one side of the light guide plate **123** and includes at least one LED **129***a* and a printed circuit board (PCB) **129***b* where the LED **129***a* is disposed.

[0036] A direction of the light from the LEDs **129***a* is substantially parallel to a surface of the PCB **129***b*. This may be referred to as a side view type LED assembly.

[0037] The LEDs **129***a* emit red, green and blue color light. The LEDs **129***a* are simultaneously turned on and off such that white light can be provided from the LEDs **129***a* by color mixture.

[0038] To improve the optical efficiency and the brightness, an LED including a blue LED chip and a yellow fluorescent substance, e.g., cesium-doped yttrium-aluminum-garnet (YAG:Ce), may be used.

[0039] The blue light from the blue LED chip is mixed with the yellow light from the yellow fluorescent substance such that the white light is provided.

[0040] The light emitted from the LED **129***a* is incident to the light guide plate **123** and refracted or reflected to be dispersed onto a wide region of the light guide plate **123**. The light is processed into a planar light source and provided onto the liquid crystal panel **110**.

[0041] The light guide plate **123** is formed of a transparent material and has a flat surface. For example, the light guide plate **123** may be formed of an acryl-based plastic material, e.g., polymethylmethacrylate (PMMA), or a polycarbonate-based material.

[0042] To provide a uniform plane light source, the light guide plate **123** may include patterns on a rear side surface. For example, the pattern on the rear side surface of the light guide plate **123** is an elliptical pattern, a polygonal pattern, or a hologram pattern.

[0043] The reflective sheet **125** is disposed at a rear side of the light guide plate **123**. The light passing through a rear side surface of the light guide plate **123** is reflected on the reflective sheet **125** such that light brightness provided into the liquid crystal panel **110** is improved.

[0044] The optical sheet **121** includes a plurality of sheets, e.g., a diffusion sheet and at least one light-concentration sheet. The light dispersed through the light guide plate **123** is diffused and/or/concentrated by the optical sheet **121** such that a uniform planar light source can be projected onto the liquid crystal panel **110**.

[0045] The diffusion sheet is disposed directly over the light guide plate **123** to diffuse the light from the light guide plate **123**. The light is directed by the diffusion sheet toward the light-concentration sheet.

[0046] The diffused light from the diffusion sheet is concentrated toward the liquid crystal panel **110** by the light-concentration sheet. Most of the light from the light-concentration sheet is substantially perpendicular to the liquid crystal panel **110**.

[0047] Alternatively, the optical sheet **121** may be a multi-functional optical sheet having both diffusing and light-concentration functions. The optical sheet **121** may have a laminated structure including the diffusion sheet and the light-concentration sheet.

[0048] For instance, the multi-functional optical sheet may include a base substrate of a transparent material, a diffusion layer, which is disposed on the base layer, for light diffusion, and a light-concentration layer, which is disposed on the diffusion layer, for light concentration.

[0049] The liquid crystal panel **110** and the backlight unit **120** are combined with the main frame **130** and the bottom frame **150** for assembly. The liquid crystal panel **110** and the backlight unit **120** are disposed on and over the bottom frame **150**. The bottom frame **150** includes a horizontal surface **151** and a side surface **153** upwardly protruding from edges of the horizontal surface **151**. For example, the side surface **153** vertically protrudes. The rear side of the backlight unit **120** is covered by the horizontal surface **151** of the bottom frame **150**.

[0050] The main frame **130** surrounds side surfaces of the backlight unit **120**. The liquid crystal panel **110** is attached and fixed to the main frame **130**. The main frame **130** includes a first guide portion **130***a* and a second guide portion **130***b* facing and opposite to the first guide portion **130***a*. The LED assembly **129** is disposed in the first guide portion **130***a*.

[0051] When edges of the liquid crystal panel **110** are defined as first to fourth edges, the LED assembly **129**

corresponds to the first edge, and the second edge faces opposite to the first edge. The third and fourth edges are perpendicular to the first and second edges and face each other. The first and second guide portions **130***a* and **130***b* are separated from each other and correspond to the first and second edges, respectively. The first and second guide portions **130***a* and **130***b* each has a bar shape.

[0052] The backlight unit **120** is disposed between the first and second guide portions **130***a* and **130***b*, and two opposite side surfaces of the backlight unit **120** are covered by the first and second guide portions **130***a* and **130***b*. The liquid crystal panel **110** is attached on and fixed to the first and second guide portions **130***a* and **130***b*.

[0053] Since there is no main frame along the third and fourth edges of the liquid crystal panel **110**, a narrow bezel structure may minimize the non-display area of the LCD device.

[0054] The bottom edge surfaces of the liquid crystal panel **110** in the third and fourth edges are fixed to the side surface **153** of the bottom frame **150** using an adhesive such as glue, as described further with respect to FIG. **3**B. Accordingly, the liquid crystal panel **110** is securely assembled with the bottom frame **150** without a main frame along the third and fourth edges.

[0055] The main frame **130** may be referred to as a guide panel, a main support, or a mold frame, and the bottom frame **150** may be referred to as a cover bottom, a bottom cover, or a lower cover.

[0056] As illustrated above, the LCD device of the present invention does not require a top frame covering front edges of the liquid crystal panel **110**, which reduces the thickness and weight of the LCD device and simplifies the assembly process. In addition, the production costs of the LCD device are reduced.

[0057] Moreover, the display area of the LCD device is increased and the bezel (which is a non-display area of the LCD device) is decreased by eliminating the top frame. In other words, the LCD device is a narrow bezel LCD device.

[0058] The main frame **130** includes separated first and second guide portions **130***a* and **130***b* corresponding to the first and second edges of the liquid crystal panel **110** without portions corresponding to the third and fourth edges of the liquid crystal panel **110**. As a result, the bezel of the LCD device is further narrowed.

[0059] In addition, since the third and fourth edges of the liquid crystal panel **110** are attached and fixed to the side surfaces **153** of the bottom frame **150**, the LCD device is securely assembled.

[0060] FIG. **2** is a schematic perspective view of a main frame with a bottom frame.

[0061] As shown in FIG. **2**, the bottom frame **150** includes the horizontal surface **151** and first to fourth side surfaces **153***a* to **153***d* vertically protruding from the horizontal surface **151**. The first to fourth side surfaces **153***a* to **153***d* of the bottom frame **150** correspond to the first to fourth edges of the liquid crystal panel **110**, respectively.

[0062] The LED assembly **129** (of FIG. **1**) is positioned to correspond to the first side surface **153***a* and the first edge of the liquid crystal panel **110**. The first guide portion **130***a* of the main frame **130** is positioned on an inner side of the first side surface **153***a*, and the second guide portion **130***b* of the main frame is positioned on an inner side of the second side surface **153***b*.

[0063] The first guide portion **130***a* has a length corresponding to a length of the first side surface **153***a* of the bottom frame **150** and includes an LED guide groove **131** for the LED **129***a* (of FIG. **1**). Each LED **129***a* is inserted into each LED guide groove **131** such that three sides of the LED **129***a* are surrounded by the first guide portion **130***a*. The LED assembly **129** is attached on and fixed to the first guide portion **130***a*.

[0064] Namely, the LED **129** is arranged and mounted on a surface of the PCB **129***b* (of FIG. **1**) and is inserted into the LED groove **131** of the first guide portion **130***a*. The surface of the PCB **129***b*, where the LED **129** is arranged, is attached on and fixed to an upper surface of the first guide portion **130***a*.

[0065] As a result, the LED assembly **129** has a fixed position in the LCD device by the first guide portion **130***a*.

[0066] The second guide portion **130***b* has a length corresponding to a length of the second side surface **153***b* of the bottom frame **150**, and a protrusion **133**, which vertically protrudes from an upper surface of the second guide portion **130***b*, is positioned at both ends of the second guide portion **130***b*. The liquid crystal panel **110** is disposed on and supported by the protrusion **133**. The protrusion **133** has substantially the same thickness as the PCB **129***b* of the LED assembly **129**.

[0067] As illustrated above, the LED assembly **129** is attached to the first guide portion **130***a* by attaching the surface of the PCB **129***b*, where the LED **129***a* is arranged, to the upper surface of the first guide portion **130***a*, and the first edge of the liquid crystal panel **110** is attached to an opposite surface of the PCB **129***b* and supported by the LED assembly **129**. In addition, the second edge of the liquid crystal panel **110** is attached to and supported by the protrusion **133** of the second guide portion **130***b*. In this instance, the opposite surface (i.e., an upper surface) of the PCB **129***b* and the protrusion **133** have substantially the same height from the horizontal surface **151** of the bottom frame **150**. In addition, the first to fourth side surfaces **153***a* to **153***d* of the bottom frame **150** have substantially the same height from the horizontal surface **151** of the bottom frame **150** as the protrusion **133** and the PCB **129***b*. As a result, the liquid crystal panel **110** is securely attached and fixed to the PCB **129***b* and the protrusion **133** without an inclination or a gap. In other words, the opposite surface of the PCB **129***b* and the protrusion **133** form one horizontal plane.

[0068] The first and second guide portions **130***a* and **130***b*, which are separated from each other and respectively positioned at the first and second side surfaces **153***a* and **153***b* of the bottom frame **150**, form the main frame **130** without portions at the third and fourth side surfaces **153***c* and **153***c* of the bottom frame **150**. Accordingly, the non-display region at the third and fourth edges of the liquid crystal panel is minimized to provide a narrow bezel LCD device.

[0069] FIGS. **3**A and **3**B are cross-sectional views along the lines and III'-III' in FIG. **1**, respectively, according to a first embodiment of the present invention.

[0070] As shown in FIGS. **3**A and **3**B, in the LCD device, the reflective sheet **125**, the light guide plate **123**, the LED assembly **129**, which includes the LED **129***a* and the PCB **129***b* and is positioned at one side of the light guide plate **123**, and the optical sheet **121** on the light guide plate **123** constitute the backlight unit **120**. The liquid crystal panel **110**, which includes the first and second substrates **112** and **114** and the liquid crystal layer (not shown) therebetween, is

disposed over the backlight unit **120**. The first and second polarizing plates **119***a* and **119***b* for selectively transmitting light are positioned on respective outer sides of the first and second substrates **112** and **114**.

[0071] The sides of the backlight unit **120** and the liquid crystal panel **110** are surrounded by the main frame **130**, which includes the first and second guide portions **130***a* and **130***b*, and the bottom frame **150**, which covers a rear side of the backlight unit **120** and is attached to the main frame **130**.

[0072] As shown in FIG. **3**A, two opposite sides of the backlight unit **120** are surrounded by the main frame **130**, and the LED **129***a* of the LED assembly **129** is inserted into the guide groove **131** formed in the first guide portion **130***a* of the main frame **130** such that the light from the LED **129***a* is incident toward the light guide plate **123**. The PCB **129***b* is attached and fixed to the upper surface of the first guide portion **130***a* using an adhesive material such as double-faced tape.

[0073] The liquid crystal panel **110** is attached to and supported by the PCB **129***b*, the protrusion **133** of the second guide portion **130***b*, and an upper surface of each of the first to fourth side surfaces **153***a* to **153***d*.

[0074] As shown in FIG. **3**B, the other two opposite sides of the backlight unit **120** are surrounded by the third and fourth side surfaces **153***c* and **153***d* of the bottom frame **150** without the main frame **130**. The first side of the light guide plate **123** faces the LED **129***a* or the first guide portion **130***a* of the main frame **130**, and the second side of the light guide plate **123** faces the second guide portion **130***b* of the main frame **130**. The third and fourth sides of the light guide plate **123** face the third and fourth side surfaces **153***c* and **153***d* of the bottom frame **150**, respectively.

[0075] The liquid crystal panel **110**, which is attached and fixed to the PCB **129***b*, the protrusion **133** of the second guide portion **130***b*, and the upper surface of each of the first to fourth side surfaces **153***a* to **153***d*, has a size larger than the bottom frame **150** such that edges of the liquid crystal panel **110** protrude beyond the bottom frame **150**. Namely, the edges of the liquid crystal panel **110** protrude beyond the first to fourth side surfaces **153***a* to **153***d*. The rear edges of the liquid crystal panel **110** and an outer side of the side surfaces of the bottom frame **150** are attached by an adhesive **200** such as glue. For example, the adhesive **200** may be formed at the third and fourth side surfaces **153***c* and **153***d* but not at the first and second side surfaces **153***a* and **153***b* because there is no main frame **130** in the third and fourth side surfaces **153***c* and **153***d*.

[0076] Since the third and fourth edges of the liquid crystal panel **110** are attached to the third and fourth side surfaces **153***c* and **153***d* by the adhesive **200** without the main frame **130**, the assembly of the LCD device is secured and the bezel of the LCD device is decreased.

[0077] The positioning and/or coverage of the adhesive **200** in the third and fourth edges of the liquid crystal panel **110** are explained with respect to second and third embodiments.

[0078] FIG. **4** is a cross-sectional view along the line III'-III' in FIG. **1** of an LCD device according to a second embodiment of the present invention.

[0079] As shown in FIG. **4**, in the LCD device, the reflective sheet **125**, the light guide plate **123**, the LED assembly **129**, which includes the LED **129***a* and the PCB **129***b* and is positioned at one side of the light guide plate **123**, and the optical sheet **121** on the light guide plate **123** constitute the backlight unit **120**. The liquid crystal panel **110**, which includes the first and second substrates **112** and **114** and the liquid crystal layer (not shown) therebetween, is disposed over the backlight unit **120**. The first and second polarizing plates **119***a* and **119***b* for selectively transmitting light are positioned on outer sides of the first and second substrates **112** and **114**.

[0080] The sides of the backlight unit **120** and the liquid crystal panel **110** are surrounded by the main frame **130** (of FIG. **2**), which includes the first and second guide portions **130***a* and **130***b*, and the bottom frame **150**, which covers a rear side of the backlight unit **120** and is attached to the main frame **130**.

[0081] The liquid crystal panel **110** has a size larger than the bottom frame **150** such that edges of the liquid crystal panel **110** protrude beyond the bottom frame **150**. The protruding edges of the liquid crystal panel **110** and an outer side of the third and fourth side surfaces **153***c* and **153***d* of the bottom frame **150** are attached with an adhesive **200** such as glue. Namely, the protruding edges liquid crystal panel **110** are attached and fixed to the third and fourth side surfaces **153***c* and **153***d* of the bottom frame **150** by the adhesive **200**.

[0082] In the LCD device of the second embodiment, the adhesive **200** covers the side of the liquid crystal panel **110**. Namely, the adhesive **200** is formed to cover the side surface of the first and second substrates **112** and **114** of the liquid crystal panel **110**, the exposed rear edge of the first substrate **112**, the exposed rear edge of the first polarizing plate **119***a*, the side surface of the first polarizing plate **119***a*, and the outer side of the third and fourth side surfaces **153***c* and **153***d* of the bottom frame **150**.

[0083] The adhesive **200** has a black color and covers the side surface of the liquid crystal panel **110** such that light leakage from the side surface of the liquid crystal panel **110** is prevented or reduced due to the adhesive **200**. Namely, the adhesive **200** is formed of a material that is highly light absorbing.

[0084] In addition, since the area of the adhesive **200** in the second embodiment is increased relative to that of the adhesive **200** in the first embodiment (where the adhesive **200** covers the rear edge of the liquid crystal panel **110** except the side surface of the liquid crystal panel **110**), the adhesion of the adhesive **200** is improved to more securely attach the liquid crystal panel **110** to the bottom frame **150**.

[0085] In this instance, the thickness of the adhesive **200** at the side surface of the liquid crystal panel **110** is less than about 0.1 mm such that the resulting increase in the bezel of the LCD device is minimized without light leakage (and while maintaining secure assembly).

[0086] FIG. **5** is a cross-sectional view along the line III'-III' in FIG. **1** of an LCD device according to a third embodiment of the present invention.

[0087] As shown in FIG. **5**, in the LCD device, the reflective sheet **125**, the light guide plate **123**, the LED assembly **129**, which includes the LED **129***a* and the PCB **129***b* and is positioned at one side of the light guide plate **123**, and the optical sheet **121** on the light guide plate **123** constitute the backlight unit **120**. The liquid crystal panel **110**, which includes the first and second substrates **112** and **114** and the liquid crystal layer (not shown) therebetween, is disposed over the backlight unit **120**. The first and second

polarizing plates **119***a* and **119***b* for selectively transmitting light are positioned on outer sides of the first and second substrates **112** and **114**.

[0088] The sides of the backlight unit **120** and the liquid crystal panel **110** are surrounded by the main frame **130** (of FIG. **2**), which includes the first and second guide portions **130***a* and **130***b*, and the bottom frame **150**, which covers a rear side of the backlight unit **120** and is attached to the main frame **130**.

[0089] The liquid crystal panel **110** has a size larger than the bottom frame **150** such that edges of the liquid crystal panel **110** protrude beyond the bottom frame **150**. The protruding edges of the liquid crystal panel **110** and an outer side of the third and fourth side surfaces **153***c* and **153***d* of the bottom frame **150** are attached with an adhesive **200** such as glue. Namely, the protruding edges liquid crystal panel **110** are attached and fixed to the third and fourth side surfaces **153***c* and **153***d* of the bottom frame **150** by the adhesive **200**.

[0090] In the LCD device of the third embodiment, the second polarizing plate **119***b* at an outer side of the second substrate **114** of the liquid crystal panel **110** has a size larger than the liquid crystal panel **110**. Namely, a rear edge of the second polarizing plate **119***b* protrudes beyond the liquid crystal panel **110**. In this instance, the sides of the second polarizing plate **119***b* corresponding to the third and fourth side surfaces **153***c* and **153***d* of the bottom frame **150** protrude beyond the liquid crystal panel **110**, while the sides of the second polarizing plate **119***b* corresponding to the first and second side surfaces **153***a* and **153***b* of the bottom frame **150** may not protrude beyond the liquid crystal panel **110**. Namely, ends of the second polarizing plate **119***b* corresponding to the first and second side surfaces **153***a* and **153***b* of the bottom frame **150** may be positioned in the liquid crystal panel **110**. The adhesive **200** covers from the rear edge of the second polarizing plate **119***b* to the outer side of the third and fourth side surfaces **153***c* and **153***d* of the bottom frame **150**.

[0091] Namely, the adhesive **200** is formed to cover the rear edge of the second polarizing plate **119***b*, the side surface of the first and second substrates **112** and **114** of the liquid crystal panel **110**, the exposed rear edge of the first substrate **112**, the exposed rear edge of the first polarizing plate **119***a*, the side surface of the first polarizing plate **119***a*, and the outer side of the third and fourth side surfaces **153***c* and **153***d* of the bottom frame **150**.

[0092] The adhesive **200** has a black color and covers the side surface of the liquid crystal panel **110** such that light leakage from the side surface of the liquid crystal panel **110** is prevented or reduced due to the adhesive **200**.

[0093] In addition, since the area of the adhesive **200** in the third embodiment is increased relative to that of the adhesive **200** in the first embodiment (where the adhesive **200** covers the rear edge of the liquid crystal panel **110** except the side surface of the liquid crystal panel **110**), the liquid crystal panel **110** is more securely attached to the bottom frame **150**.

[0094] Moreover, since the exposed edge of the second polarizing plate **119***b* serves as a dam in the process of coating a liquid phase material for the adhesive **200**, the process efficiency for applying the adhesive **200** is improved.

[0095] Furthermore, since the second polarizing plate **119***b* has the larger size than the liquid crystal panel **110**, the end of the second polarizing plate **119***b* is not positioned in the display area of the liquid crystal panel **110**. Namely, the top frame covering front edges of the liquid crystal panel **110** and the front edges of the second polarizing plate **119***b* is unnecessary. As a result, the LCD device is a clear borderless type LCD device without a border between the image display screen and the frame.

[0096] As explained above, since the LCD device of the present invention does not require the top frame, a thin and light-weight LCD device is provided and the assembly process is simplified. Production costs are also reduced.

[0097] In addition, without the top frame, the display area is increased and the non-display area is decreased such that a narrow bezel LCD device is provided.

[0098] Moreover, the main frame **130** includes separated first and second guide portions **130***a* and **130***b* corresponding to the first and second edges of the liquid crystal panel **110** without portions corresponding to the third and fourth edges of the liquid crystal panel **110**. As a result, the bezel of the LCD device is further narrowed. The third and fourth edges of the liquid crystal panel **110** without the portions of the main frame **130** are attached and fixed to the third and fourth side surfaces **153***c* and **153***d* of the bottom frame **150** by the adhesive **200** for secure assembly of the LCD device.

[0099] Furthermore, the adhesive **200** has a black color and covers the side surface of the liquid crystal panel **110** such that light leakage from the side surface of the liquid crystal panel **110** is prevented or reduced due to the adhesive **200**. Since the second polarizing plate **119***b* has a larger size than the liquid crystal panel **110**, the process efficiency for applying the adhesive **200** is improved and a clear borderless type LCD device is provided.

[0100] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A liquid crystal display device, comprising:

a backlight unit;

a liquid crystal panel including first and second substrates, a liquid crystal layer between the first and second substrates;

a first polarizing plate between the first substrate and the backlight unit;

a bottom frame supporting the first polarizing plate; and

an adhesive securing a portion of the bottom frame to an edge of the first polarizing plate and to an edge of the first substrate.

2. The liquid crystal display device according to claim **1**, wherein the adhesive secures a lower surface and a side surface of the first polarizing plate to the portion of the bottom frame.

3. The liquid crystal display device according to claim **1**, wherein the adhesive secures a lower surface and a side surface of the first substrate to the portion of the bottom frame.

4. The liquid crystal display device according to claim **1**, wherein the adhesive further secures a side surface of the second substrate to the portion of the bottom frame.

5. The liquid crystal display device according to claim **1**, further comprising a second polarizing plate on an outer side

of the second substrate, wherein the adhesive further secures an edge of the second polarizing plate to the portion of the bottom frame.

6. The liquid crystal display device according to claim **1**, further comprising a second polarizing plate on an outer side of the second substrate, wherein an end of the second polarizing plate protrudes from the liquid crystal panel, and the adhesive further secures a lower surface of the end of the second polarizing plate to the portion of the bottom frame.

7. The liquid crystal display device according to claim **1**, further comprising a second polarizing plate on an outer side of the second substrate, wherein a first pair of opposite edges of the second polarizing plate protrude from the liquid crystal panel, and a second pair of opposite edges of the second polarizing plate are separated by a first distance less than a second distance between corresponding opposite edges of the liquid crystal panel, the first distance parallel to the second distance.

8. The liquid crystal display device according to claim **7**, wherein the adhesive covers the first pair of opposite edges of the second polarizing plate and exposes the second pair of opposite edges of the second polarizing plate.

9. The liquid crystal display device according to claim **1**, further comprising a main frame including first and second guide portions respectively corresponding to a first pair of opposite side surfaces of the bottom frame,

wherein the first pair of opposite side surfaces of the bottom frame face the first and second guide portions of the main frame, and a second pair of opposite side surfaces of the bottom frame face a light guide plate of the backlight unit, the second pair of opposite side surfaces including the portion of the bottom frame.

10. The liquid crystal display device according to claim **1**, wherein the adhesive covers a first side surface of the first polarizing plate and exposes a second side surface of the first polarizing plate.

* * * * *

专利名称(译)	液晶显示装置		
公开(公告)号	US20160306219A1	公开(公告)日	2016-10-20
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[标]申请(专利权)人(译)	乐金显示有限公司		
申请(专利权)人(译)	LG DISPLAY CO. , LTD.		
当前申请(专利权)人(译)	LG DISPLAY CO. , LTD.		
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发明人	JEONG, HAE-HYEON YANG, SEUNG-HOON KIM, WON-TAE KIM, MIN-WOO LEE, KWANG-MIN KIM, MI-RA		
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其他公开文献	US9715135		
外部链接	Espacenet USPTO		

摘要(译)

一种液晶显示装置，包括：液晶面板，包括第一和第二基板以及在所述第一和第二基板之间的液晶层;在所述液晶面板下方的背光单元;底框架，包括水平表面和第一，第二，第三和第四侧表面，所述第一侧表面对应于所述液晶面板的第一边缘并且与所述第二侧表面相对，其中所述液晶面板具有尺寸大于所述底部框架，使得所述液晶面板的一侧突出超过所述底部框架;主框架，包括与所述第一边缘对应的第一引导部分和与所述液晶面板的与所述第一边缘相对的第二边缘对应的第二引导部分;以及覆盖所述液晶面板的侧面和所述第三和第四侧面的外侧的粘合剂。