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(54) **Liquid crystal display**

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EP 2 105 786 B1

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Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority from and the benefit of Korean Patent Application No. 10-2008-0029090, filed on March 28, 2008.

BACKGROUND OF THE INVENTION

[0002] FIELD OF THE INVENTION

[0003] The present invention relates to a liquid crystal display.

[0004] DISCUSSION OF THE BACKGROUND

[0005] Liquid crystal displays (LCDs) are one of the most widely used flat panel displays, and an LCD includes a pair of panels provided with field-generating electrodes, such as pixel electrodes and a common electrode, and a liquid crystal (LC) layer disposed between the two panels. The LCD displays images when voltages are applied to the field-generating electrodes to generate an electric field in the LC layer, which determines the orientations of LC molecules therein, thereby adjusting the polarization of light incident thereto.

[0006] Among LCDs, a vertical alignment (VA) mode LCD, in which LC molecules are aligned such that the long axes of the LC molecules are perpendicular to the panels in the absence of an electric field, has been developed.

[0007] In a VA mode LCD, a wide viewing angle can be realized due to cutouts, such as slits in the field-generating electrodes and protrusions on the field-generating electrodes. Since the cutouts and protrusions may determine the tilt directions of the LC molecules, the tilt directions may be distributed in several directions using the cutouts and protrusions, thereby widening the reference viewing angle.

[0008] Also, a method for pretilting LC molecules in the absence of an electric field has been developed to improve the response speed of the LC molecules while realizing a wide viewing angle. For the LC molecules to pretilt in various directions, alignment layers having various alignment directions may be used. Alternatively, the LC layer may be subjected to an electric field and a thermal or light-hardened material may be added. Then light may be irradiated onto the LC layer to harden the thermal or light-hardening material, thereby pretilting the LC molecules.

[0009] However, the VA mode liquid crystal display may have lower side visibility compared with front visibility. To improve the side visibility, one pixel may be divided into two subpixels and different voltages may be applied to the subpixels.

[0010] VA mode LCD devices with improved side visibility are disclosed in US 2008/0018573, US 2006/0164352 and US 2007/0097279.

SUMMARY OF THE INVENTION

[0011] The present invention provides a liquid crystal display that may have a wide viewing angle and a fast response speed, as well as excellent visibility and transmittance.

[0012] Additional features 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.

[0013] The present invention provides a liquid crystal display according to appended claim 1.

[0014] Preferably the liquid crystal display provided by the present invention includes the features of appended dependent claims 2-37.

[0015] 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

[0016] The accompanying drawings together with the description serve to explain the principles of the invention.

[0017] FIG. 1 is an equivalent circuit diagram of one pixel in a liquid crystal display according to an exemplary embodiment of the present invention.

[0018] FIG. 2 is a layout view of a liquid crystal display according to an exemplary embodiment of the present invention.

[0019] FIG. 3 is a cross-sectional view of the liquid crystal display shown in FIG. 2 taken along line III-III.

[0020] FIG. 4 is a layout view of the liquid crystal display shown in FIG. 2 without the pixel electrode.

[0021] FIG. 5 is a top plan view showing the pixel electrode of the liquid crystal display show in FIG. 2.

[0022] FIG. 6 is a top plan view of a basic electrode of the pixel electrode according to an exemplary embodiment of the present invention.

[0023] FIG. 7 is an enlarged view of the portion of the basic electrode shown in FIG. 6.

[0024] FIG. 8 is a view showing a process of pretilting liquid crystal molecules using prepolymers polarized by light such as ultraviolet rays.

[0025] FIG. 9 and FIG. 12 are layout views of a liquid crystal display not according to the present invention and FIG. 15 is a layout view of a liquid crystal display according to another exemplary embodiment of the present invention.

[0026] FIG. 10, FIG. 13, and FIG. 16 are layout views of the liquid crystal displays shown in FIG. 9, FIG. 12, and FIG. 15 without the pixel electrodes.

[0027] FIG. 11, FIG. 14, and FIG. 17 are top plan views of the pixel electrodes in the liquid crystal displays shown in FIG. 9, FIG. 12, and FIG. 15.

[0028] FIG. 18 is a top plan view of a portion of a pixel electrode in a liquid crystal display according to another

exemplary embodiment of the present invention.

[0029] FIG. 19 is a top plan view of the portion of the pixel electrode shown in FIG. 18.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

[0030] The invention is described more fully hereinafter with reference to the accompanying drawings, in which 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. Rather, these embodiments are provided so that this disclosure is thorough, and will fully convey the scope of the invention to those skilled in the art. In the drawings, the size and relative sizes of layers and regions may be exaggerated for clarity. Like reference numerals in the drawings denote like elements.

[0031] It will be understood that when an element or layer is referred to as being "on" or "connected to" another element or layer, it can be directly on or directly connected to the other element or layer, or intervening elements or layers may be present. In contrast, when an element is referred to as being "directly on" or "directly connected to" another element or layer, there are no intervening elements or layers present.

[0032] FIG. 1 is an equivalent circuit diagram of one pixel in a liquid crystal display according to an exemplary embodiment of the present invention.

[0033] Referring to FIG. 1, a liquid crystal display according to an exemplary embodiment of the present invention includes signal lines, which include a plurality of gate lines GL, a plurality of pairs of data lines DLa and DLb, and a plurality of storage electrode lines SL, and a plurality of pixels PX connected to the signal lines. The liquid crystal display includes a lower panel 100 and an upper panel 200 facing each other, and a liquid crystal layer 3 disposed therebetween.

[0034] Each pixel PX includes a pair of subpixels PXa and PXb. Each subpixel PXa/PXb includes a switching element Qa/Qb, a liquid crystal capacitor Clca/Clcb, and a storage capacitor Csta/Cstb.

[0035] Each switching element Qa/Qb is a three-terminal element, such as a thin film transistor, provided on a lower panel 100 and including a control terminal connected to the gate line GL, an input terminal connected to the data line DLa/DLb, and an output terminal connected to the liquid crystal capacitor Clca/Clcb and the storage capacitor Csta/Cstb.

[0036] The liquid crystal capacitor Clca/Clcb uses a subpixel electrode and a common electrode 270 as two terminals. The liquid crystal layer 3 between the electrodes 191a/191b and 270 functions as a dielectric material.

[0037] The storage capacitor Csta/Cstb serving as an assistant to the liquid crystal capacitor Clca/Clcb includes a storage electrode line SL on the lower display panel 100, a subpixel electrode 191a/191b overlapping the storage electrode line, and an insulator disposed therebetween. A voltage, such as a common voltage Vcom, is applied to the storage electrode line SL.

[0038] A difference is generated between the voltages charged to two liquid crystal capacitors Clca and Clcb. For example, the data voltage applied to the liquid crystal capacitor Clca may less than or greater than the data voltage applied to the liquid crystal capacitor Clcb. Therefore, when the voltages of the first and second liquid crystal capacitors Clca and Clcb are appropriately adjusted, it may be possible to make an image viewed from the side as similar as possible to an image viewed from the front, thereby improving the side visibility.

[0039] Next, a liquid crystal display according to an exemplary embodiment of the present invention will be described in detail with reference to FIG. 2, FIG. 3, FIG. 4, FIG. 5, FIG. 6, and FIG. 7.

[0040] FIG. 2 is a layout view of a liquid crystal display according to an exemplary embodiment of the present invention, FIG. 3 is a cross-sectional view of the liquid crystal display shown in FIG. 2 taken along line III-III, FIG. 4 is a layout view of the liquid crystal display shown in FIG. 2 without the pixel electrode, FIG. 5 is a top plan view showing the pixel electrode of the liquid crystal display show in FIG. 2, FIG. 6 is a top plan view of a basic electrode of the pixel electrode according to an exemplary embodiment of the present invention, and FIG. 7 is an enlarged view of a portion of the basic electrode shown in FIG. 6.

[0041] Referring to FIG. 2 and FIG. 3, a liquid crystal display according to an exemplary embodiment of the present invention includes a lower panel 100 and an upper panel 200 facing each other, and a liquid crystal layer 3 disposed between the two panels 100 and 200.

[0042] First, the lower panel 100 will be described.

[0043] A plurality of gate lines 121 and a plurality of storage electrode lines 131 are formed on an insulating substrate 110.

[0044] The gate lines 121 transmit gate signals and extend in a transverse direction. Each gate line 121 includes a plurality of first and second gate electrodes 124a and 124b protruding upward.

[0045] The storage electrode lines 131 include a stem extending substantially parallel to the gate lines 121, and a plurality of branches extending from the stem. Each branch includes a longitudinal portion 137, a loop 135, a first storage electrode 133a, and a second storage electrode 133b.

[0046] The longitudinal portion 137 extends upward and downward from the stem (hereinafter, an imaginary straight line in the direction in which the longitudinal portion 137 extends is referred to as a "longitudinal center line").

[0047] The loop 135 may be substantially rectangular, and the upper edge thereof vertically may meet the longitudinal portion 137.

[0048] The first storage electrode 133a extends in a transverse direction from the center of the left edge of

the loop 135 to the center of the right edge, and may have a wider width than the longitudinal portion 137 or the loop 135. The first storage electrode 133a and the longitudinal portion 137 vertically meet each other.

[0049] The left edge of the loop 135 extends downward and curves to the right to form the second storage electrode 133b. The width of the second storage electrode 133b is expanded and extends substantially parallel to the first storage electrode 133a in the transverse direction.

[0050] However, the shapes and arrangement of the storage electrode lines 131 may be modified in various forms.

[0051] A gate insulating layer 140 is formed on the gate lines 121 and the storage electrode lines 131 and a plurality of semiconductors 154a and 154b, which may be made of amorphous or crystallized silicon, are formed on the gate insulating layer 140.

[0052] A pair of ohmic contacts 163b and 165b are formed on the first semiconductor 154b, and the ohmic contacts 163b and 165b may be formed of a material such as n+ hydrogenated amorphous silicon in which an n-type impurity is doped with a high concentration or silicide.

[0053] A pair of data lines 171a and 171b and a plurality of first and second drain electrodes 175a and 175b are formed on the ohmic contacts 163b and 165b, and on the gate insulating layer 140.

[0054] The data lines 171a and 171b transmit data signals, extend substantially in the longitudinal direction, and cross the gate lines 121 and the storage electrode lines 131. Each data line 171a/171b includes a plurality of first/second source electrode 173a/173b extending toward the first/second gate electrode 124a/124b and curving with a "U" shape, and the first/ second source electrode 173a/173b is opposite the first/second drain electrode 175a/175b with respect to the first/second gate electrode 124a/124b.

[0055] Each first drain electrode 175a has one end enclosed by the first source electrode 173a from which it extends upward, curves to the left following the upper edge of the second storage electrode 133b, and again extends upward near the longitudinal center line to form the other end. The other end of the first drain electrode 175a extends to where the second storage electrode 133b is disposed, and has a wide area for connection with another layer.

[0056] Each second drain electrode 175b has one end enclosed by the second source electrode 173b from which it extends upward to the second storage electrode 133b, curves to the right, extends following the lower edge of the second storage electrode 133b, expands with a wide area near the longitudinal center line, and again extends downward to form a longitudinal portion 176.

[0057] However, the shapes and arrangement of the first and second drain electrodes 175a and 175b and the data lines 171a and 171 b may be modified in various ways.

[0058] A first/second gate electrode 124a/124b, a first/second source electrode 173a/173b, and a first/second drain electrode 175a/175b respectively form a first/second thin film transistor (TFT) Qa/Qb along with a first/second semiconductor 154a/154b, and a channel of the first /second thin film transistor Qa/Qb is formed on the first/second semiconductor 154a/154b between the first/second source electrode 173a/173b and the first/second drain electrode 175a/175b.

[0059] The ohmic contacts 163b and 165b are disposed only between the underlying semiconductor islands 154a and 154b and the overlying data lines 171a and 171b and drain electrodes 175a and 175b, and may reduce contact resistance between them. The semiconductors 154a and 154b each have a portion that is exposed without being covered by the data lines 171a and 171b and the drain electrodes 175a and 175b, and a portion between the source electrodes 173a and 173b and the drain electrodes 175a and 175b.

[0060] A lower passivation layer 180p, which may be made of silicon nitride or silicon oxide, is formed on the data lines 171a and 171b, the drain electrodes 175a and 175b, and the exposed portions of the semiconductors 154a and 154b.

[0061] A black matrix including a plurality of light blocking members 220 spaced at intervals from each other is formed on the lower passivation layer 180p. Each light blocking member 220 may include a stripe portion extending upward and downward, and a quadrangle portion corresponding to the thin film transistor to prevent light leakage.

[0062] A plurality of color filters 230 are formed on the lower passivation layer 180p and the light blocking members 220. The color filters 230 are mostly formed in a region surrounded by light blocking members 220. The color filters 230 have a plurality of holes 235a and 235b disposed on the first and second drain electrodes 175a and 175b, and a plurality of openings 233a and 233b disposed on the first and second storage electrodes 133a and 133b, respectively. The opening 233a and 233b reduce the thickness of the dielectric material forming the storage capacitors Csta and Cstb such that the storage capacitance may be increased.

[0063] Here, the lower passivation layer 180p may prevent pigments of the color filter 230 from flowing into the exposed semiconductors 154a and 154b.

[0064] An upper passivation layer 180q is formed on the light blocking members 220 and the color filters 230. The upper passivation layer 180q may be made of an inorganic insulating material, such as silicon nitride or silicon oxide, and may prevent the color filters 230 from lifting and suppress the contamination of the liquid crystal layer 3 by the organic material, such as a solvent flowing from the color filters 230, so defects generated during driving, such as an afterimage, may be prevented.

[0065] However, at least one of the light blocking members 220 and the color filters 230 may be disposed on the upper panel 200, and one of the lower passivation

layer 180p and the upper passivation layer 180q of the lower panel 100 may be omitted in this case.

[0066] The upper passivation layer 180q and the lower passivation layer 180p have a plurality of contact holes 185a and 185b respectively exposing the first and second drain electrodes 175a and 175b.

[0067] A plurality of pixel electrodes 191 is formed on the upper passivation layer 180q, and the above-described color filters 230 may extend according to a column of the pixel electrodes 191.

[0068] Referring to FIG. 5, each pixel electrode 191 includes the first and second subpixel electrodes 191 a and 191 b that are spaced apart from each other with a gap 91 having a quadrangular belt shape therebetween, and the first and second subpixel electrodes 191a and 191b respectively include a basic electrode 199 shown in FIG. 6, or at least one modification thereof.

[0069] Next, the basic electrode 199 will be described in detail with reference to FIG. 6.

[0070] As shown in FIG. 6, the basic electrode 199 may be a quadrangle and may include a cross-shaped stem having a transverse stem 193 that crosses a longitudinal stem 192. Also, the basic electrode 199 is divided into a first subregion Da, a second subregion Db, a third subregion Dc, and a fourth subregion Dd by the transverse stem 193 and the longitudinal stem 192, and each subregion Da-Dd includes a plurality of first, second, third, and fourth branches 194a, 194b, 194c, and 194d.

[0071] The first branch 194a extends obliquely from the transverse stem 193 or the longitudinal stem 192 in the upper-left direction, as shown in FIG. 7, and the second branch 194b extends obliquely from the transverse stem 193 or the longitudinal stem 192 in the upper-right direction. Also, the third branch 194c extends obliquely from the transverse stem 193 or the longitudinal stem 192 in the lower-left direction, and the fourth branch 194d extends obliquely from the transverse stem 193 or the longitudinal stem 192 in the lower-right direction.

[0072] The first, second, third, and fourth branches 194a, 194b, 194c, and 194d form an angle of about 45 degrees or 135 degrees with the gate lines 121 or the transverse stem 193. Also, the branches 194a, 194b, 194c, and 194d of two neighboring subregions Da, Db, Dc, and Dd may be crossed.

[0073] The width of the branches 194a, 194b, 194c, and 194d may be in the range of 2.5 μm to 5.0 μm, and the interval between the neighboring branches 194a, 194b, 194c, and 194d in one subregion Da, Db, Dc, and Dd may be in the range of 2.5 μm to 5.0 μm.

[0074] Also, referring to FIG. 7, the width of the branches 194a, 194b, 194c, and 194d may become wider approaching the transverse stem 193 or the longitudinal stem 192, and the difference between the widest width and the narrowest width in one of the branches 194a, 194b, 194c, and 194d may be in the range of 0.2 μm to 1.5 μm.

[0075] Again, referring to FIG. 2, FIG. 3, FIG. 4, and FIG. 5, the first subpixel electrode 191a includes one basic electrode 199 as shown in FIG. 6. The transverse stem 193 of the basic electrode 199 forming the first subpixel electrode 191a expands downward and upward to form a first expansion 193a, and the first expansion 193a overlaps the first storage electrode 133a. Also, the protrusion that protrudes downward to contact the first drain electrode 175a is formed in the center of the downward edge of the first expansion 193a.

[0076] The second subpixel electrode 191b includes an upper electrode 191bu and a lower electrode 191bb, and each of the upper electrode 191bu and the lower electrode 191bb includes one basic electrode 199. The upper electrode 191bu and the lower electrode 191bb are connected to each other through left and right connections 195b.

[0077] The second subpixel electrode 191b encloses the first subpixel electrode 191a with the gap 91 therebetween. A portion of the center of the transverse stem of the lower electrode 191bb extends upward and downward to form a second expansion 193bb overlapping the second storage electrode 133b. Also, the protrusion that protrudes downward to contact the second drain electrode 175b is formed in the center of the downward edge of the second expansion 193bb.

[0078] The area of the second subpixel electrode 191b may be about 1.0 to 2.2 times the area of the first subpixel electrode 191 a.

[0079] Each first/second subpixel electrode 191a/191b is connected to the first/second drain electrode 175a/175b through the contact hole 185a/185b, and receives data voltages from the first/second drain electrode 175a/175b.

[0080] On the other hand, the upper electrode 191bu may receive the data voltages directly from the second drain electrode 175b. In this case, the second drain electrode 175b extends to the upper electrode 191 bu, and a contact hole (not shown) through which the upper electrode 191bu contacts the second drain electrode 175b is required. In this case, the left and right connections 195b are not necessary.

[0081] An alignment layer 11 is formed on the pixel electrodes 191.

[0082] Next, the upper panel 200 will be described.

[0083] A common electrode 270 is formed on an insulating substrate 210, and an alignment layer 21 is formed thereon.

[0084] Each alignment layer 11 and 21 may be a vertical alignment layer.

[0085] Finally, polarizers (not shown) may be provided on the outer surface of the display panels 100 and 200.

[0086] The liquid crystal layer 3 disposed between the lower panel 100 and the upper panel 200 includes liquid crystal molecules 310 and polymers 350 and 370 having negative dielectric anisotropy.

[0087] The liquid crystal molecules 310 are pretilted by the polymers 350 and 370 for the long axis thereof to be parallel to the directions in which the first, second, third, and fourth branches 194a, 194b, 194c, and 194d

of the first and second subpixel electrode 191a and 191b extend, and are aligned vertically with respect to the surface of the two panels 100 and 200. Accordingly, the first and second subpixels PXa and PXb each include four subregions Da, Db, Dc, and Dd in which the liquid crystal molecules 310 are pretilted in different directions.

[0088] If the gate lines 121 are applied with the gate signals, the data voltage is applied to the first and second subpixel electrodes 191a and 191b through the data lines 171a and 171b. Then, the first and second subpixel electrodes 191a and 191b receive the data voltage and the common electrode 270 receives the common voltage, thereby generating an electric field in the liquid crystal layer 3. Accordingly, the liquid crystal molecules 310 of the liquid crystal layer 3 are arranged in response to the electric field such that the major axes of the liquid crystal molecules 310 change direction to be perpendicular to the direction of the electric field. The degree to which the polarization of light incident to the liquid crystal layer 3 changes depends on the inclination degree of the liquid crystal molecules 310, and the change in the polarization is represented by a change in the transmittance by a polarizer, thereby causing the liquid crystal display to display an image.

[0089] On the other hand, the edges of the branches 194a, 194b, 194c, and 194d distort the electric field to make the horizontal components perpendicular to the edges of the branches 194a, 194b, 194c, and 194d, and the alignment of the liquid crystal molecules 310 is determined by the horizontal components. Accordingly, the liquid crystal molecules 310 first tend to tilt in a direction perpendicular to the edges of the branches 194a, 194b, 194c, and 194d. However, the directions of the horizontal components of the electric field by the neighboring branches 194a, 194b, 194c, and 194d are opposite to each other and the intervals between the branches 194a, 194b, 194c, and 194d are narrow such that the liquid crystal molecules 310, which tend to arrange in opposite directions, are tilted in the direction parallel to the directions in which the branches 194a, 194b, 194c, and 194d extend. Accordingly, if the liquid crystal molecules 310 are not initially pretilted in the direction in which the branches 194a, 194b, 194c, and 194d extend, the liquid crystal molecules 310 may be tilted in the directions in which the branches 194a, 194b, 194c, and 194d extend through two steps. However, in the present exemplary embodiment, the liquid crystal molecules 310 are already pretilted in a direction parallel to the directions of in which branches 194a, 194b, 194c, and 194d extend so the liquid crystal molecules 310 are pretilted in one step. Therefore, if the liquid crystal molecules 310 are pretilted, they may be tilted in the required direction in one step such that the response speed of the liquid crystal display may be improved.

[0090] Also, in an exemplary embodiment of the present invention, the branches 194a, 194b, 194c, and 194d extend in different directions in one pixel PX such that the the liquid crystal molecules 310 are inclined in four directions. Therefore, the viewing angle of the liquid crystal display may be widened by varying the inclined directions of the liquid crystal molecules.

[0091] The first/second sub-pixel electrode 191a/191b and the common electrode 270 form the liquid crystal capacitor Clca/Clcb to maintain an applied voltage even after the TFT is turned off. Also, the first and second storage electrodes 133a and 133b of the storage electrode line 131 respectively overlap the first and second subpixel electrodes 191a and 191b in the openings 188a and 188b to form the storage capacitors Csta and Cstb.

[0092] The loop 135 of the storage electrode line 131 overlaps the gap 91 of the pixel electrode 191 such that it functions as a shielding member to block light leakage between the first subpixel electrode 191a and the second subpixel electrode 191b. The loop 135 disposed between the data lines 171a and 171b, and the first subpixel electrode 191a, may prevent crosstalk, which may reduce degradation of the display quality.

[0093] Also, in the structure of pixel electrode 191 in an exemplary embodiment of the present invention, the alignment of the liquid crystal molecules 310 may not be controlled near the longitudinal and the transverse stems of the first and second subpixel electrodes 191a and 191b so texture may be generated. Accordingly, the storage electrode line 131, the longitudinal portion 137 of the storage electrode line 131, and the first and second storage electrodes 133a and 133b overlap the transverse stem or the longitudinal stem of the first and second subpixel electrodes 191a and 191b such that the texture may be covered, so the aperture ratio may be increased.

[0094] On the other hand, the first subpixel electrode 191a and the second subpixel electrode 191b are applied with different data voltages through the different data lines 171a and 171b, and the voltage of the first subpixel electrode 191a having a relatively small area is higher than the voltage of the second subpixel electrode 191b having a relatively large area.

[0095] In this way, if the voltages of the first sub-pixel electrode 191 a and the second sub-pixel electrode 191b are different from each other, the voltage applied to the first liquid crystal capacitor Clca formed between the first sub-pixel electrode 191a and the common electrode 270 and the voltage applied to the second liquid crystal capacitor Clcb formed between the second sub-pixel electrode 191b and the common electrode 270 are different from each other such that the declination angle of the liquid crystal molecules of the subpixels PXa and PXb are different from each other, and as a result the luminance of the two subpixels become different. Accordingly, if the voltages of the first and second liquid crystal capacitors Clca and Clcb are appropriately controlled, the images shown at the side may be approximate to the image shown at the front, that is to say, the gamma curve of the side may be approximately close to the gamma curve of the front, which may improve the side visibility.

[0096] Also, in an exemplary embodiment of the present invention, if the first subpixel electrode 191a ap-

plied with the higher voltage is disposed in the center of the pixel PX, the first subpixel electrode 191a is father apart from the gate line 121 such that an overlapping portion therebetween is not generated, which may reduce a kick-back voltage and remove flicker.

[0097] Next, the alignment method for initially pretilting liquid crystal molecules 310 will be described with reference to FIG. 8.

[0098] FIG. 8 is a view showing a process for pretilting liquid crystal molecules using prepolymers, which are polymerized by light such as ultraviolet rays.

[0099] First, prepolymers 330, such monomers, which are hardened through polymerization by light such as ultraviolet rays, are inserted between the two display panels 100 and 200 along with the liquid crystal material. The prepolymers 330 may include reactive mesogen that is polymerized by light, such as ultraviolet rays.

[0100] Next, the first and second subpixel electrodes 191a and 191b receive the data voltages and the common electrode 270 of the upper panel 200 receives the common voltage to generate an electric field to the liquid crystal layer 3 between two display panels 100 and 200. Thus, the liquid crystal molecules 310 of the liquid crystal layer 3 are inclined in a direction parallel to the length direction of the branches 194a, 194b, 194c, and 194d through two steps, as above-described, in response to the electric field, and the liquid crystal molecules 310 in one pixel PX are inclined in a total of four directions.

[0101] If the liquid crystal layer 3 is irradiated, for example, with ultraviolet rays, after the application of the electric field to the liquid crystal layer 3, the prepolymers 330 are polymerized such that the first polymer 350 and the second polymer 370 are formed as shown in FIG. 8.

[0102] The first polymer 350 is formed in the liquid crystal layer 3, and the second polymer 370 is formed close to the display panels 100 and 200. The liquid crystal molecules 310 are pretilted in the directions in which the branches 194a, 194b, 194c, and 194d extend by the first and second polymers 350 and 370.

[0103] Accordingly, the liquid crystal molecules 310 are arranged to pretilt in four different directions when no voltage is applied to the electrodes 191 and 270.

[0104] Next, an exemple not according to the present invention will be described with the reference to FIG. 9, FIG. 10, and FIG. 11.

[0105] FIG. 9 is a layout view of a liquid crystal display not according to the present invention, FIG. 10 is a layout view of the liquid crystal display shown in FIG. 9 without the pixel electrode, and FIG. 11 is a top plan view showing the pixel electrode of the liquid crystal display shown in FIG. 9.

[0106] The layered structure of the liquid crystal display according to the present exemple is almost the same as the layered structure of the liquid crystal display shown in FIG. 2, FIG. 3, FIG. 4, and FIG. 5.

[0107] Referring to FIG. 9, FIG. 10, and FIG. 11, the storage electrode line 131 includes left and right longitudinal portions 138 extending downward from the storage electrode line 131, and a storage electrode 133 protruding in the right direction from the left longitudinal portion 138. The storage electrode 133 has the wider width than that of the other portion for overlapping with a pixel electrode 191 to be described below.

[0108] The first drain electrode 175a includes one end having a wide area extending a long distance upward, and the second drain electrode 175b includes one end having a wide area extending a short distance upward.

[0109] The color filters (not shown) have through holes 235a and 235b where contact holes 185a and 185b pass through and an opening 233 disposed on the storage electrode 133, and an upper passivation layer (not shown) and a lower passivation layer (not shown) have a plurality of contact holes 185a and 185b to expose the first and second drain electrodes 175a and 175b.

[0110] The pixel electrode 191 according to the present exemple also includes first and second subpixel electrodes 191a and 191b that are spaced apart from each other with a gap 91 having a quadrangular belt shape, like the exemplary embodiment shown in FIG. 2, FIG. 3, FIG. 4, and FIG. 5.

[0111] The first subpixel electrode 191a is made of one basic electrode 199, as shown in FIG. 6. A transverse stem of the first subpixel electrode 191 a expands upward and downward to form an expansion 193c, and the expansion 193c overlaps the storage electrode 133 in an opening 233 to form a storage capacitor Csta.

[0112] The second subpixel electrode 191b includes one basic electrode 199, and a connection bridge 196b enclosing the first subpixel electrode 191 a, which is disposed below the second subpixel electrode 191b with a gap 91 therebetween.

[0113] The left lower portion of the connection bridge 196b protrudes to the right with a wide area to contact the second drain electrode 175b. As shown in FIG. 9, the second subpixel electrode 191b receives data voltages from the second drain electrode 175b through the connection bridge 196b.

[0114] The lower transverse edge of the connection bridge 196b overlaps a portion of the gate line 121 to prevent the first subpixel electrode 191a from being influenced by the gate signals of the gate lines 121.

[0115] Both longitudinal edges of the connection bridge 196b cover the data lines 171a and 171 b to prevent cross talk between the data signal and the first subpixel electrode 191a.

[0116] The width of the connection bridge 196b may be in the range of 5.0 μm to 15 μm.

[0117] The storage electrode line 131 overlaps the gap 91 of the pixel electrode 191 to block light leakage between the first subpixel electrode 191a and the second subpixel electrode 191b. Also, the right and left longitudinal portions 138 of the storage electrode line 131 are disposed between the first subpixel electrode 191a and the data lines 171 a and 171 b, to prevent cross talk between the data lines 171a and 171b and the first subpixel electrode 191a.

[0118] The area of the second subpixel electrode 191b may be about 1.25 to 2.75 times the area of the first subpixel electrode 191 a.

[0119] Unlike the above-described exemplary embodiment, according to the present exemple, the first/second drain electrode 175a/175b do not overlap the second/first subpixel electrode 191b/191a that receive data voltages having different polarities from each other, but instead overlap only the first/second subpixel electrode 191a/191b that receive data voltages having the same polarity such that a texture due to distortion of the electric field is not generated near the first and second drain electrodes 175a and 175b even though the first and second data lines 171a and 171b receive data voltages of opposite polarities. Accordingly, texture may be prevented, which may increase transmittance.

[0120] Also, according to the present exemple, the contact holes 185a and 185b are disposed at edges or corners of the first and second subpixel electrodes 191a and 191b so that it may be easy to form color filters (not shown) by an inkjet printing process.

[0121] Like the above described exemplary embodiment, the liquid crystal molecules are inclined in four directions such that the viewing angle of the liquid crystal display may be increased, and the liquid crystal molecules are pretilted through the polymerization of the prepolymer such that the response speed may be improved. Also, the first and second subpixel electrodes 191a and 191b receive different data voltages, which may improve side visibility.

[0122] Next, another exemple not according to the present invention will be described with reference to FIG. 12, FIG. 13, and FIG. 14.

[0123] FIG. 12 is a layout view of a liquid crystal display not according to the present invention, FIG. 13 is a layout view of the liquid crystal display shown in FIG. 12 without the pixel electrode, and FIG. 14 is a top plan view showing the pixel electrode of the liquid crystal display shown in FIG. 12.

[0124] A liquid crystal display according to the present exemple is almost the same as the liquid crystal display shown in FIG. 9, FIG. 10, and FIG. 11.

[0125] Referring to FIG. 12, FIG. 13, and FIG. 14, the wide end portion of the first drain electrode 175a to apply the data voltage to the first subpixel electrode 191a is disposed at the right lower corner of the first subpixel PXa, and is connected to the first subpixel electrode 191a through the contact hole 185a. Accordingly, when forming the color filter (not shown) through an inkjet printing process, the process may be easily executed and the transmittance may be improved.

[0126] Also, the storage electrodes and the openings having a wide area to form the storage capacitors Csta and Cstb do not exist in the present exemple, which may increase the aperture ratio.

[0127] Next, another exemplary embodiment of the present invention will be described with reference to FIG. 15, FIG. 16, and FIG. 17.

[0128] FIG. 15 is a layout view of a liquid crystal display according to another exemplary embodiment of the present invention, FIG. 16 is a layout view of the liquid crystal display shown in FIG. 15 except for the pixel electrode, and FIG. 17 is a top plan view showing the pixel electrode of the liquid crystal display shown in FIG. 15.

[0129] The layered structure of the liquid crystal display according to the present exemplary embodiment is almost the same as the layered structure of the liquid crystal display shown in FIG. 2, FIG. 3, FIG. 4, and FIG. 5.

[0130] Referring to FIG. 15, FIG. 16, and FIG. 17, the storage electrode line 131 includes left and right longitudinal portions 139 that extend upward and downward from the storage electrode line 131, a transverse connection 132 connected between two longitudinal portions 139, and a storage electrode 133c protruding from the center of the transverse connection 132 to the lower direction and having a wide area.

[0131] The color filters (not shown) have through holes 235a and 235b where contact holes 185a and 185b pass through, and an opening 233 disposed on the storage electrode 133c, and an upper passivation layer (not shown) and a lower passivation layer (not shown) have a plurality of contact holes 185a and 185b exposing the first and second drain electrodes 175a and 175b.

[0132] The pixel electrode 191 also includes the first and second subpixel electrodes 191a and 191 b that are spaced apart from each other with a gap 91 having a quadrangular belt shape.

[0133] The second subpixel electrode 191b includes an upper electrode 191 bu and a lower electrode 191 bb, and the upper electrode 191 bu and the lower electrode 191 bb are connected through left and right connections 195b.

[0134] Two longitudinal portions 139 of the storage electrode line 131 overlap the gap 91 to block light leakage between the first subpixel electrode 191a and the second subpixel electrode 191 b and prevent cross talk between the first subpixel electrode 191a and the data lines 171 a and 171 b. Also, the transverse connection 132 of the storage electrode line 131 covers the texture near the transverse stem 193d of the first subpixel electrode 191a, which may improve the aperture ratio.

[0135] In the present exemplary embodiment, different from the exemplary embodiment shown in FIG. 2, FIG. 3, FIG. 4, and FIG. 5, a transverse stem 193du of the upper electrode 191 bu is not disposed on the center of the upper electrode 191 bu, but is near the upper edge, and the transverse stem 193db of the lower electrode 191 bb is disposed near the lower edge of the lower electrode 191bb. Accordingly, as for each of the upper and lower electrodes 191bu and 191bb, two subregions among four subregions Da, Db, Dc, and Dd of the basic electrode 199 of FIG. 6 as above-described almost disappear and remain as dummies. However, all of the subregions Da, Db, Dc, and Dd still exist in the second subpixel electrode 191b such that the liquid crystal molecules 310 may be inclined in four directions.

[0136] In this case, the area of the two remaining subregions Dc and Dd of the upper electrode 191bu may be more than 1.5 times the area of the two subregions Da and Db, which become small. The area of the two remaining subregions Da and Db of the lower electrode 191bb may be more than 1.5 times the area of the two subregions Dc and Dd, which may become small.

[0137] Also, the length between the upper edge and the lower edge of the two subregions Da and Db of the upper electrode 191bu or two subregions Dc and Dd of the lower electrode 191 bb, which may become small, may be about 5 μm.

[0138] Like the present exemplary embodiment, two subregions Da and Db of the upper electrode 191bu or two subregions Dc and Dd of the lower electrode 191bb overlap the gate line 121 as dummies such that the aperture ratio and the transmittance may be increased and texture may be covered near the transverse stems 193du and 193db.

[0139] The reason why the two subregions Da and Dd, which are almost eliminated but remain as dummies, will be described with reference to FIG. 18 and FIG. 19.

[0140] FIG. 18 is a top plan view of a portion of a pixel electrode in a liquid crystal display according to another exemplary embodiment of the present invention, and FIG. 19 is a top plan view of the portion of the pixel electrode shown in FIG. 17.

[0141] As shown in FIG. 18, if two subregions Da and Db of the upper electrode 191bu are altogether removed, a fringe field is generated in the direction D1 vertical to the upper edge of the upper electrode 191bu. Thus, disclination DL of the liquid crystal molecules 310 may generated, which may generate a texture because the inclined direction D2 of the liquid crystal molecules 310 in the two subregions Dc and Dd discord with the direction D1 of the fringe field.

[0142] However, as shown in FIG. 19, if the two subregions Da and Db are left as dummies at the top of the upper electrode 191 bu, the liquid crystal molecules 310 are inclined in the direction D1 such that the horizontal inclination direction of the liquid crystal molecules 310 of the subregions Da and Db is the same as that of the liquid srystal molecules 310 of the subregions Dc and Dd, and thereby the texture may be weakened.

[0143] The longitudinal stems 192du and 192db of the upper and the lower electrodes 191bu and 191bb of the second subpixel electrode 191b may be positioned near the left edge or the right edge of the pixel PX, instead of locating the transverse stems 193du and 193db of the upper or lower electrodes 191bu or 191bb of the second subpixel electrode 191b near the upper and lower edges of the pixel PX like the present exemplary embodiment, such that a difference between the areas of the left subregions Da and Dc and the right subregions Db and Dd may be generated. In this case, the area of the subregions which become wide, may be more than 1.5 times the area of the subregions which become small.

[0144] Also, according to the present exemplary embodiment, differently from the exemplary embodiment shown in FIG. 2, FIG. 3, FIG. 4, and FIG. 5, the transverse stem 193 of the first subpixel electrode 191a does not include the expanded portion, and the portion disposed under the longitudinal stem 192 expands at both sides to form a third expansion 192a. Also, the a portion to contact with the first drain electrode 175a is formed under the third expansion 192a, and another wide portion for the contact with the second drain electrode 175b is formed at the bottom of the longitudinal stem 192db of the lower electrode 191bb of the second subpixel electrode 191b.

[0145] In the present exemplary embodiment, as in the previously described exemplary embodiment, the liquid crystal molecules are inclined in four directions so that the viewing angle of the liquid crystal display may be increased, and the liquid crystal molecules are pretilted by the polymerization of the prepolymer, which may improve the response speed. Also, the first and second subpixel electrodes 191a and 191b receive different data voltages, which may improve side visibility.

[0146] Different from an exemplary embodiment of the present invention, a light alignment method in which light such as ultraviolet rays is obliquely irradiated to the alignment layers 11 and 21 may be used to control the alignment direction and the alignment angle of the liquid crystal molecules 310 to form a plurality of subregions Da, Db, Dc, and Dd where the liquid crystal molecules 310 are inclined in different directions. In this case, the branches 194a, 194b, 194c, and 194d of the pixel electrodes 191 are not necessary to increase the aperture ratio and improve the response time due to the pretilt of the liquid crystal molecules 310, which is generated by light alignment.

[0147] It will be apparent to those skilled in the art that various modifications and variation can be made in the present invention without departing from the scope of the appended claims.

Claims

1. A liquid crystal display, comprising:

a pixel electrode (191) comprising a first subpixel electrode (191a) and a second subpixel electrode (191b) electrically separated by a gap (91) therebetween in plan view;

a common electrode (270) facing the pixel electrode (191); and

a liquid crystal layer (3) disposed between the pixel electrode (191) and the common electrode (270), the liquid crystal layer (3) comprising a plurality of liquid crystal molecules (310),

wherein the first subpixel electrode (191 a) and the second subpixel electrode (191 b) each comprise a plurality of branches (194a, 194b, 194c, 194d) and

a plurality of subregions (Da, Db, Dc, Dd), the branches (194a, 194b, 194c, 194d) extending in different directions in different subregions (Da, Db, Dc, Dd);

characterized in that
the second subpixel electrode (191b) comprises an upper part (191bu) arranged above the first subpixel electrode (191a) in plan view and a lower part (191bb) arranged below the first subpixel electrode (191a) in plan view that each comprise four subregions (Da, Db, Dc, Dd); and
each of the first subpixel electrode (191a) and the upper and lower parts (191bu, 191bb) of the second subpixel electrode (191 b) comprises a transverse stem (193) and a longitudinal stem (192), the plurality of branches (194a, 194b, 194c, 194d) each branching off one of the stems (192; 193).

2. The liquid crystal display of claim 1, wherein:

the liquid crystal molecules (310) are aligned to pretilt according to the directions in which the branches (194a, 194b, 194c, 194d) extend.

3. The liquid crystal display of claim 2, wherein:

the liquid crystal layer (3) further comprises polymers (350, 370) to facilitate pretilting of the liquid crystal molecules (310).

4. The liquid crystal display of claim 3, wherein:

the polymers (350, 370) are formed by irradiating polymers (330) comprising monomers.

5. The liquid crystal display of claim 4,
the prepolymers (330) being irradiated with ultraviolet rays.

6. The liquid crystal display of claim 2, further comprising:

an alignment layer (11, 21) disposed on the pixel electrode (191) or the common electrode (270), the alignment layer (11, 21) being light-aligned to control the alignement direction and the alignement angle of the liquid crystal molecules (310) in the directions in which the branches (194a, 194b, 194c, 194d) extend.

7. The liquid crystal display of claim 1, wherein:

the width of the branches (194a, 194b, 194c, 194d) in plan view is in the range of 2.5 μm to 5.0 μm.

8. The liquid crystal display of claim 1, wherein:

the interval between neighboring branches (194a, 194b, 194c, 194d) in plan view in the range of 2.5 μm to 5.0 μm.

9. The liquid crystal display of claim 1, wherein
the transverse stems (193) and the longitudinal stems (192) form a boundary of the subregions (Da, Db, Dc, Dd); and
the branches (194a, 194b, 194c, 194d) of the first subpixel electrode (191a) and the second subpixel electrode (191 b) extend from the respective transverse stems (193) or the respective longitudinal stems (192) toward edges of the first subpixel electrode (191a) and the second subpixel electrode (191 b).

10. The liquid crystal display of claim 9, wherein:

the width of the branches (194a, 194b, 194c, 194d) in plan view becomes narrower from the transverse stem (193) or the longitudinal stem (192) toward the edge of the first subpixel electrode (191 a) or the second subpixel electrode (191b).

11. The liquid crystal display of claim 10, wherein:

the difference between the widest width of the branches (194a, 194b, 194c, 194d) in plan view and the narrowest width thereof in plan view is in the range of 0.2 μm to 1.6 μm.

12. The liquid crystal display of claim 1, wherein:

the first subpixel electrode (191 a) or the second subpixel electrode (191b) comprises four subregions (Da, Db, Dc, Dd).

13. The liquid crystal display of claim 12, wherein:

the first subpixel electrode (191a) or the second subpixel electrode (191 b) comprises four subregions (Da, Db, Dc, Dd) having different areas.

14. The liquid crystal display of claim 12, wherein:

the transverse stems (193) and the longitudinal stems (192) form boundaries of the subregions (Da, Db, Dc, Dd).

15. The liquid crystal display of claim 14, wherein:

an area of two of the subregions (Da, Db, Dc, Dd), which are disposed on as first side of the transverse stem (193) of the first subpixel electrode (191a) or the second subpixel electrode (191b), is at least 1.5 times the area of the remaining two subregions in each of the upper part

(191 bu) and the lower part (191bb) of the second subpixel electrode (191b), wherein the remaining two subregions are disposed on a second side of the transverse stem (193), the first side being opposite the second side.

16. The liquid crystal display of claim 15, wherein:

the longitudinal width of the two subregions (Da, Db, Dc, Dd) disposed on the first side of the transverse stem (193) of the first subpixel electrode (191 a) or the second subpixel electrode, (191 b) is at least 5 μm.

17. The liquid crystal display of claim 14, wherein:

the area of two subregions (Dc, Dd), which are disposed on a first side of the longitudinal stem (192) of the first subpixel electrode (191 a) or the second subpixel electrode (191b), is at least 1.5 times the area of the remaining two subregions (Da, Db) in each of the upper part (191bu) and the lower part (191bb) of second subpixel electrode (191b) wherein the remaining two subregions (Da, Db) are disposed on a second side of the longitudinal stem (192), the first side being opposite the second side.

18. The liquid crystal display of claim 17, wherein:

the transverse width of the two subregions (Dc, Dd) disposed on the first side of the longitudinal stem (192) of the first subpixel electrode (191 a) or the second subpixel electrode (191b) is at least 5 μm.

19. The liquid crystal display of claim 1, further comprising means to supply
a voltage to the first subpixel electrode (191a) being higher than a voltage supplied by said means to the second subpixel electrode (191b).

20. The liquid crystal display of claim 1, wherein:

the area of the second subpixel electrode (191 b) is 1.0 to 2.2 times the area of the first subpixel electrode (191a).

21. The liquid crystal display of claim 1, wherein
the second subpixel electrode (191 b) further comprises connections (195b) disposed to the left and the right of the first subpixel electrode (191a) in plan view, and
the connections (195b) connect the upper part (191 bu) and the lower part (191bb) of the second subpixel electrode (191b).

22. The liquid crystal display of claim 1, further comprising means to supply
voltages to the first subpixel electrode (191 a) and to the second subpixel electrode (191 b) being different from each other.

23. The liquid crystal display of claim 22
the first subpixel electrode (191 a) and the second subpixel electrode (191 b) being adapted to receive different data voltages provided from information of one image.

24. The liquid crystal display of claim 1,
wherein the liquid crystal layer (3) comprises a first portion disposed between the first subpixel electrode (191 a) and the common electrode (270) and a second portion disposed between the second subpixel electrode (191b) and the common electrode (270),
the liquid crystal molecules (310) are aligned In different directions in different subregions (Da, Db, Dc, Dd), and
areas of the subregions (Da, Db, Dc, Dd) are different from each other in the first portion or in the second portion.

25. The liquid crystal display of claim 24, wherein:

an area of one subregion, which has a wider area, is 1.5 times that of another subregion, which has a narrower area.

26. The liquid crystal display of claim 25, wherein:

the alignment directions of the liquid crystal molecules (310) of the first portion and the second portion correspond to the directions in which the branches (194a, 194b, 194c, 194d) extend.

27. The liquid crystal display of claim 1, further comprising:

a first signal line (GL; 121) and a second signal line (SL);
a third signal line (DLa; 171 a) and a fourth signal line (DLb; 171 b) crossing the first signal line (GL; 121) and the second signal line (SL);
a first switching element (Qa; 124a, 173a, 175a, 154a) connected to the first signal line (GL; 121) and the third signal line (DLa; 171 a), the first switching element (Qa; 124a, 173a, 175a, 154a) transmitting a data voltage from the third signal line (DLa; 171a) to the first subpixel electrode (191a);
a second switching element (Qb; 124b, 173b, 175b, 154b) connected to the first signal line (GL; 121) and the fourth signal line (DLb; 171 b), the second switching element (Qb; 124b, 173b, 175b, 154b) transmitting a data voltage from the fourth signal line (DLb; 171 b) to the

second subpixel electrode (191 b).

28. The liquid crystal display of claim 27, wherein:

the second signal line (SL) transmits a common voltage (Vcom).

29. The liquid crystal display of claim 28, wherein:

the second signal line (SL) overlaps a portion of the gap (91) or boundaries between the subregions (Da, Db, Dc, Dd) in plan view.

30. The liquid crystal display of claim 27, wherein:

areas of the subregions (Da, Db, Dc, Dd) are different from each other in the first subpixel electrode (191a) or the second subplxel electrode (191b).

31. The liquid crystal display of claim 30, wherein:

a subregion that has a smaller area, overlaps the first signal line (GL; 121) in plan view.

32. The liquid crystal display of claim 31, wherein:

the longitudianl width of the subregion that has smaller area is at least 5 μm.

33. The liquid crystal display of claim 27, wherein:

the connection (195b) covers the third signal line (DLa; 171 a) or the fourth signal line (DLb; 171b) in plan wiew.

34. The liquid crystal display of claim 27, wherein:

the upper part (191 bu) comprises a first contact portion to receive a data voltage from the second switching element (Qb; 124b, 173b, 175b, 154b); and
the lower part (191bb) comprises a second contact portion to receive a data voltage from the second switching element (Qb; 124b, 173b, 175b, 154b).

35. The liquid crystal display of claim 27, wherein:

the first subpixel electrode (191 a) comprises a third contact portion to receive a data voltage from the first switching element (Qa; 124a, 173a, 175a, 154a);
the second subpixel electrode (191 b) comprises a fourth contact portion to receive a data voltage from the second switching element (Qb; 124b, 173b, 175b, 154b); and
the third contact portion and the fourth contact portion are disposed on boundaries of the subregions (Da, Db, Dc, Dd).

36. The liquid crystal display of claim 34, wherein:

the fourth contact portion is positioned at a lower corner of the first subpixel electrode (191 a).

37. The liquid crystal display of claim 1, wherein
the second subpixel electrode (191b) further comprises connections (195b) disposed to the left and the right of the first subpixel electrode (191a) in plan view; and
the second subpixel electrode (191 b) encloses the first subpixel electrode (191a).

Patentansprüche

1. Flüssigkristallanzeige, umfassend:

eine Pixelelektrode (191) umfassend eine erste Subpixelelektrode (191a) und eine zweite Subpixelelektrode (191b), wobei beide durch einen Spalt (91) in Planansicht voneinander getrennt sind;
eine gemeinsame der Pixelelektrode (191) zugewandte Elektrode (270); und
eine Flüssigkristallschicht (3), die zwischen der Pixelelektrode (191) und der gemeinsamen Elektrode (270) angeordnet ist, wobei die Flüssigkristallschicht (3) eine Vielzahl von Flüssigkristallmolekülen (310) enthält, in welcher die erste Subpixelelektrode (191a) und die zweite Subpixelelektrode (191b) jeweils eine Mehrzahl von Zweigen (194a, 194b, 194c, 194d) umfassen und
eine Vielzahl von Subregionen (Da, Db, Dc, Dd), wobei die Zweige (194a, 194b, 194c, 194d) sich in verschiedenen Subregionen (Da, Db, Dc, Dd) in verschiedenen Richtungen erstrecken;

dadurch gekennzeichnet,
dass die zweite Subpixelelektrode (191b) einen oberen Teil (191b), das über der ersten Subpixelelektrode (191a) in Planansicht liegt und ein Teil (191bb), das under der ersten Subpixelelektrode (191a) in Planansicht liegt, enthält, wobei jedes Teil vier Subregionen (Da, Db, Dc, Dd) umfasst;
die erste Subpixelelektrode (191a) sowohl als die obere und untere Teile (191ba, 191bb) der zweiten Subpixelelektrode (191b) jeweils einen Querstamm (193) und einen Längsstamm (192) umfassen,
wobei die Vielzahl von Zweigen (194a, 194b, 194c, 194d) jeweils von einem der Stämme (192; 193) abzeigen.

2. Flüssigkristallanzeige nach Anspruch 1, in welcher:

zum Vorneigen nach den Richtungen, in welchen die Zweige (194a, 194b, 194c, 194d) verlaufen, die Flüssigkristallmolekülen (310) ausgerichtet sind.

3. Flüssigkristallanzeige nach Anspruch 2, in welcher:

zum erleichterten Vorneigen der Flüssigkristallmolekülen (310) die Flüssigkristallschicht (3) Polymere (350, 370) ferner enthält.

4. Flüssigkristallanzeige nach Anspruch 3, in welcher:

die Polymere (350, 370) durch das Bestrahlen von Monomeren umfassenden Prepolymeren (330) ausgebildet sind.

5. Flüssigkristallanzeige nach Anspruch 4, wobei die Prepolymere (330) mit ultravioletten Strahlen bestrahlt werden.

6. Flüssigkristallanzeige nach Anspruch 2, ferner umfassend:

eine Ausrichtungsschicht (11, 21) die auf der Pixelelektrode (191) oder der gemeinsamen Elektrode (270) angeordnet ist,
wobei zur Kontrollierung der Ausrichtungsrichtung und des Ausrichtungswinkels der Flüssigkristallmolekülen (310) in den Richtungen, in den die Zweige (194a, 194b, 194c, 194d) verlaufen, die Ausrichtungsschicht (11, 12) auf das Licht ausgerichtet ist.

7. Flüssigkristallanzeige nach Anspruch 1, in welcher:

Die Breite der Zweige (194a, 194b, 194c, 194d) in Planansicht im Bereich von 2,5 μm bis 5,0 μm liegt.

8. Flüssigkristallanzeige nach Anspruch 1, in welcher: . ,

der Abstand zwischen benachbarten Zweigen (194a, 194b, 194c, 194d) in Planansicht im Bereich von 2,5 μm bis 5,0 μm liegt.

9. Flüssigkristallanzeige nach Anspruch 1, in welcher die Querstämme (193) und die Längsstämme (192) eine Grenze der Subregionen (Da, Db, Dc, Dd) bilden; und
die Zweige (194a, 194b, 194c, 194d) der ersten Subpixelelektrode (191a) und der zweiten Subpixelelektrode (191b) von den jeweiligen Querstämmen (193) oder von den jeweiligen Längsstämme (192) nach den Kanten der ersten Subpixelelektrode (191a) und der zweiten Subpixelelektrode (191) aus gehen.

10. Flüssigkristallanzeige nach Anspruch 9, in welcher:

die Breite der Zweige (194a, 194b, 194c, 194d) in Planansicht vom Querstamm (193) oder vom Längsstamm (192) nach der Kante der ersten Subpixelelektrode (191a) oder der zweiten Subpixelelektrode (191b) enger wird.

11. Flüssigkristallanzeige nach Anspruch 10, in welcher:

der Unterschied zwischen der breitesten Breite der Zweige (194a, 194b, 194c, 194d) in Planansicht und der engsten Breite in Planansicht im Bereich von 0,2 μm bis 1,69 μm liegt.

12. Flüssigkristallanzeige nach Anspruch 1, in welcher:

die erste Subpixelelektrode (191a) oder die zweite Subpixelelektrode (191b) vier Subregionen (Da, Db, Dc, Dd) umfasst.

13. Flüssigkristallanzeige nach Anspruch 12, in welcher:

die erste Subpixelelektrode (191a) oder die zweite Subpixelelektrode (191b) vier Subregionen (Da, Db, Dc, Dd) mit unterschiedlichen Flächen umfasst.

14. Flüssigkristallanzeige nach Anspruch 12, in welcher:

die Querstämme (193) und die Längsstämme (192) Grenzen der Subregionen (Da, Db, Dc, Dd) bilden.

15. Flüssigkristallanzeige nach Anspruch 14, in welcher:

eine Fläche zweier der Subregionen (Da, Db, Dc, Dd), die auf einer ersten Seite des Querstamms (193) der ersten Subpixelelektrode (191a) oder der zweiten Subpixelelektrode (191b) angeordnet sind, mindestens 1,5-mal die Fläche der verbleibenden zwei Subregionen in jedem des oberen Teils (191 bu) und des unteren Teils (191b) der zweiten Subpixelelektrode (191b) beträgt, wobei die verbleibenden zwei Subregionen auf einer zweiten Seite des Querstamms (193) angeordnet sind, wobei die erste Seite der zweiten Seite entgegengesetzt ist.

16. Flüssigkristallanzeige nach Anspruch 15, in welcher:

die Längsbreite der beiden Subregionen (Da, Db, Dc, Dd), die auf der ersten Seite des Querstamms (193) der ersten Subpixelelektrode (191a) oder der zweiten Subpixelelektrode (191b) angeordnet sind, mindestens 5 μm beträgt.

17. Flüssigkristallanzeige nach Anspruch 14, in welcher:
die Fläche zweier der Subregionen (Dc, Dd), die auf einer ersten Seite des Querstamms (192) der ersten Subpixelelektrode (191a) oder der zweiten Subpixelelektrode (191) angeordnet sind, mindestens 1,5-mal die Fläche der verbleibenden zwei Subregionen (Da, Db) in jedem des oberen Teils (191 bu) und des unteren Teils (191b) der zweiten Subpixelelektrode (191b) beträgt, wobei die verbleibenden zwei Subregionen (Da, Db) auf einer zweiten Seite des Querstamms (192) angeordnet sind, wobei die erste Seite der zweiten Seite entgegengesetzt ist.

18. Flüssigkristallanzeige nach Anspruch 17, in welcher:

die Querbreite der zwei Subregionen (Dcn Dd), die auf der ersten Seite des Längsstamms (19) der ersten Subpixelelektrode (191a) oder der zweiten Subpixelelektrode (191b) mindestens 5 μm beträgt.

19. Flüssigkristallanzeige nach Anspruch 1, ferner umfassend Mittel zur Versorgung einer Spannung an die erste Subpixelelektrode (191a), die höher ist als eine durch dieses Mittel an die zweite Subpixelelektrode (191b) versorgte Spannung.

20. Flüssigkristallanzeige nach Anspruch 1, in welcher:

die Fläche der zweiten Subpixelelektrode (191b) 1,0 bis 2,2-mal die Fläche der ersten Subpixelelektrode (191a) beträgt.

21. Flüssigkristallanzeige nach Anspruch 1, in welcher:

zweite Subpixelelektrode (191b) Anschlüsse (195b) ferner enthält,die links und rechts der ersten Subpixelelektrode (191a) in Planansicht angeordnet sind und die Anschlüsse (195b) den oberen Teil (191bu) und den unteren Teil (191bb) der zweiten Subpixelelektrode (191b) verbinden.

22. Flüssigkristallanzeige nach Anspruch 1, ferner umfassend Mittel zur Versorgung von Spannungen an die erste Subpixelelektrode (191a) und an die zweite Subpixelelektrode (191b, wobei diese beiden Spannungen unterschiedlich voneinander sind.

23. Flüssigkristallanzeige nach Anspruch 22,
wobei die erste Subpixelelektrode (191a) und die zweite Subpixelelektrode zur Aufnahme von unterschiedlichen aus Informationen über ein Bild versorgten Datenspannungen (191b) angepasst sind.

24. Flüssigkristallanzeige nach Anspruch 1,
in welcher die Flüssigkristallschicht (3) einen ersten Abschnitt, der zwischen der ersten Subpixelelektrode (191a) und der gemeinsamen Elektrode (270) angeordnet ist, und einen zweiten Abschnitt, der zwischen der zweiten Subpixelelektrode (191b) und der gemeinsamen Elektrode (270) angeordnet ist, umfasst,
wobei die Flüssigkristallmolekülen (310) in unterschiedlichen Richtungen in unterschiedlichen Subregionen (Da, Db, Dc, Dd) ausgerichtet sind, und Flächen der Subregionen (Da, Db, Dc, Dd) im ersten Abschnitt und im zweiten Abschnitt voneinander verschieden sind.

25. Flüssigkristallanzeige nach Anspruch 24, in welcher:

eine Fläche einer Subregion, die eine breitere Fläche aufweist, 1,5-mal die einer anderen Subregion beträgt, die eine engere Fläche aufweist.

26. Flüssigkristallanzeige nach Anspruch 25, in welcher:

die Ausrichtungsrichtungen der Flüssigkristallmolekülen (310) des ersten Abschnitts und des zweiten Abschnitts den Richtungen entsprechen, in denen sich die Zweige (194a, 194b, 194c, 194d) erstrecken.

27. Flüssigkristallanzeige nach Anspruch 1, ferner umfassend:

eine erste Signalleitung (GL; 121) und eine zweite Signalleitung (SL);
eine dritte Signalleitung (DLa; 171a) und eine vierte Signalleitung (DLb; 171b), die die erste Signalleitung (GL; 121) und die zweite Signalleitung (SL) überquert;
ein erstes Schaltelement (Qa; 124a, 173a, 175a, 154a), das mit der ersten Signalleitung (GL; 121) und der dritten Signalleitung (SL) verbunden ist, wobei das erste Schaltelement (Qa; 124a, 173a, 175a, 154a) von der dritten Signalleitung (DLa; 171a) an die erste Subpixelelektrode (191a) eine Datenspannung übertragt;
ein zweites Schaltelement (Qb; 124b, 173b, 175b, 154b), das mit der ersten Signalleitung (GL; 121) und der vierten Signalleitung (DLb; 171b) verbunden ist, wobei das zweite Schaltelement (Qb; 124b, 173b, 175b, 154b) von der vierten Signalleitung (DLb; 171b) an die zweite Subpixelelektrode (191b) eine Datenspannung überträgt.

28. Flüssigkristallanzeige nach Anspruch 27, in welcher:
die zweite Signalleitung (SL) eine gemeinsame Spannung (Vcom) überträgt.

29. Flüssigkristallanzeige nach Anspruch 28, in welcher:

die zweite Signalleitung (SL) einen Abschnitt

des Spaltes (91) oder Grenzflächen zwischen den Subregionen (Da, Db, Dc, Dd) in Planansicht überlappt.

30. Flüssigkristallanzeige nach Anspruch 27, in welcher:

Flächen der Subregionen (Da, Db, Dc, Dd) in der ersten Subpixelelektrode (191a) oder in der zweiten Subpixelelektrode (191b) unterschiedlich voneinander sind.

31. Flüssigkristallanzeige nach Anspruch 30, in welcher:

eine Subregion mit einer schmaleren Fläche die erste Signalleitung (QL; 121) in Planansicht überlappt.

32. Flüssigkristallanzeige nach Anspruch 31, in welcher:

der Anschluss (195b) die dritte Signalleitung (DLa; 171a) oder die vierte Signalleitung (DLb; 171b) in Planansicht überdeckt.

33. Flüssigkristallanzeige nach Anspruch 27, in welcher:

der Anschluss (195b) die dritte Signalleitung (DLa; 171a) oder die vierte Signalleitung (DLb; 171b) in Planansicht überdeckt.

34. Flüssigkristallanzeige nach Anspruch 27, in welcher:

zum Empfangen einer Datenspannung vom zweiten Schaltelemente (Qb; 124b, 173b, 175b, 154b) der obere Teil (191bu) einen ersten Berührungsabschnitt aufweist; und
zum Empfangen einer Datenspannung vom zweiten Schaltelemente (Qb; 124b, 173b, 175b, 154b) der untere Teil (191bb) einen zweiten Berührungs- abschnitt aufweist.

35. Flüssigkristallanzeige nach Anspruch 27, in welcher:

zum Empfangen einer Datenspannung vom ersten Schaltelemente (Qa; 124a, 173a, 175a, 154a) die erste Subpixelelektrode (191ba) einen dritten Berührungsabschnitt aufweist;
zum Empfangen einer Datenspannung vom zweiten Schaltelemente (Qb; 124b, 173b, 175b, 154b) die zweite Subpixelelektrode (191b) einen vierten Berührungsabschnitt aufweist; und
der dritte Berührungsabschnitt und der vierte Berührungsabschnitt an Grenzflächen der Subregionen (Da, Db, Dc, Dd) ausgelegt sind.

36. Flüssigkristallanzeige nach Anspruch 34, in welcher:

der vierte Berührungsabschnitt an einer unteren Ecke der ersten Subpixelelektrode (191a) angordnet ist.

37. Flüssigkristallanzeige nach Anspruch 1, in welcher die zweite Subpixelelektrode (191b) Anschlüsse (195b) ferner enthält, die links und rechts der ersten Subpixelelektrode (191a) in Planansicht angeordnet sind; und
die zweite Subpixelelektrode (191b) die erste Subpixelelektrode (191a) einschließt.

Revendications

1. Affichage à cristaux liquides, comprenant :

une électrode de pixel (191) contenant une première électrode de sous-pixel (191a) et une électrode de sous-pixel (191b) séparées électriquement par un entrefer (91) en vue en plan;
une électrode commune (270) faisant face à l'électrode de pixel (191); et
une couche de cristaux liquides (3) disposée entre l'électrode de pixel (191) et l'électrode commune (270), la couche de cristaux liquides (3) comprenant une pluralité de molécules de cristaux liquides (310), où la première électrode de sous-pixel (191a) et la seconde électrode de sous-pixel (191b) comportent chacune une pluralité de branches (194a, 194b, 194c, 194d) et une pluralité de sous-régions (Da, Db, Dc, Dd), les branches (194a, 194b, 194c, 194d) s'étendant dans des directions différentes dans des sous-régions différentes (Da, Db, Dc, Dd);

caractérisé en ce que
la seconde électrode de sous-pixel (191b) comprend une partie supérieure (191b) disposée au-dessus de la première électrode de sous-pixel (191a) en vue en plan et une partie (191bb) disposée au-dessous de la première électrode de sous-pixel (191a) en vue en plan, chacune comportant quatre sous-régions (Da, Db, Dc, Dd);
chacune de la première électrode de sous-pixel (191a) et des parties supérieure et inférieure (191ba, 191bb) de la seconde électrode de sous-pixel (191b) comprend une tige transversale (193) et une tige longitudinale (192),
la pluralité de branches (194a, 194b, 194c, 194d) se ramifiant chacune à partir de l'une des tiges (192; 193).

2. Affichage à cristaux liquides selon la revendication 1, dans lequel :

les molécules de cristaux liquides (310) sont alignées pour se pré-incliner selon les directions dans lesquelles s'étendent les branches (194a, 194b, 194c,194d).

3. Affichage à cristaux liquides selon la revendication 2, dans lequel :

la couche de cristaux liquides (3) comprend en outre des polymères (350, 370) destinés à faciliter la pré-inclinaison des molécules de cristaux liquides (310).

4. Affichage à cristaux liquides selon la revendication 3, dans lequel:

on obtient les polymères pores (350, 370) en irradiant des prépolymères (330) comportant des monomères.

5. Affichage à cristaux liquides selon la revendication 4, les prépolymères (330) étant irradiés par des rayons ultraviolets.

6. Affichage à cristaux liquides selon la revendication 2, comprenant en outre :

une couche d'alignement (11,21) disposée sur l'électrode de pixel (191) ou l'électrode commune (270),
la couche d'alignement (11, 21) étant alignée sur la lumière pour commander la direction d'alignement et l'angle d'alignement des molécules de cristaux liquides (310) dans les directions dans lesquelles s'étendent les branches (194a, 194b, 194c, 194d).

7. Affichage à cristaux liquides selon la revendication 1, dans lequel :

la largeur des branches (194a, 194b, 194c, 194d) en vue en plan est dans la fourchette de 2,5 μm à 5,0 μm.

8. Affichage à cristaux liquides selon la revendication 1, dans lequel :

l'intervalle entre des branches adjacentes (194a, 194b, 194c, 194d) en vue en plan est dans la fourchette de 2,5 μm à 5,0 μm.

9. Affichage à cristaux liquides selon la revendication 1, dans lequel:

les tiges transversales (193) et les tiges longitudinales (192) forment une frontière des sous-régions (Da, Db, Dc, Dd); et
les branches (194a, 194b, 194c, 194d) de la première électrode de sous-pixel (191a) et de la seconde électrode de sous-pixel (191b) s'étendent à partir des tiges transversales (193) respectives ou des tiges longitudinales (192) respectives vers les bords de la première électrode de sous-pixel (191a) et de la seconde électrode de sous-pixel (191b).

10. Affichage à cristaux liquides selon la revendication 9, dans lequel :

la largeur des branches (194a, 194b, 194c, 194d) en vue en plan devient plus étroite à partit de la tige transversale (193) ou de la tige longitudinale (192) vers le bord de la première électrode de sous-pixel (191a) et de la seconde électrode de sous-pixel (191b).

11. Affichage à cristaux liquides selon la revendication 10, dans lequel :

la différence entre la plus grande largeur des branches (194a, 194b, 194c, 194d) en vue en plan et la largeur la pus petite en vue en plan est dans la fourchette de 0,2 μm à 1,6 μm.

12. Affichage à cristaux liquides selon la revendication 1, dans lequel :

la première électrode de sous-pixel (191a) ou la seconde électrode de sous-pixel (191b) comprend quatre sous-régions (Da, Db, Dc, Dd).

13. Affichage à cristaux liquides selon la revendication 12, dans lequel :

la première électrode de sous-pixel (191a) ou la seconde électrode de sous-pixel (191b) comprend quatre sous-régions (Da, Db, Dc, Dd) présentant des zones différentes.

14. Affichage à cristaux liquides selon la revendication 12, dans lequel :

les tiges transversales (193) et les tiges longitudinales (192) forment des frontières des sous-régions (Da, Db, Dc, Dd).

15. Affichage à cristaux liquides selon la revendication 14, dans lequel :

une superficie de deux des sous-régions (Da, Db, Dc, Dd), disposées sur un premier côté de la tige transversale (193) de la première électrode de sous-pixel (191a) ou de la seconde électrode de sous-pixel (191b), correspond à au moins 1,5 fois la superficie des deux sous-régions restantes dans chacune de la partie supérieure (191bu) et de la partie inférieure (191b) de la seconde électrode de sous-pixel (191b), **caractérisé en ce que** les deux sous-régions restantes sont disposées sur un second côté de la tige transversale (193), le premier côté étant

opposé au second côté.

16. Affichage à cristaux liquides selon la revendication 15, dans lequel :

la largeur longitudinale des deux sous-régions (Da, Db, Dc, Dd) disposée sur le premier côté de la tige transversale (193) de la première électrode de sous-pixel (191a) ou de la seconde électrode de sous-pixel (191b) est d'au moins 5 μm.

17. Affichage à cristaux liquides selon la revendication 14, dans lequel : la superficie de deux sous-régions (Dc, Dd), disposées sur un premier côté de la tige transversale (192) de la première électrode de sous-pixel (191a) ou de la seconde électrode de sous-pixel (191b), correspond à au moins 1,5 fois la superficie des deux sous-régions restantes (Da, Db) dans chacune de la partie supérieure (191bu) et de la partie inférieure (191b) de la seconde électrode de sous-pixel (191b), **caractérisé en ce que** les deux sous-régions restantes (Da, Db) sont disposées sur un second côté de la tige longitudinale (192), le premier côté étant opposé au second côté.

18. Affichage à cristaux liquides selon la revendication 17, dans lequel :

la largeur transversale des deux sous-régions (Dc, Dd) disposées sur le premier côté de la tige transversale (192) de la première électrode de sous-pixel (191a) ou de la seconde électrode de sous-pixel (191b) est d'au moins 5 μm.

19. Affichage à cristaux liquides selon la revendication 1, comprenant en outre un moyen pour fournir une tension à la première électrode de sous-pixel (191a) étant supérieure à une tension fournie par ledit moyen à la seconde électrode de sous-pixel (191b).

20. Affichage à cristaux liquides selon la revendication 1, dans lequel :

la superficie de la seconde électrode de sous-pixel (191b) correspond à 1,0 à 2,2 fois la superficie de la première électrode de sous-pixel (191a).

21. Affichage à cristaux liquides selon la revendication 1, dans lequel :

la seconde électrode de sous-pixel (191b) comprend en outre des connexions (195b) disposées à gauche et à droite de la première électrode de sous-pixel (191a) en vue en plan et les connexions (195b) relient la partie supérieure (191bu) et la partie inférieure (191bb) de la seconde électrode de sous-pixel (191b).

22. Affichage à cristaux liquides selon la revendication 1, comprenant en outre un moyen pour fournir des tensions à la première électrode de sous-pixel (191a) et à la seconde électrode de sous-pixel (191b) étant différentes l'une de l'autre.

23. Affichage à cristaux liquides selon la revendication 22,
la première électrode de sous-pixel (191a) et la seconde électrode de sous-pixel (191b) étant adaptées à la réception de différentes tensions de données provenant des informations d'une image.

24. Affichage à cristaux liquides selon la revendication 1, **caractérisé en ce que** la couche de cristaux liquides (3) comprend une première portion disposée entre la première électrode de sous-pixel (191a) et l'électrode commune (270) et une seconde portion disposée entre la seconde électrode de sous-pixel (191b) et l'électrode commune (270),
les molécules de cristaux liquides (310) sont alignées dans des directions différentes dans des sous-régions différentes (Da, Db, Dc, Dd), et
les superficies des sous-régions (Da, Db, Dc, Dd) sont différentes l'une de l'autre dans la première portion ou dans la seconde portion.

25. Affichage à cristaux liquides selon la revendication 24, dans lequel :

une superficie d'une sous-région, de superficie plus large, correspond à 1,5 fois celle d'une autre sous-région, de superficie plus étroite.

26. Affichage à cristaux liquides selon la revendication 25, dans lequel :

les directions d'alignement des molécules de cristaux liquides (310) de la première portion et de la seconde portion correspondent aux directions dans lesquelles s'étendent les branches (194a, 194b, 194c, 194d).

27. Affichage à cristaux liquides selon la revendication 1, comprenant en outre :

une première ligne du signal (GL; 121) et une deuxième ligne du signal (SL);
une troisième ligne du signal (DLa; 171a) et une quatrième ligne du signal (DLb; 171b) croisant la première ligne du signal (GL; 121) et la deuxième ligne du signal (SL);
un premier élément de commutation (Qa; 124a, 173a, 175a, 154a) connecté à la première ligne du signal (GL; 121) et la troisième ligne du signal (DLa; 171a), le premier élément de commuta-

tion (Qa; 124a, 173a, 175a, 154a) transmettant une tension de données en provenance de la troisième ligne du signal (DLa; 171a) à la première électrode de sous-pixel (191a);
un second élément de commutation (Qb; 124b, 173b, 175b, 154b) connecté à la première ligne du signal (GL; 171a) et la quatrième ligne du signal (DLb; 171b), le second élément de commutation (Qb; 124b, 173b, 175b, 154b) transmettant une tension de données en provenance de la quatrième ligne du signal (DLb; 171b) à la seconde électrode de sous-pixel (191b).

28. Affichage à cristaux liquides selon la revendication 27, dans lequel :

la deuxième ligne du signal (SL) transmet une tension commune (Vcom)

29. Affichage à cristaux liquides selon la revendication 28, dans lequel :

la deuxième ligne du signal (SL) chevauche une portion de l'entrefer (91) ou des frontières séparant les sous-régions (Da, Db, Dc, Dd) en vue en plan.

30. Affichage à cristaux liquides selon la revendication 27, dans lequel :

les superficies des sous-régions (Da, Db, Dc, Dd) sont différentes l'une de l'autre dans la première électrode de sous-pixel (191a) ou la seconde électrode de sous-pixel (191b).

31. Affichage à cristaux liquides selon la revendication 30, dans lequel: une sous-région de superficie réduite chevauche la première ligne du signal (QL; 121) en vue en plan.

32. Affichage à cristaux liquides selon la revendication 31, dans lequel :

la largeur longitudinale de la sous-région de superficie réduite est d'au moins 5 μm.

33. Affichage à cristaux liquides selon la revendication 31, dans lequel :

la connexion (195b) recouvre la troisième ligne du signal (DLa; 171a) ou la quatrième ligne du signal (DLb; 171b) en vue en plan.

34. Affichage à cristaux liquides selon la revendication 27, dans lequel:

la partie supérieure (191bu) comprend une première portion de contact pour recevoir une tension de données en provenance du second élément de commutation (Qb; 124b, 173b, 175b, 154b); et
la partie inférieure (191bb) comprend une deuxième portion de contact pour recevoir une tension de données en provenance du second élément de commutation (Qb; 124b, 173b, 175b, 154b).

35. Affichage à cristaux liquides selon la revendication 27, dans lequel :

la première électrode de sous-pixel (191a) comprend une troisième portion de contact pour recevoir une tension de données en provenance du premier élément de commutation (Qa; 124a, 173a, 175a, 154a);
la seconde électrode de sous-pixel (191b) comprend une quatrième portion de contact pour recevoir une tension de données en provenance du deuxième élément de commutation (Qb; 124b, 173b, 175b, 154b); et
la troisième portion de contact et la quatrième portion de contact sont disposées sur des frontières des sous-régions (Da, Db, Dc, Dd).

36. Affichage à cristaux liquides selon la revendication 34, dans lequel :

la quatrième portion de contact occupe un coin inférieur de la première électrode de sous-pixel (191a).

37. Affichage à cristaux liquides selon la revendication 1, **caractérisé en ce que** la seconde électrode de sous-pixel (191b) comprend en outre des connexions (195b) disposées à gauche et à droite de la première électrode de sous-pixel (191a) en vue en plan; et
la seconde électrode de sous-pixel (191b) renferme la première électrode de sous-pixel (191a).

FIG.1

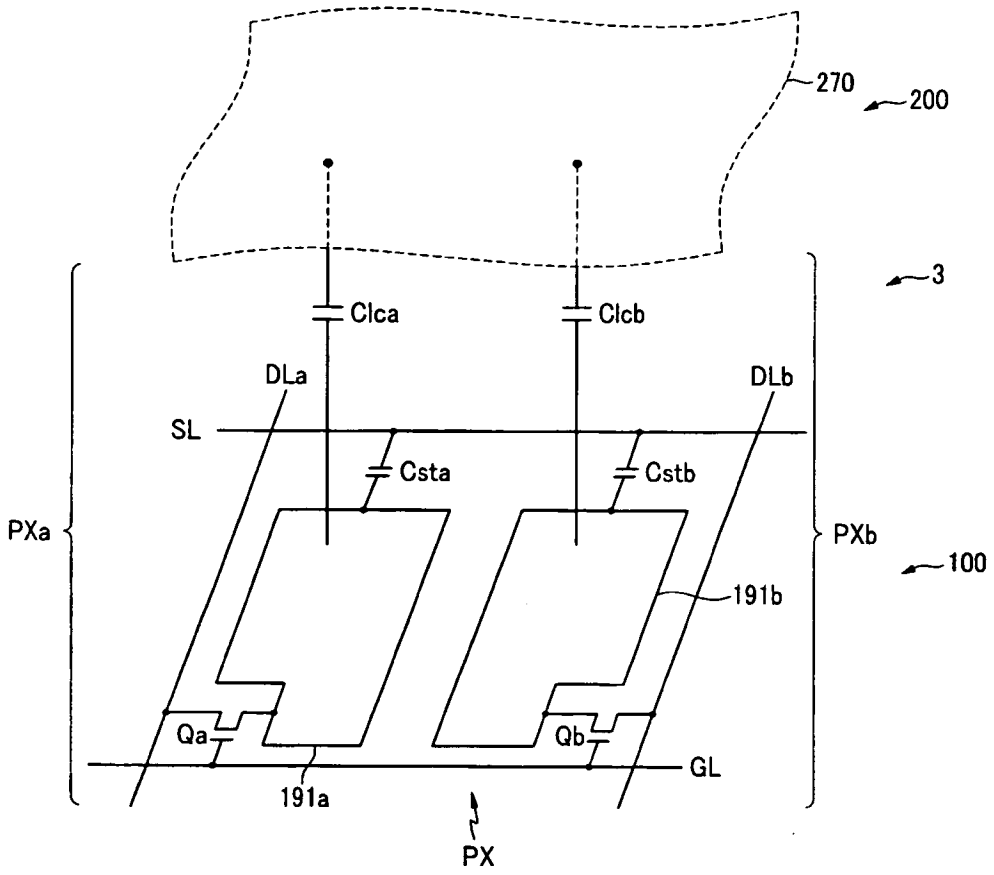

270
200
3
Clca
Clcb
DLa
DLb
SL
Csta
Cstb
PXa
PXb
100
191b
Qa
Qb
GL
191a
PX

FIG.2

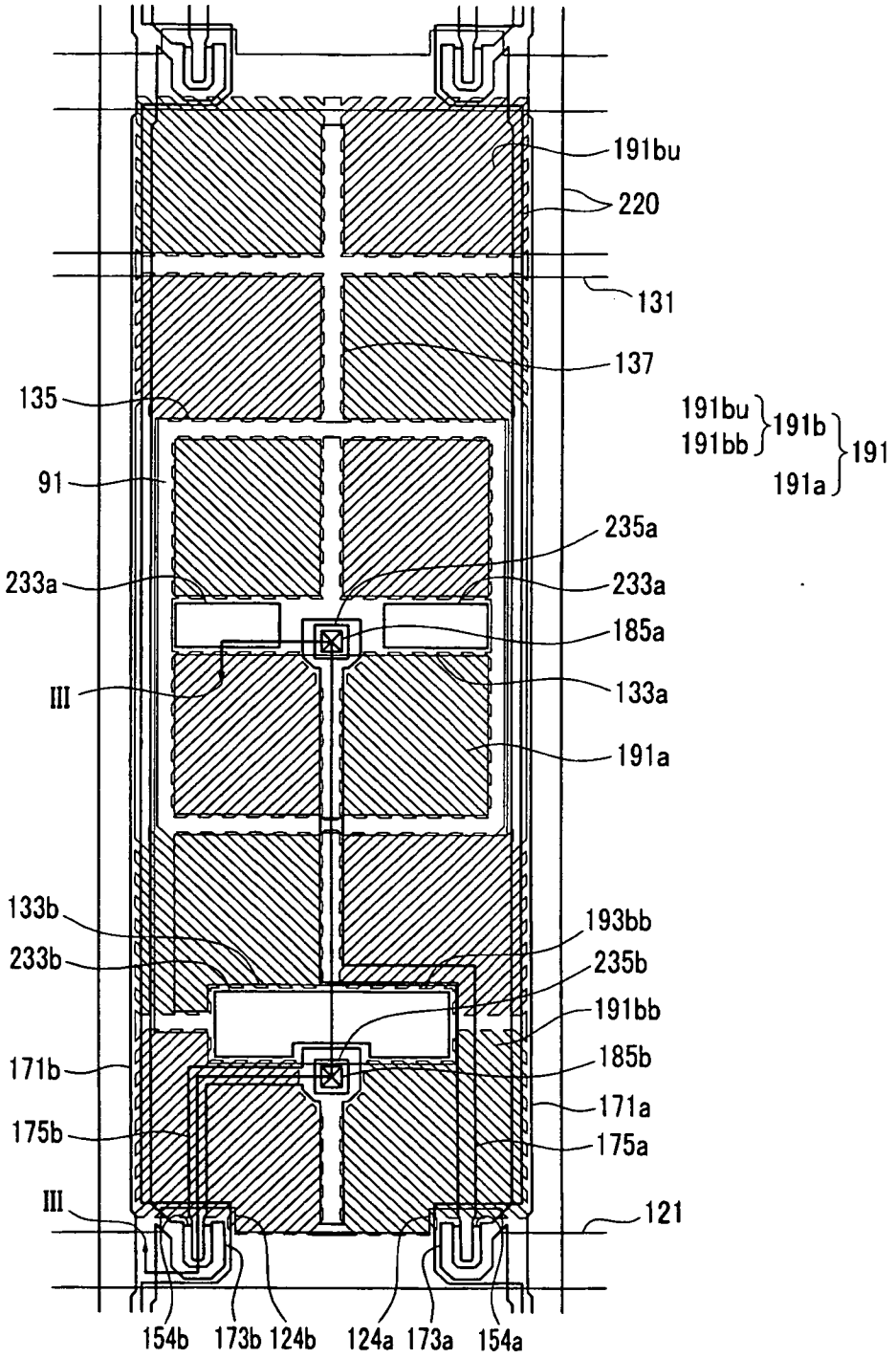

191bu
220
131
137
135
191bu
191bb
191b
191
191a
91
235a
233a
233a
185a
III
133a
191a
133b
193bb
233b
235b
191bb
171b
185b
171a
175b
175a
III
121
154b
173b
124b
124a
173a
154a

FIG.3

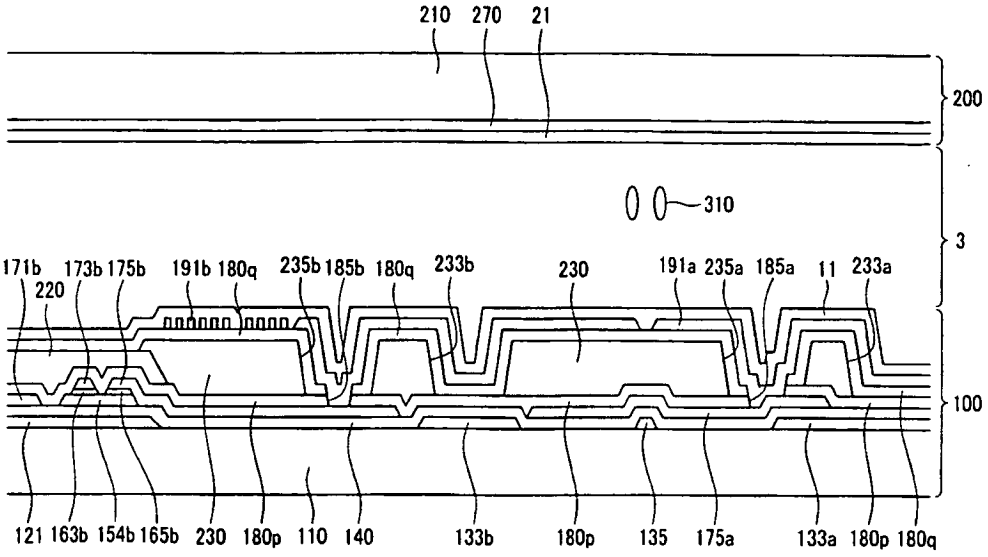

210
270
21
200
310
3
171b
173b
175b
191b
180q
235b
185b
180q
233b
230
191a
235a
185a
11
233a
220
100
121
163b
154b
165b
230
180p
110
140
133b
180p
135
175a
133a
180p
180q

FIG.4

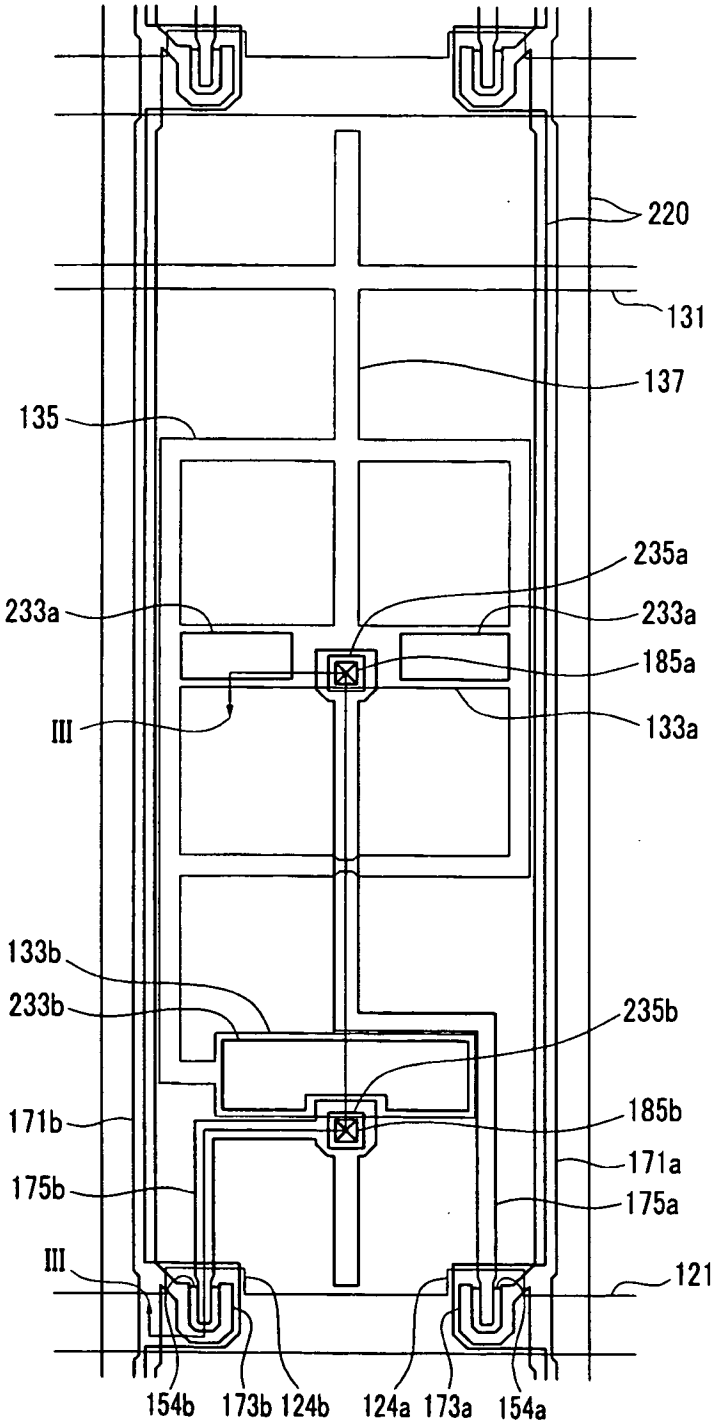

220
131
137
135
235a
233a
233a
185a
III
133a
133b
233b
235b
185b
171b
171a
175b
175a
III
121
154b
173b
124b
124a
173a
154a

FIG.5

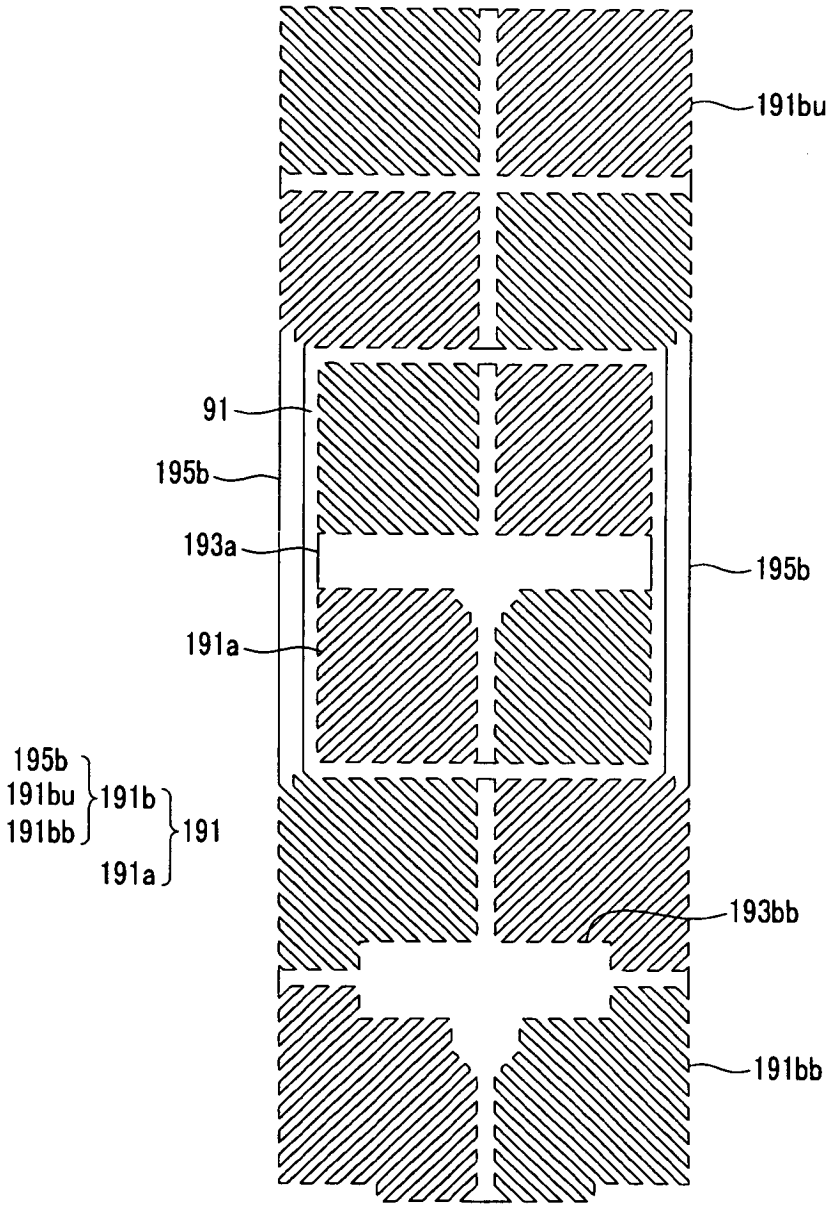

191bu
91
195b
193a
195b
191a
195b
191bu
191bb
191b
191
191a
193bb
191bb

FIG.6

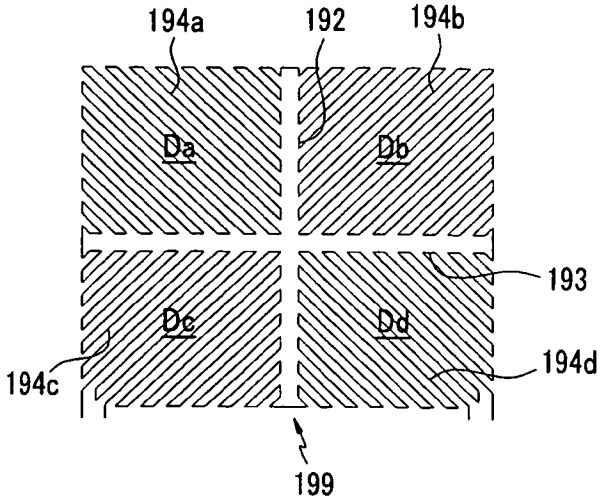


FIG.7

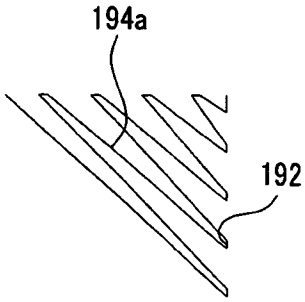


FIG.8

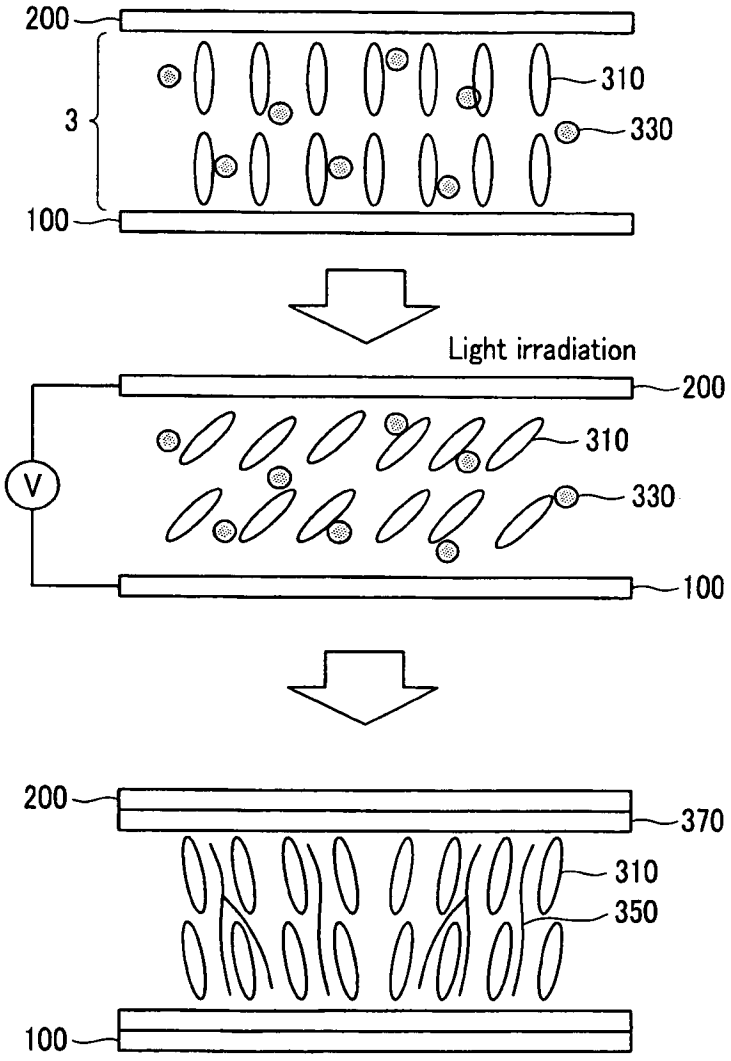

200
3
310
330
100
Light irradiation
200
V
310
330
100
200
370
310
350
100

FIG.9

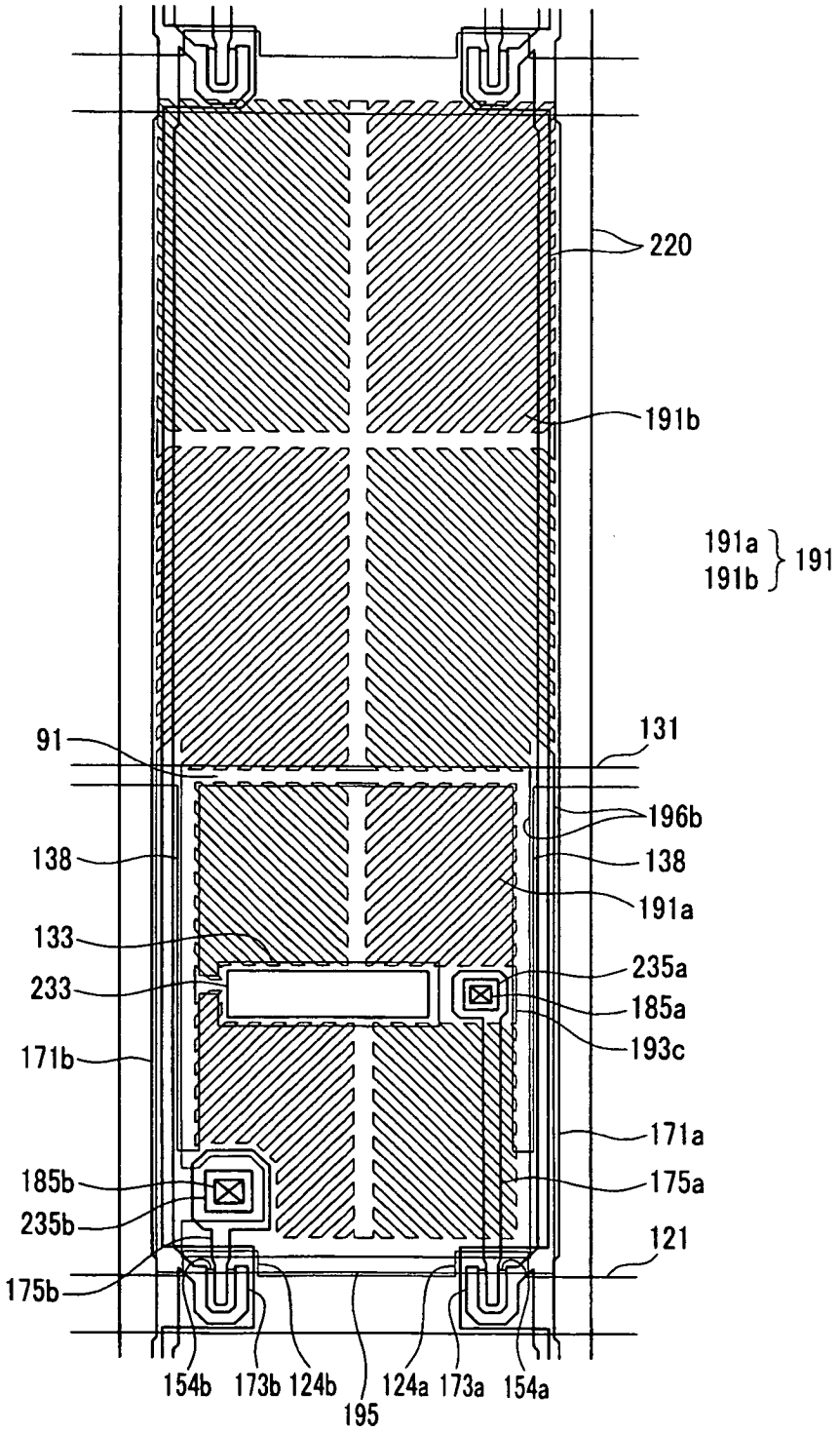

220
191b
191a
191b
191
91
131
196b
138
138
191a
133
235a
233
185a
193c
171b
171a
185b
175a
235b
121
175b
154b
173b
124b
195
124a
173a
154a

FIG.10

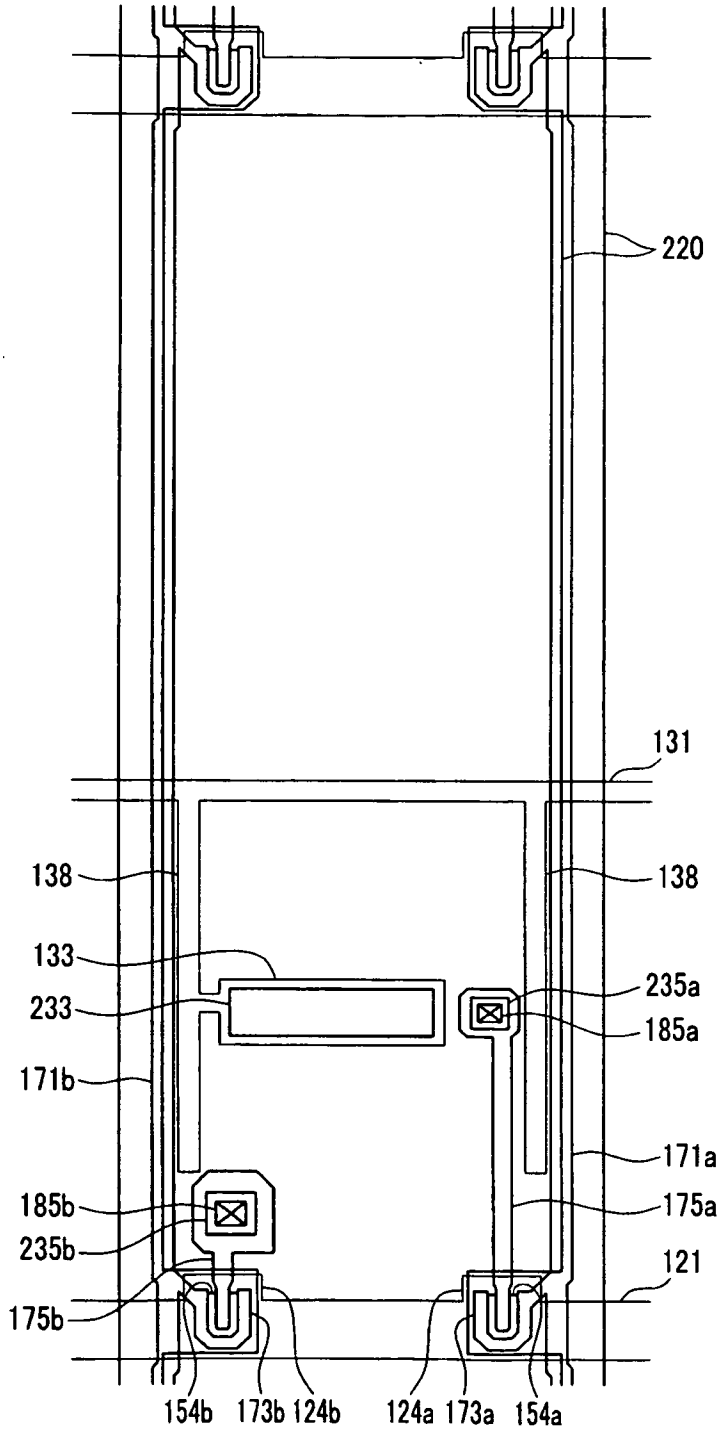

220
131
138
138
133
233
235a
185a
171b
171a
185b
175a
235b
121
175b
154b
173b
124b
124a
173a
154a

FIG.11

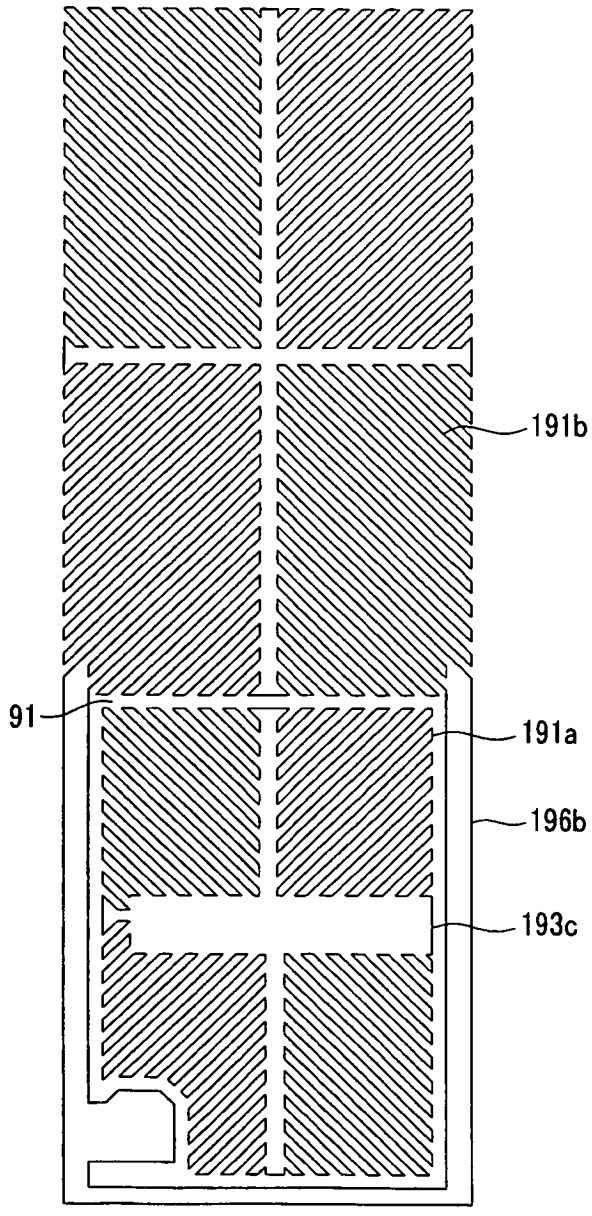


FIG.12

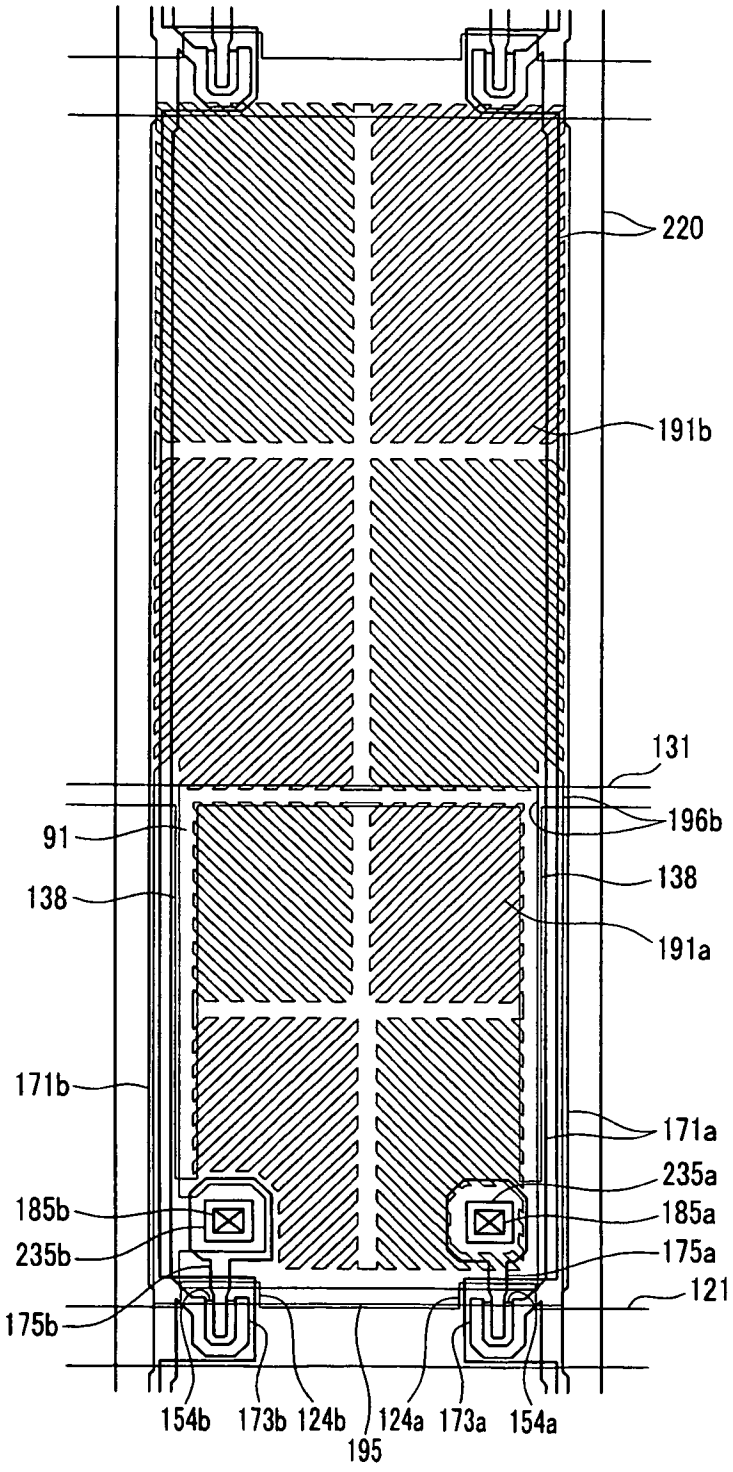

220
191b
131
196b
91
138
138
191a
171b
171a
235a
185b
185a
235b
175a
121
175b
154b
173b
124b
124a
173a
154a
195

FIG.13

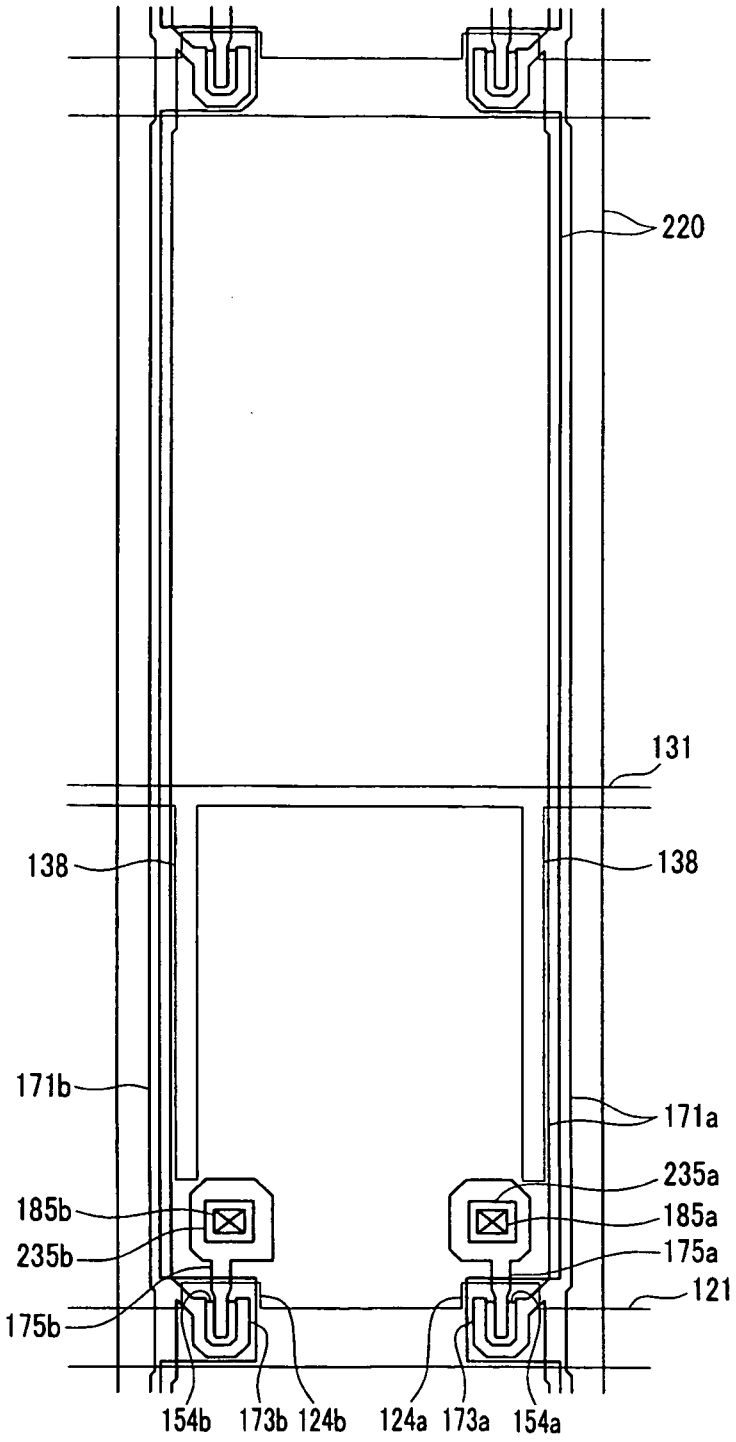

220
131
138
138
171b
171a
235a
185b
185a
235b
175a
121
175b
154b
173b
124b
124a
173a
154a

FIG.14

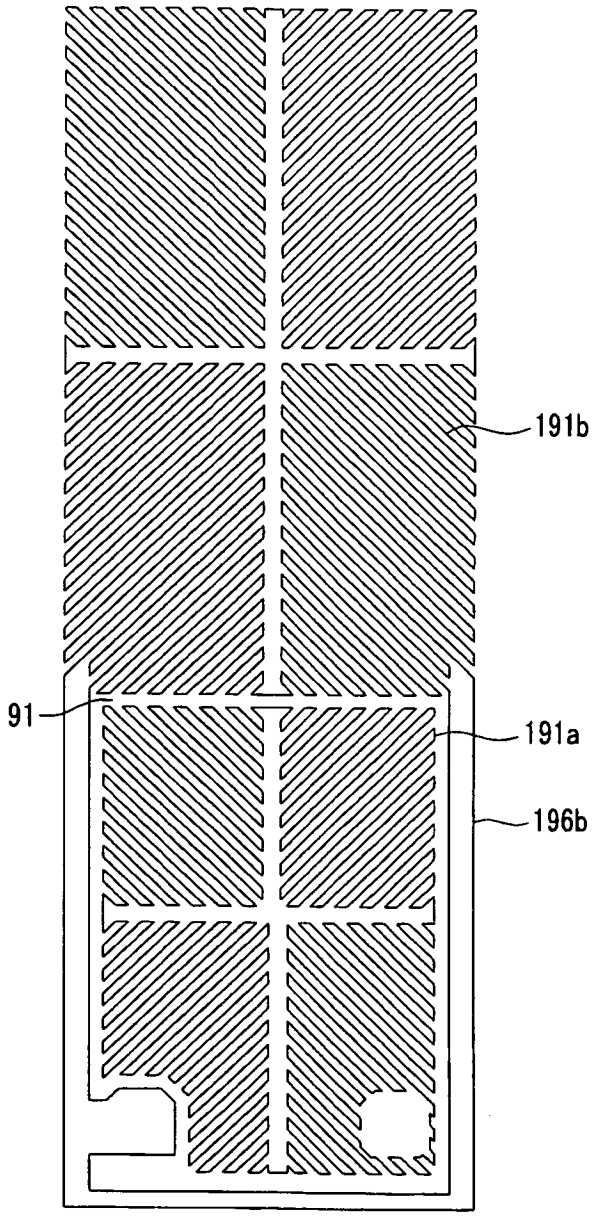


FIG.15

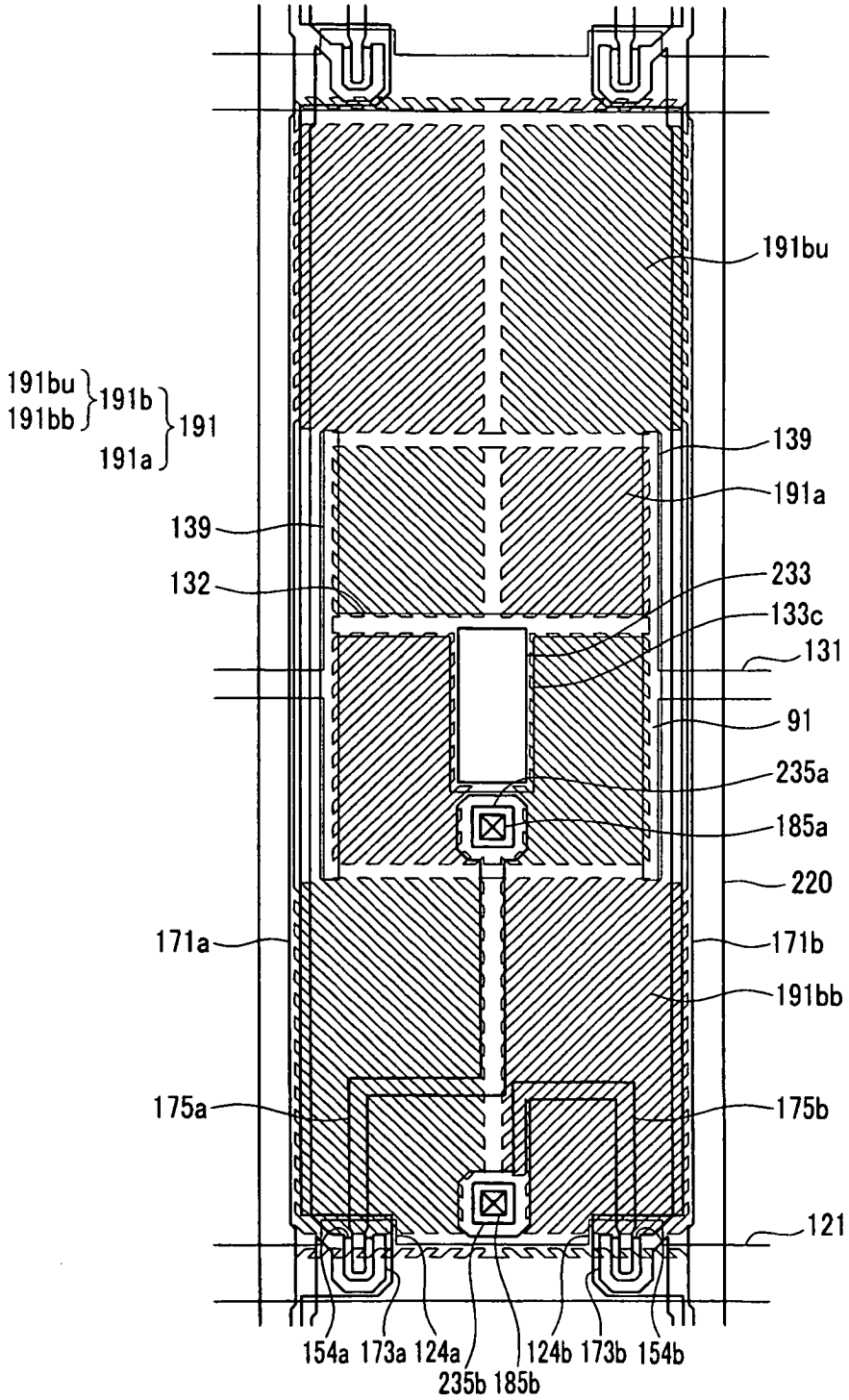

191bu
191bu
191bb
191b
191
191a
139
191a
139
132
233
133c
131
91
235a
185a
220
171a
171b
191bb
175a
175b
121
154a
173a
124a
235b
185b
124b
173b
154b

FIG.16

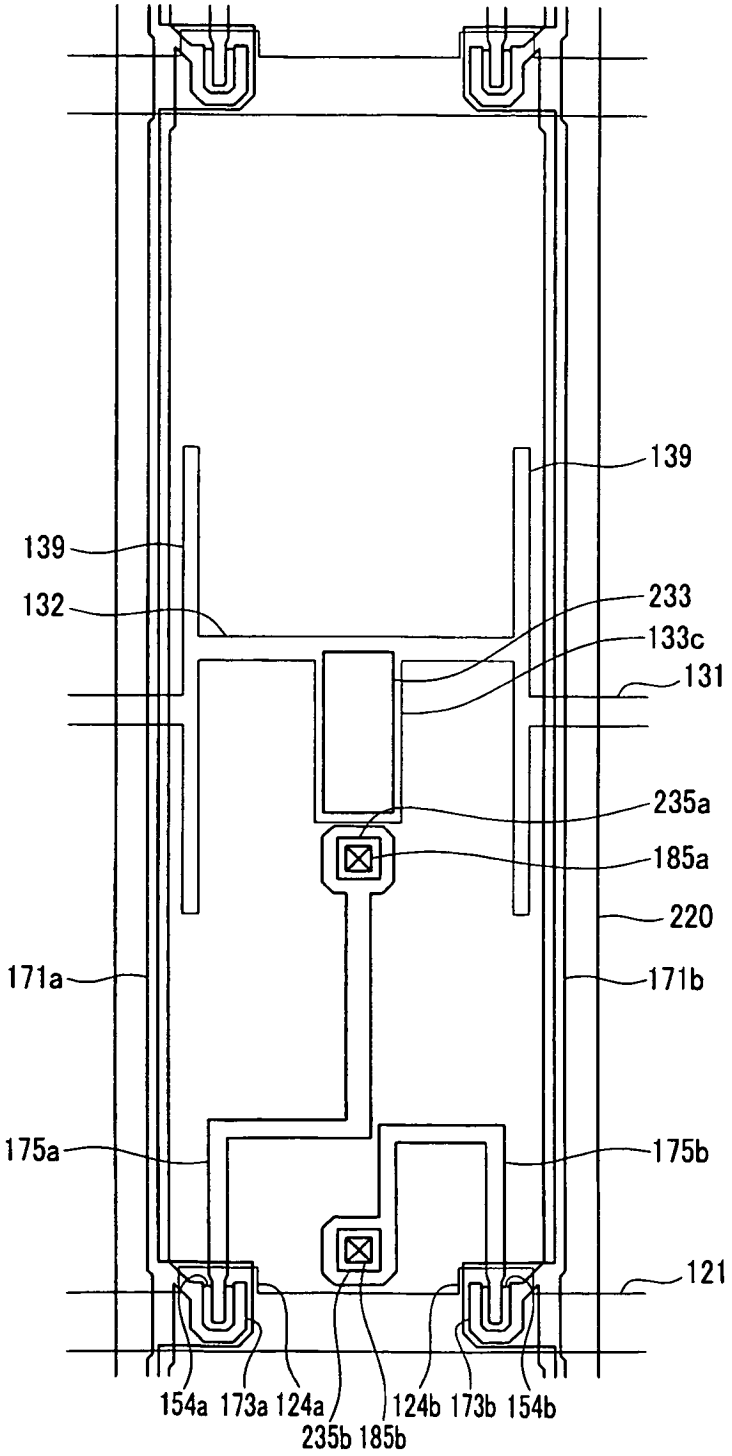

139
139
132
233
133c
131
235a
185a
220
171a
171b
175a
175b
121
154a
173a
124a
235b
185b
124b
173b
154b

FIG.17

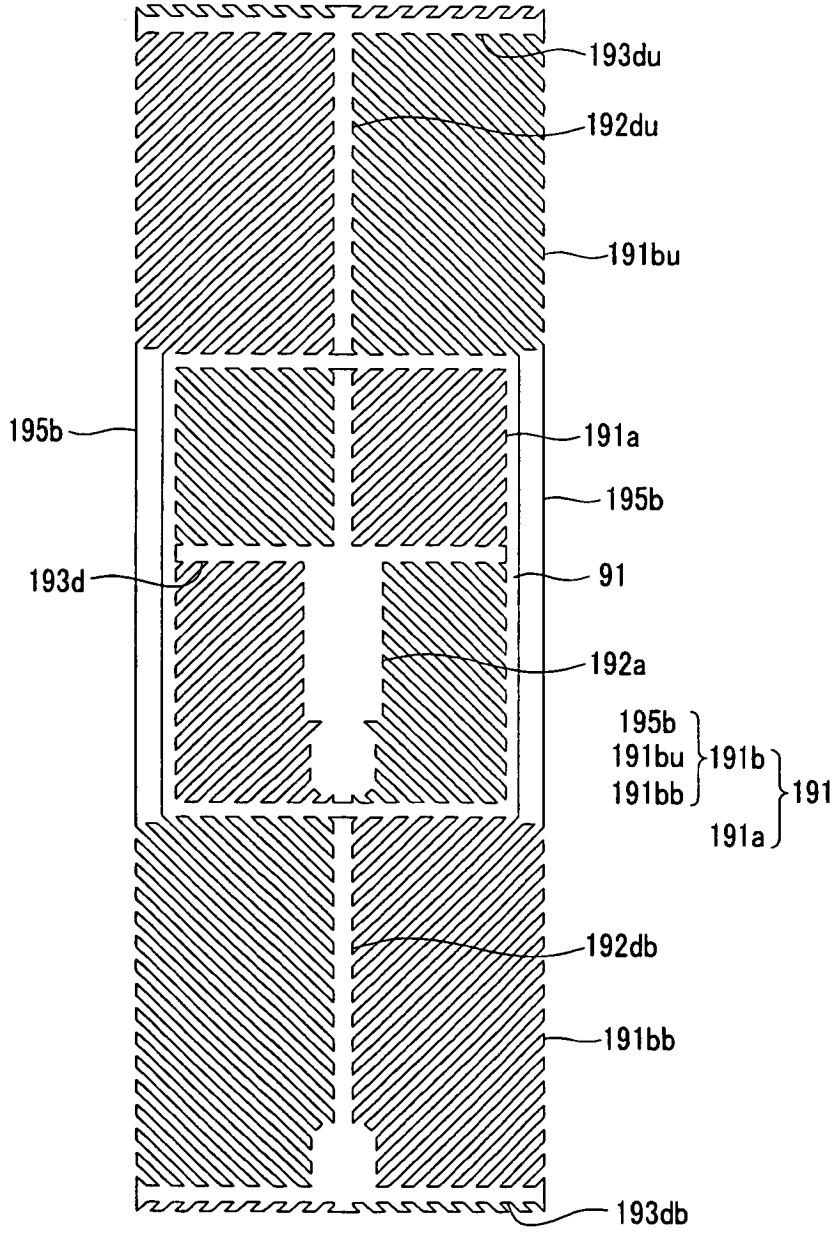

193du
192du
191bu
195b
191a
195b
193d
91
192a
195b
191bu
191bb
191b
191
191a
192db
191bb
193db

FIG.18

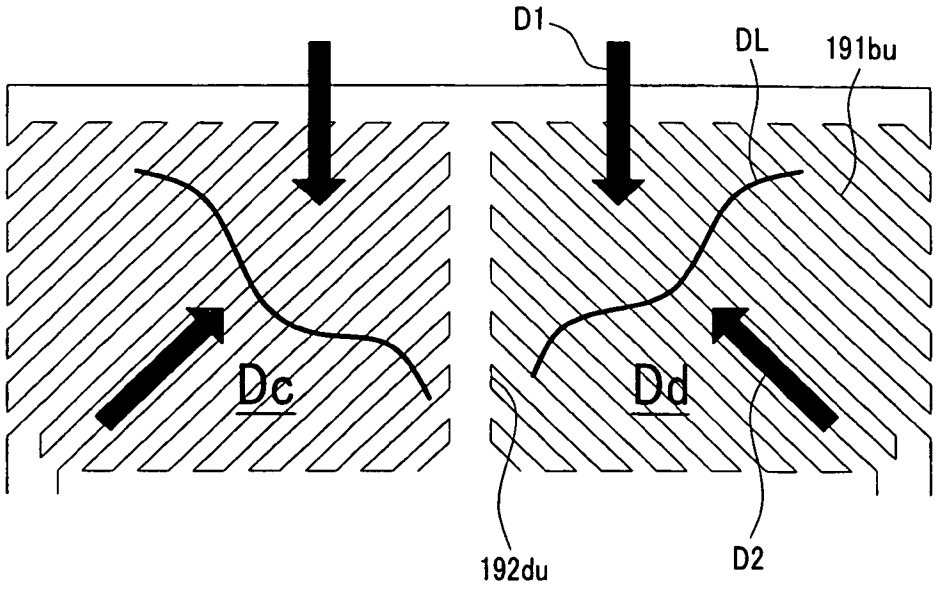
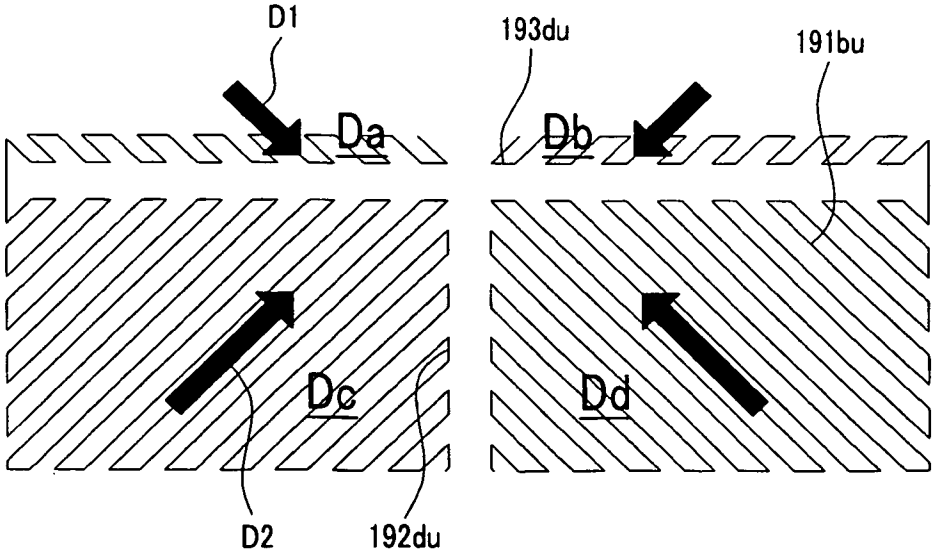


FIG.19



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- KR 1020080029090 **[0001]**
- US 20080018573 A **[0010]**
- US 20060164352 A **[0010]**
- US 20070097279 A **[0010]**

专利名称(译)	液晶显示器		
公开(公告)号	EP2105786B1	公开(公告)日	2012-03-07
申请号	EP2008021670	申请日	2008-12-12
[标]申请(专利权)人(译)	三星电子株式会社		
申请(专利权)人(译)	三星电子有限公司		
当前申请(专利权)人(译)	三星DISPLAY CO.，LTD.		
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发明人	JUNG, MEE-HYE SOHN, JI-WON LYU, JAE-JIN CHAI, CHONG-CHUL		
IPC分类号	G02F1/1362 G02F1/1337 G02F1/1343		
CPC分类号	G02F1/134336 G02F1/1337 G02F1/133753 G02F1/133788 G02F1/134309 G02F1/136227 G02F1/13624 G02F1/136286 G02F1/1368 G02F2001/133715 G02F2001/133742		
代理机构(译)	DR.威猛和合作伙伴		
优先权	1020080029090 2008-03-28 KR		
其他公开文献	EP2105786A1		
外部链接	Espacenet		

摘要(译)

液晶显示器技术领域本发明涉及一种液晶显示器，包括像素电极（191），该像素电极包括第一子像素电极（191a）和第二子像素电极（191b），第一子像素电极（191a）之间具有间隙（91），公共电极（270）面向像素电极（191）和形成在像素电极（191）和公共电极（270）之间并包括多个液晶分子（310）的液晶层（3）。第一和第二子像素电极（191a，191b）包括多个分支（194a-d），并且第一和第二子像素电极（191a，191b）中的每一个包括多个子区域（Da-Dd）。分支（194a-d）在不同的子区域（Da-Dd）中沿不同方向延伸。

FIG.1