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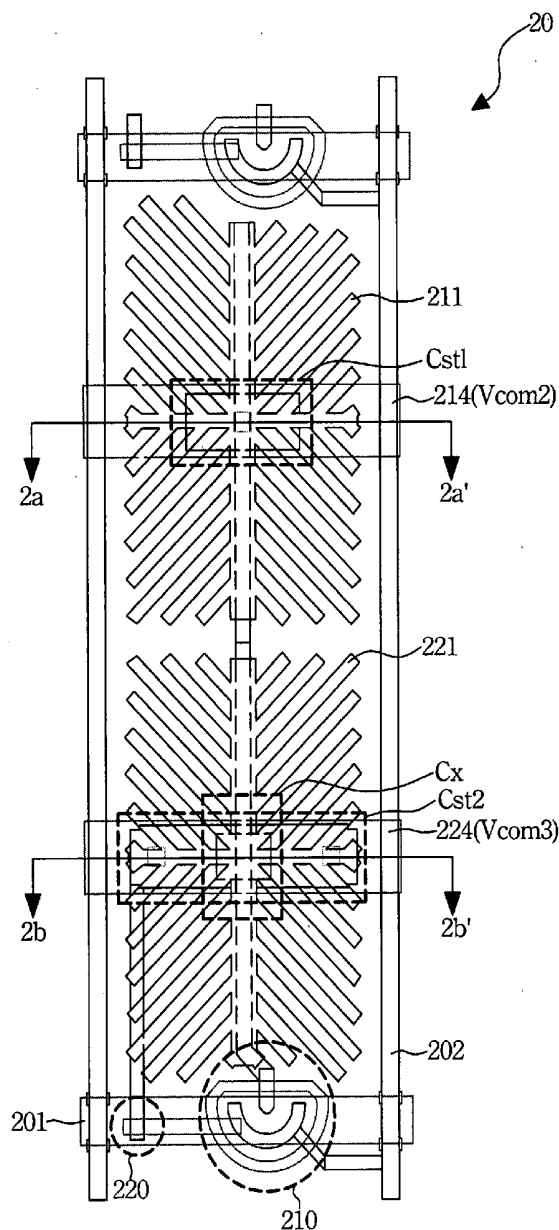
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Chan et al.(10) **Pub. No.: US 2008/0036931 A1**(43) **Pub. Date: Feb. 14, 2008**(54) **PSA LCD PANEL**(22) Filed: **Mar. 23, 2007**(75) Inventors: **Te-Wei Chan, Hsin-Chu (TW);**
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G02F 1/1343 (2006.01)(52) **U.S. Cl.** **349/38; 349/143**(57) **ABSTRACT**

A PSA LCD panel includes a plurality of pixel units. Each of the pixel units includes a first pixel electrode and a second pixel electrode separated from the first pixel electrode. Each of the first and second pixel electrodes has a pattern scattered from a center in such a manner to form four domains.

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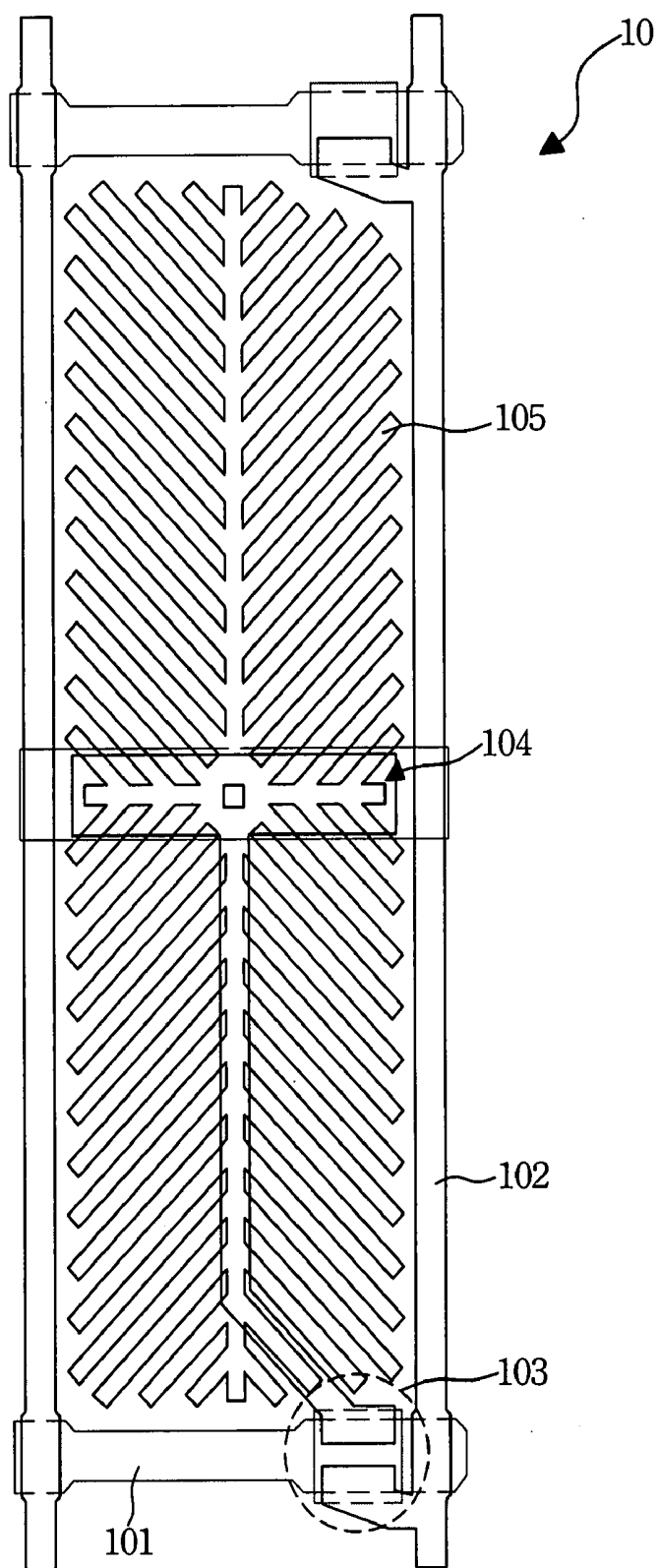


FIG. 1 (Prior Art)

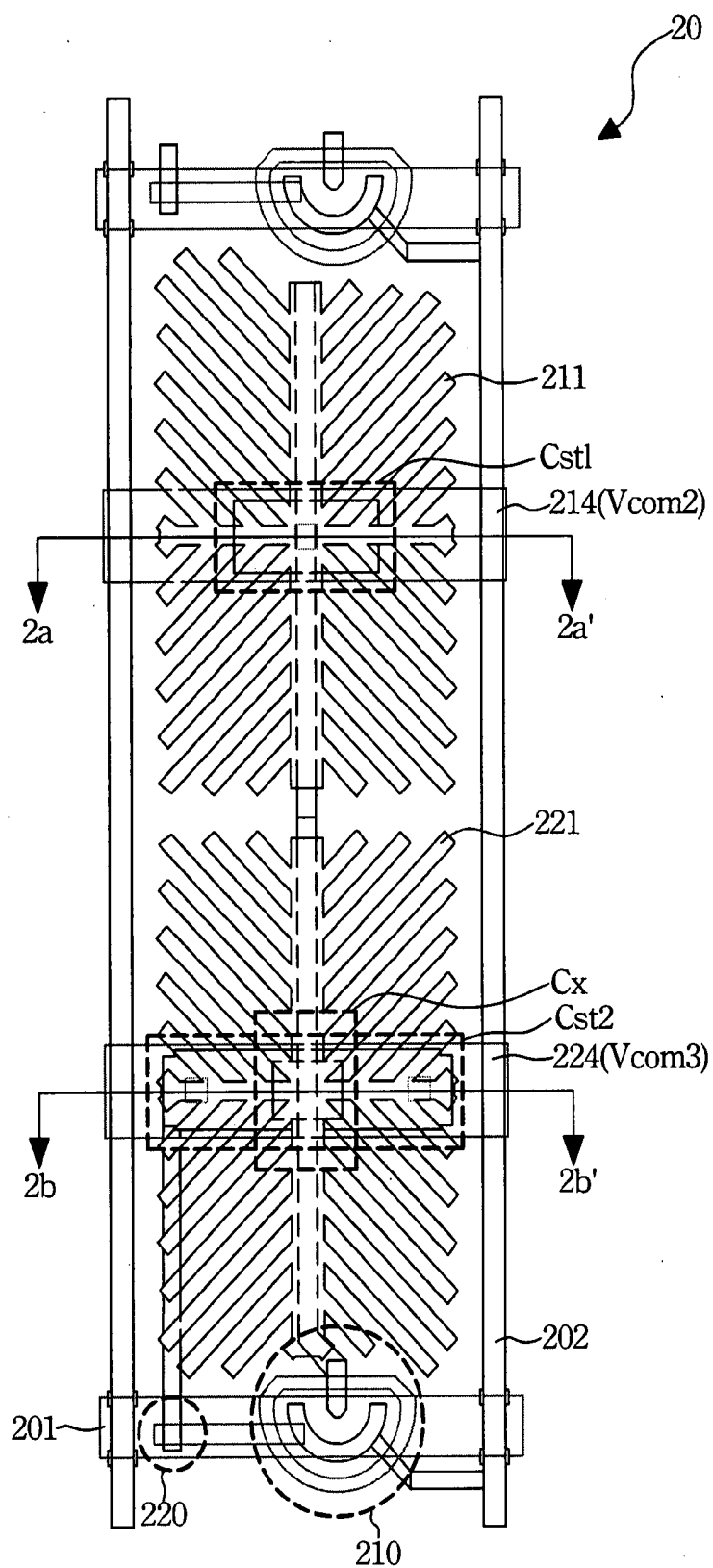


FIG. 2

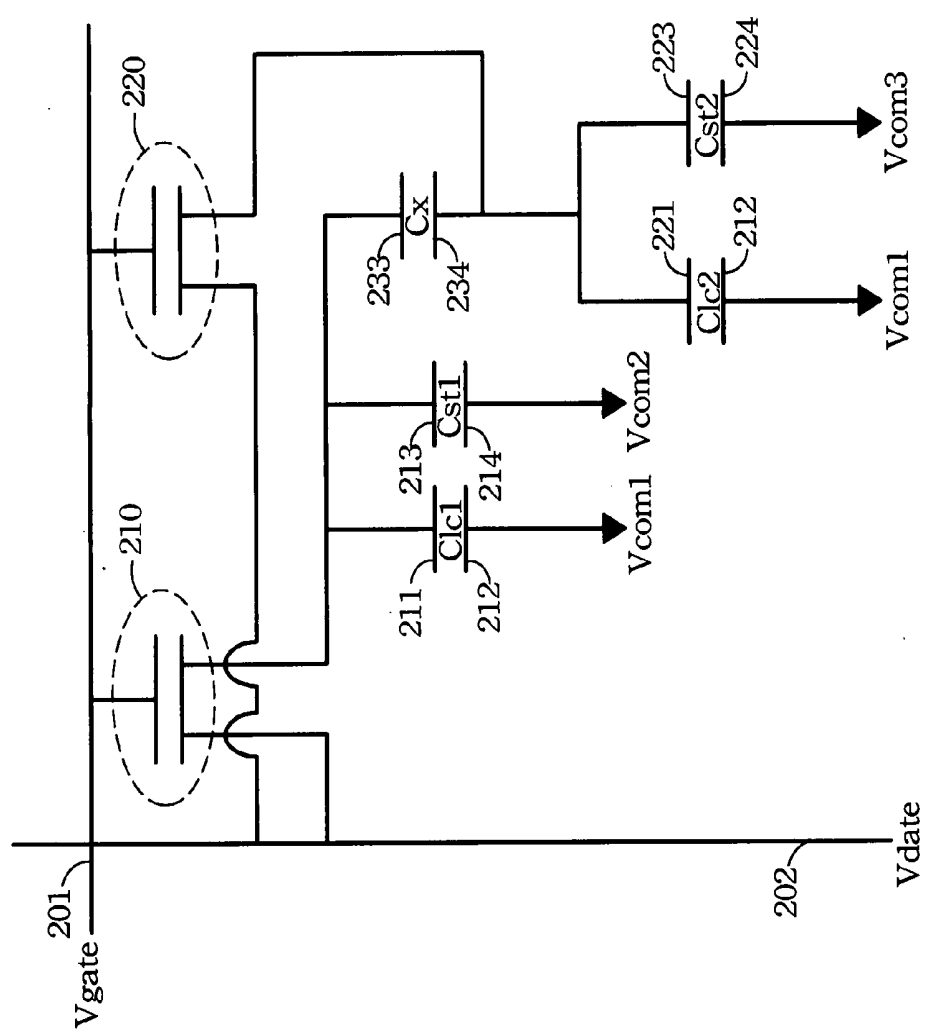


FIG. 3.

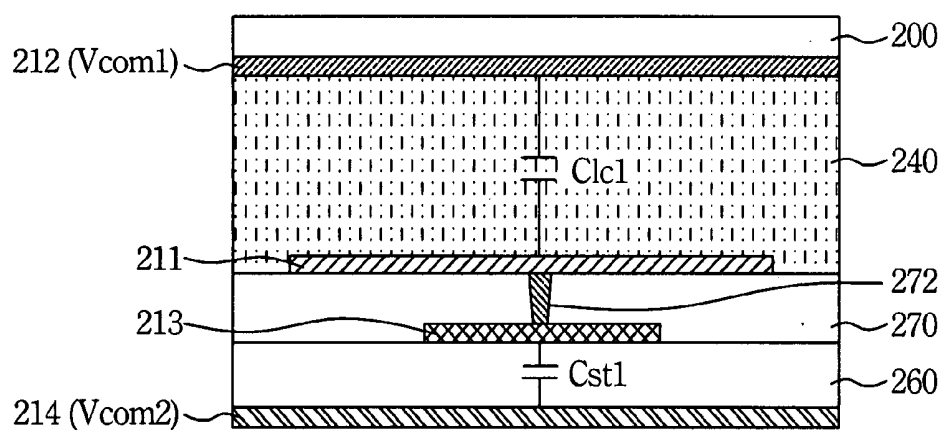


FIG. 4 A

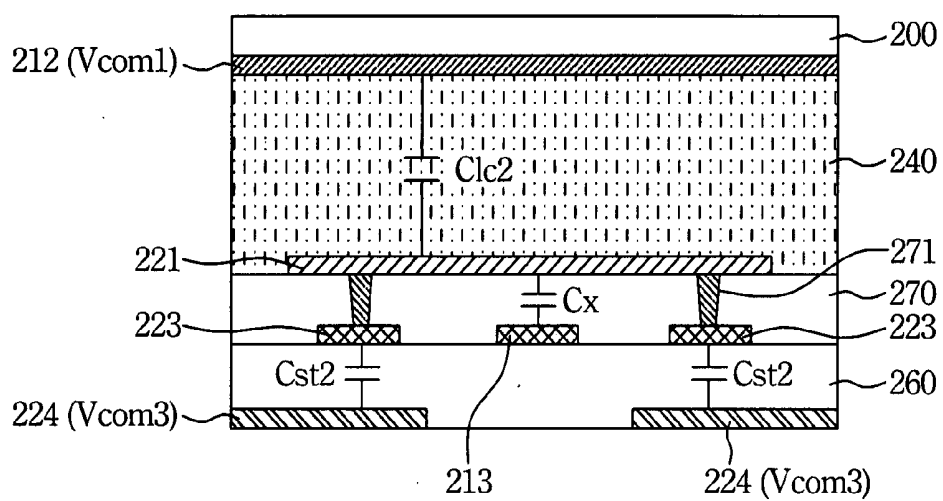


FIG. 4 B

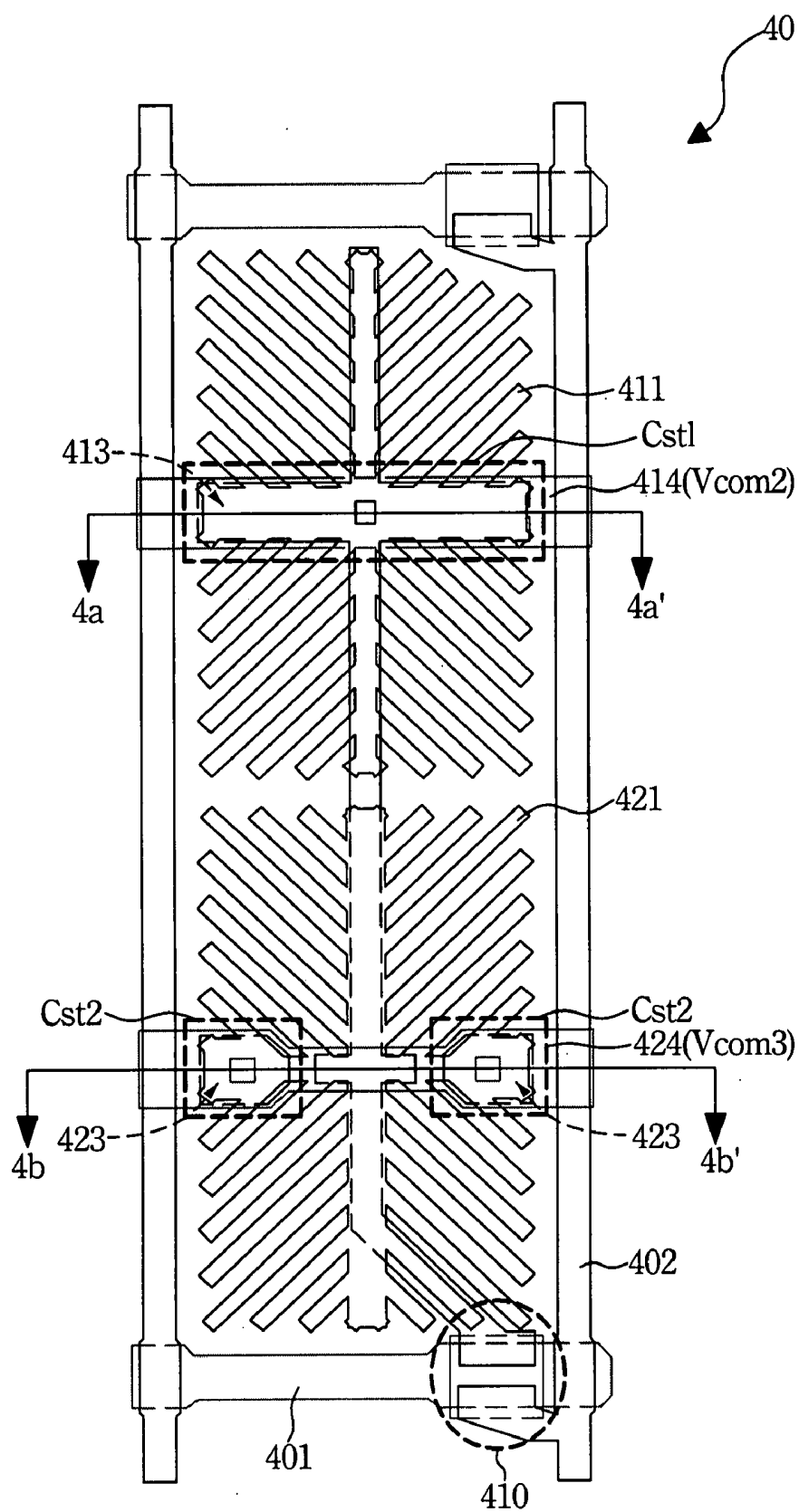


FIG. 5

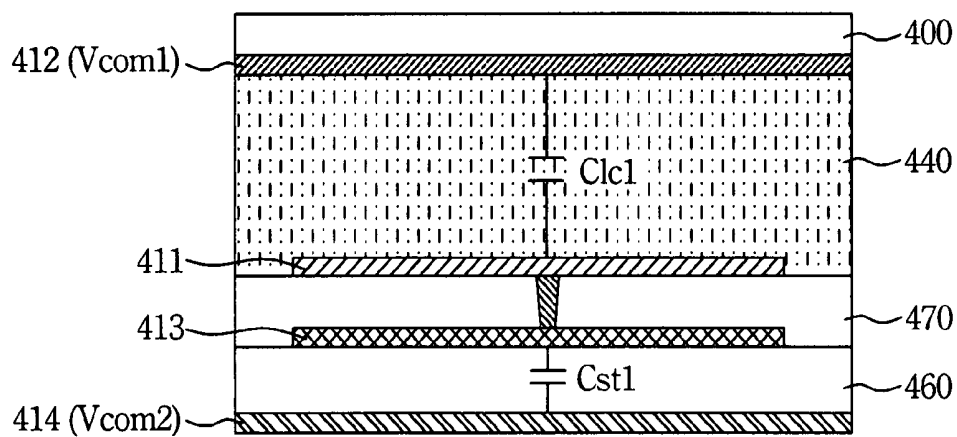


FIG. 6 A

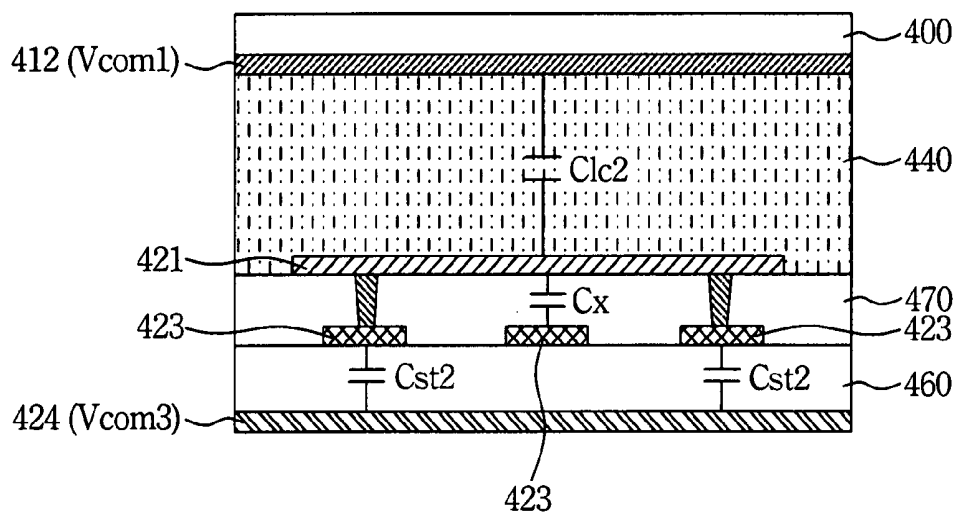


FIG. 6 B

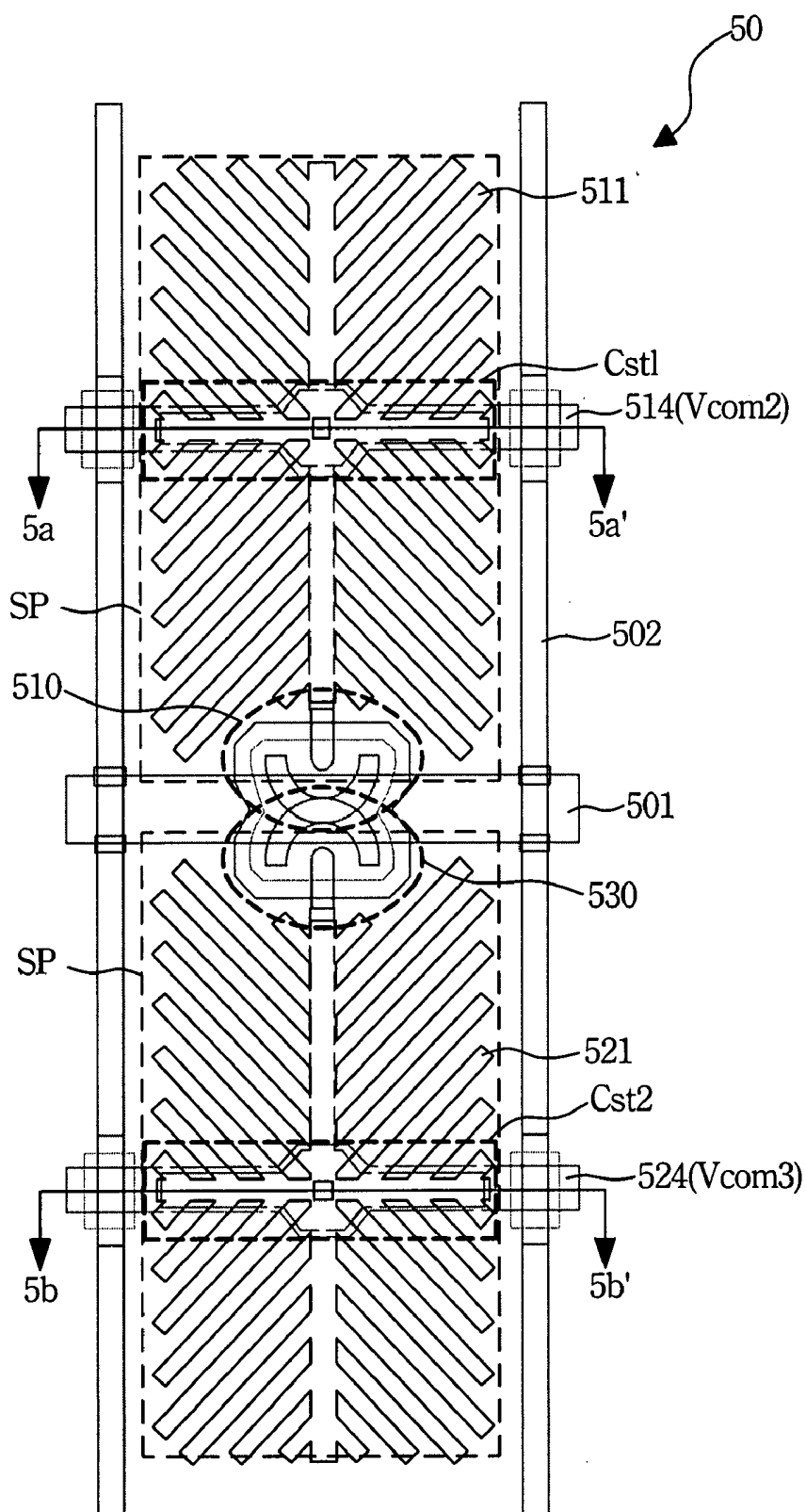


FIG. 7

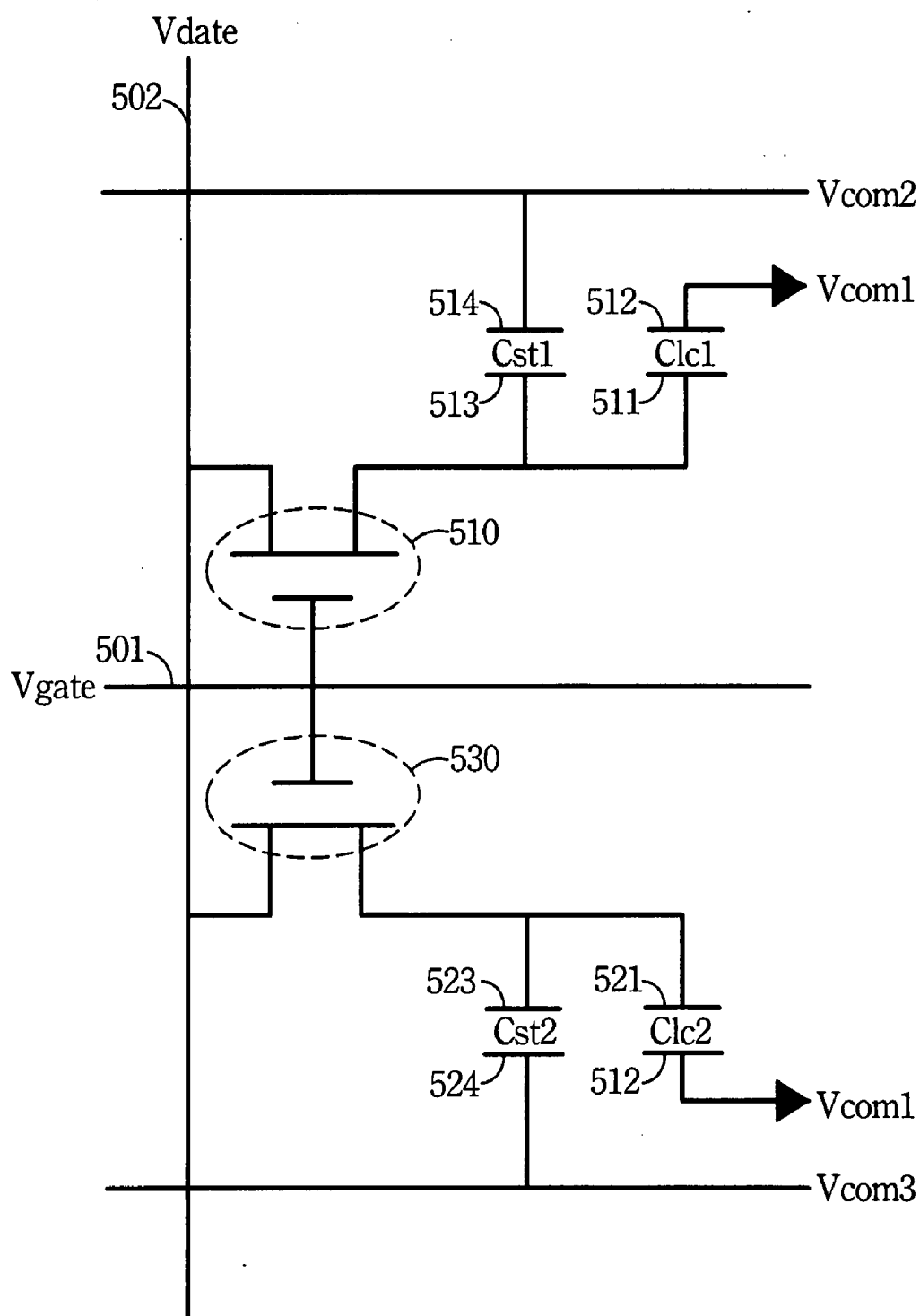


FIG. 8

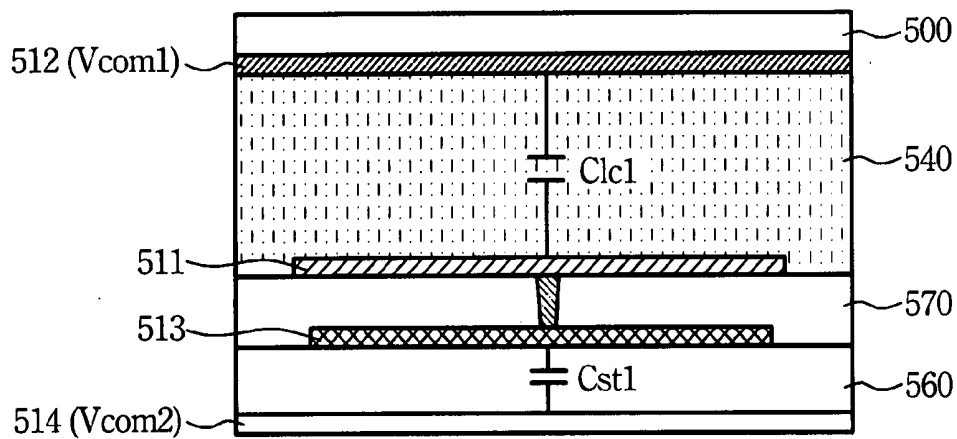


FIG. 9 A

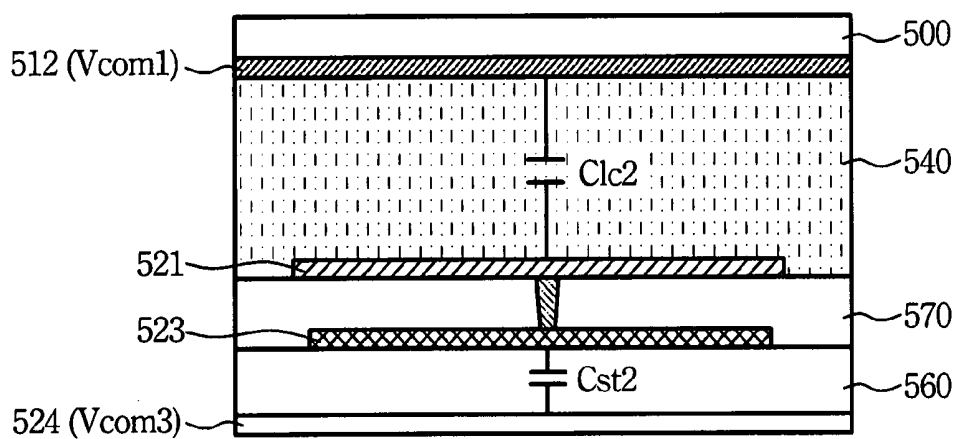


FIG. 9 B

PSA LCD PANEL

BACKGROUND OF THE INVENTION

[0001] (1) Field of the Invention

[0002] The present invention relates to an LCD panel, and more specifically to a PSA (polymer stabilized alignment) LCD panel.

[0003] (2) Description of the Prior Art

[0004] Due to rapid development in the display technology, an LCD (liquid crystal display) device is generally preferred to when compared to the conventional CRT-type display device due to its compact size and quick response time in addition to its lower power consumption and low radiation. Therefore, the LCD device is in great demand in the market and is widely used in many electronic devices, such as calculators, PDAs, notebook computers, digital cameras and mobile phones.

[0005] Due to market competition, the LCD manufacturers have devoted a tremendous effort in the research to improve the ability of the LCD device and simultaneously lower the cost. Therefore, the demand for the LCD device is increasing. Presently, the research is emphasized in the field how to widen the viewing angle of the LCD panel and shorten the response time for displaying the image.

[0006] In order to achieve the aforesaid objects, a MVA (multi-domain vertical alignment) design is implemented in the liquid crystal layer. During the construction of the LCD device, the common electrode and the pixel electrode are formed with protrusions or slits in order to control the splay of the crystal molecules when no voltage is applied on the liquid crystal layer, i.e. the crystal molecules are slightly inclined with respect to the protrusions. Thus, when the voltage is applied onto the pixel electrode, an electric field is generated that forces the crystal molecules in the liquid crystal layer to change their orientation from the slightly inclined direction to a predetermined direction, thereby shortening the response time so as to provide a wide viewing angle.

[0007] The multi-domain vertical alignment technology includes a film depositing process, an etching process and a photolithographic process to form the protrusion or slits on the common electrode and the pixel electrode. The production method is relatively complicated and results in the higher manufacturing cost. Moreover, since the protrusions formed on the substrate may hinder passage of light there-through and the increased quantity thereof consequently reduces the number of the slits, which, in turn, lowers the brightness in the display panel of the LCD device.

[0008] The LCD manufacturers have introduced a PSA (polymer stabilized alignment) technology to solve the problems resulted by the use of the MVA (multi-domain vertical alignment) technology in the LCD device.

[0009] The LCD device generally includes a liquid crystal layer sandwiched between an upper substrate and a lower substrate. A common electrode is sandwiched between the liquid crystal layer and the upper substrate.

[0010] FIG. 1 shows a pixel structure of a conventional PSA LCD panel formed on a lower substrate, and includes a plurality of pixel units 10. Each pixel unit 10 includes a scan line 101, a data line 102, a thin film transistor 103, a storage capacitor 104, and a pixel electrode 105. During the operation, the scan line 101 is capable of transmitting a scan signal through the transistor 103 so as to permit transmission of the voltage signal from the data line 102 to the pixel

electrode 105. At the same time, since the voltage signal fed through the data line 102 is retained within the storage capacitor 104, the pixel unit 10 can be kept under a preset gray value during the break of the data transmission.

[0011] As illustrated, the pixel electrode 105 includes a pattern having a plurality of parallel ribs extending along four directions (the pattern has a fish-bone configuration). Under the operation, an electric field is resulted between the pixel electrode 105 and the common electrode so as to force the crystal molecules to change their orientation. The crystal molecules change their orientation towards the four directions due to the configuration of the pixel electrode 105 so as to form four domains with respect to the center thereof.

[0012] In order to shorten the response time for displaying the image, after the pixel electrode 105 being constructed as the aforesaid manner, the PSA (polymer stabilized alignment) technology is implemented onto the pixel electrode 105 so as to direct the crystal molecules within the liquid crystal layer in a predetermined inclined angle. In other words, during construction of the aforesaid PSA LCD panel, the monomers are added into the liquid crystal layer such that when the voltage signal is applied onto the common electrode and the pixel electrode 105, the crystal molecules tend in the predetermined inclined angle with the monomers tending the same direction. A power light (visible or ultra violet light) or heat treatment is conducted such that the monomers combined together to form the polymers tending in the predetermined inclined angle.

[0013] When no voltage is applied, the crystal molecules tend in the predetermined inclined angle under the influence of the polymers. When driven by an electric field, the crystal molecules can turn swiftly from the predetermined inclined angle into the appropriate position, thereby shortening the response time for displaying the image.

[0014] Moreover, since the PSA LCD panel is not provided with the protrusions or slits, it is free from light leakage problem when compared to the MVA LCD panel. Thus, the PSA LCD panel has a high contrast and a higher brightness than the MVA LCD panel.

[0015] Presently, the pixel electrode 105 in the PSA LCD panel is made from ITO (indium tin oxide). Lithographic and etching processes are conducted to form the pattern with a fish-bone configuration having a plurality of parallel ribs divided in four domains with respect to a center, which, in turn, provides a higher contrast, a higher brightness and a shorter response time. However, it is in the trend to produce the LCD panel in a larger dimension, the aforesaid design is unable to solve the color-shift in the changing view angle and reduce the color washout phenomenon.

SUMMARY OF THE INVENTION

[0016] The object the present invention is to provide a PSA (polymer stabilized alignment) technology for constructing an LCD panel. By designing the pixel electrode, the transistor, the crystal capacitor and the storage capacitor within each pixel unit of the LCD panel, the pattern of the pixel unit can be divided into eight domains instead of four domains. Once, the pattern is thus arranged, the wide viewing and color washout phenomenon is greatly improved.

[0017] In one aspect of the present invention, a PSA (polymer stabilized alignment) LCD panel is provided and includes a plurality of pixel units. Each pixel unit includes a first pixel electrode and a second pixel electrode separated

from the first pixel electrode. Each of the first and second pixel electrodes has a pattern scattered from a center in such a manner to form four domains.

[0018] In a second aspect of the present invention, a PSA (polymer stabilized alignment) LCD panel is provided and includes a plurality of pixel units. Each pixel unit includes a scan line, a data line, a first transistor, a first crystal capacitor, a first storage capacitor, a second crystal capacitor and a second storage capacitor.

[0019] The scan line is used for transmitting a scan signal. The data line is used for transmitting a voltage signal. The first transistor is adapted to be switched on in response to the scan signal for transmitting the voltage signal. The first crystal capacitor is formed by a first pixel electrode, a crystal layer and a first common electrode, and is further coupled to the first transistor for receiving the voltage signal. The first storage capacitor is formed by a first capacitor electrode, a first dielectric layer and a second common electrode, and is coupled to the first crystal capacitor in parallel and coupled to the first transistor for receiving the voltage signal.

[0020] The second crystal capacitor is formed by a second pixel electrode, the crystal layer and the first common electrode. The second crystal capacitor is coupled to the data line, wherein the first and second pixel electrodes are separated from each other. The second storage capacitor is formed by a second capacitor electrode, the first dielectric layer and a third common electrode, and is coupled to the second crystal capacitor in parallel.

[0021] These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment, which is illustrated in the various figures and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] The present invention will now be specified with reference to its preferred embodiment illustrated in the drawings, in which:

[0023] FIG. 1 is a top view of a pixel unit in a conventional PSA (polymer stabilized alignment) LCD panel;

[0024] FIG. 2 is a top view of the first embodiment of a pixel unit in a PSA (polymer stabilized alignment) LCD panel according to the present invention;

[0025] FIG. 3 illustrates a circuit diagram representing the first embodiment shown in FIG. 2;

[0026] FIG. 4A is a cross-sectional view of the first embodiment taken along the line 2a-2a' in FIG. 2;

[0027] FIG. 4B is a cross-sectional view of the first embodiment taken along the line 2b-2b' in FIG. 2;

[0028] FIG. 5 is a top view of the second embodiment of the pixel unit in the PSA (polymer stabilized alignment) LCD panel according to the present invention;

[0029] FIG. 6A is a cross-sectional view of the second embodiment taken along the line 4a-4a' in FIG. 5;

[0030] FIG. 6B is a cross-sectional view of the second embodiment taken along the line 4b-4b' in FIG. 5;

[0031] FIG. 7 is a top view of the third embodiment of the pixel unit in the PSA (polymer stabilized alignment) LCD panel according to the present invention;

[0032] FIG. 8 illustrates a circuit diagram representing the third embodiment shown in FIG. 7;

[0033] FIG. 9A is a cross-sectional view of the third embodiment taken along the line 5a-5a' in FIG. 7; and

[0034] FIG. 9B is a cross-sectional view of the third embodiment taken along the line 5b-5b' in FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0035] An LCD panel of the present invention is constructed by using PSA (polymer stabilized alignment) technology. A pixel unit of the LCD panel includes a pattern, which can be divided into several domains so as to enhance the viewing angle and improve the color washout problem.

[0036] The PSA (polymer stabilized alignment) LCD panel of the present invention includes a plurality of pixel units 20, an upper substrate provided with a color filter and a lower substrate provided with thin film transistors (TFT). FIG. 2 is a top view of the first embodiment of a pixel unit in the PSA LCD panel according to the present invention. FIG. 3 illustrates a circuit diagram representing the first embodiment shown in FIG. 2. FIG. 4A is a cross-sectional view of the first embodiment taken along the line 2a-2a' in FIG. 2. FIG. 4B is a cross-sectional view of the first embodiment taken along the line 2b-2b' in FIG. 2. As illustrated, each pixel unit 20 includes a scan line 201, a data line 202, a first transistor 210, a first crystal capacitor Clc1, a first storage capacitor Cst1, a second crystal capacitor Clc2 and a second storage capacitor Cst2.

[0037] The scan line 201 is used for scanning and transmitting a scan signal. The data line 202 is used for transmitting a voltage signal. The first transistor 210 is adapted to be switched on in response to the scan signal for transmitting the voltage signal to the first pixel electrode 211. The first pixel electrode 211 is coupled directly to the first transistor 210 in order to receive the voltage signal.

[0038] The first crystal capacitor Clc1 is formed by the first pixel electrode 211, a crystal layer 240 and a first common electrode 212. The first crystal capacitor Clc1 is coupled to the first transistor 210 for receiving the voltage signal. Note that the first common electrode 212 is formed on the upper substrate 200.

[0039] The first storage capacitor Cst1 is formed by a first capacitor electrode 213, a first dielectric layer 260 and a second common electrode 214. The first storage capacitor Cst1 is further coupled to the first crystal capacitor Clc1 in parallel and coupled to the first transistor 210 for receiving the voltage signal. As illustrated in FIG. 2, the first transistor 21 has a gate coupled to the scan line 201, a source/drain terminal coupled to the data line 202 and another source/drain terminal coupled to the first pixel electrode 211 and the first capacitor electrode 213.

[0040] The second crystal capacitor Clc2 is formed by a second pixel electrode 221, a liquid crystal layer 240 and the first common electrode 212. The second crystal capacitor Clc2 is further coupled to the data line 202, wherein the first and second pixel electrode 211, 221 are separated from each other and are disconnected electrically. The second storage capacitor Cst2 is formed by the second capacitor electrode 223, the first dielectric layer 260 and a third common electrode 224. The second storage capacitor Cst2 is further coupled to the second crystal capacitor Clc2 in parallel.

[0041] Referring again to FIGS. 4A and 4B, each pixel unit 20 further includes a second dielectric layer 270 sandwiched between the respective pixel electrode and the respective capacitor electrode, namely between the liquid crystal layer 240 and the first dielectric layer 260.

[0042] In the aforementioned PSA LCD panel, the first and second pixel electrodes **211**, **221** of the respective pixel unit **20** are separated from each other. Each of the first and second pixel electrodes **211**, **221** has a pattern scattered from a center in such a manner to form four domains. Each of the four domains of a respective one of the first and second pixel electrodes **211**, **221** includes a plurality of parallel ribs extending in a predetermined direction.

[0043] Preferably, the parallel ribs in the four domains define (four azimuth angles) with respect to a line passing through the center ranging of 40 to 50 degrees, 130 to 140 degrees, 220 to 230 degrees and 310 to 320 degrees, respectively. Therefore, the pattern of each of the first and second pixel electrodes **211**, **221** in the pixel unit **20** has a fish-bone configuration.

[0044] Referring to FIGS. 2 and 3, the pixel unit **20** further includes a coupling capacitor Cx connected between the first transistor **210** and the second crystal capacitor Clc2. The coupling capacitor Cx is formed by a first electrode **233** coupled to a source/drain terminal of the first transistor **210** and a second electrode **234** connected to the second pixel electrode **221** and the second capacitor electrode **223**. Coupling capacitor Cx can be controlled to create plural domains, such as at least four domains while second transistor **220** doesn't exist.

[0045] FIG. 4B illustrates one embodiment of the formation of the coupling capacitor Cx, wherein the first capacitor electrode **213** serves as the first electrode **233** of the coupling capacitor Cx while the second pixel electrode **221** serves as the second electrode **234** of the coupling capacitor Cx. Therefore, the coupling capacitor Cx is formed by the second pixel electrode **221**, the second dielectric layer **270** and the first capacitor electrode **213**. Two second capacitor electrodes **223** are coupled electrically to the second pixel electrode **221** via two conducting holes **271** formed through the second dielectric layer **270**. The first capacitor electrode **213** is coupled electrically to the first pixel electrode **211** via another conducting hole **272** formed through the second dielectric layer **270**, as best shown in FIG. 4A.

[0046] As mentioned above, since the first pixel electrode **211** is directly coupled to the first transistor **210**, the coupling capacitor Cx is connected to the first crystal capacitor Clc1 in parallel and the second pixel electrode **221** is coupled via the coupling capacitor Cx to the first transistor **210**. Under this condition, two different voltages can be applied onto the first and second pixel electrodes **211**, **221** respectively via the coupling capacitor Cx such that the first and second pixel electrodes **211**, **221** have voltage levels different from each other. In other words, since the first and second crystal capacitors Clc1, Clc2 are connected to each other via the coupling capacitor Cx, the first and second storage capacitors Cst1, Cst2 have different voltages.

[0047] When the pixel unit **20** is under the operation, the first pixel electrode **211** possesses the voltage level equivalent to the voltage signal supplied by the data line **202** and the voltage level of the second pixel electrode **221** is supplied by the coupling capacitor Cx. Adjusting the capacitance of the coupling capacitor Cx can vary the voltage level of the second pixel electrode **221**, therefore at least four domains can be created.

[0048] Since the first and second pixel electrodes **211**, **221** have different voltage levels and are located on the same side of the crystal layer **240** at different domains, the orientation of the crystal molecules at the different domains differs from

each other under the influence of the electric fields with differing strength. The increased domains of the pattern of the first and second pixel electrodes **211**, **22** from four to eight domains magnificently lower the color-shift in the changing view angle and the washout phenomenon, which, in turn, provides a better display ability.

[0049] In addition, the pixel unit **20** further includes a second transistor **220**. A transistor with a lower charging ability can be selected for serving the second transistor **220**. The second transistor **220** has a gate coupled to the scan line **201** and source/drain terminals coupled respectively to the data line **202** and the second pixel electrode **221**. The second transistor **220** is adapted to be switched on in response to the scan signal to establish a communication between the data line **202** and the second pixel electrode **221** so as to enable the second transistor **220** to discharge the accumulated charge from the second pixel electrode **221** via the scan line **201**. Thus, no image-sticking phenomenon is occurred.

[0050] FIG. 5 is a top view of the second embodiment of the pixel unit in the PSA (polymer stabilized alignment) LCD panel according to the present invention. FIG. 6A is a cross-sectional view of the second embodiment taken along the line **4a-4a'** in FIG. 5. FIG. 6B is a cross-sectional view of the second embodiment taken along the line **4b-4b'** in FIG. 5.

[0051] Each pixel unit **40** of the PSA LCD panel includes a scan line **401**, a data line **402**, a first transistor **410**, a first crystal capacitor Clc1, a first storage capacitor Cst1, a second crystal capacitor Clc2 and a second storage capacitor Cst2.

[0052] The pixel unit **40** generally has the structure similar to the first embodiment, and has first and second pixel electrodes **411**, **421** separated from each other. Referring to FIG. 5, each of the first and second pixel electrodes **411**, **421** has a pattern scattered from a center in such a manner to form four domains. Each of the four domains of a respective one of the first and second pixel electrodes **411**, **421** includes a plurality of parallel ribs extending in the predetermined inclined direction.

[0053] In the above embodiment, the first crystal capacitor Clc1 is formed by the first pixel electrode **411**, the crystal layer **440** and the first common electrode **412**, wherein the first common electrode **412** is formed on the upper substrate **400**. The first storage capacitor Cst1 is formed by a first capacitor electrode **413**, the first dielectric layer **460** and the second common electrode **414**. The first storage capacitor Cst1 is coupled to the first crystal capacitor Clc1 in parallel while the second common electrode **414** is formed on the lower substrate (not shown).

[0054] The second crystal capacitor Clc2 is formed by the second pixel electrode **421**, the liquid crystal layer **440** and the first common electrode **412**. The second storage capacitor Cst2 is formed by the second capacitor electrode **423**, the first dielectric layer **460** and the third common electrode **424**. The second storage capacitor Cst2 is further coupled to the second crystal capacitor Clc2 in parallel.

[0055] Referring to FIG. 6A and FIG. 6B, the pixel unit **40** further includes the second dielectric layer **470** sandwiched between the respective pixel electrode and the respective capacitor electrode, namely between the liquid crystal layer **440** and the first dielectric layer **460**. The second capacitor electrode **423** is coupled to the second pixel electrode **421** via two conducting holes formed through the second dielectric layer **470** while the first capacitor electrode **413** is

coupled to the first pixel electrode **411** via another conducting hole formed through the second dielectric layer **470**.

[0056] The first and second storage capacitors Cst1, Cst2 are coupled respectively to the first and second crystal capacitors Clc1 and Clc2 in parallel. The first capacitor electrode **413** of the first storage capacitor Cst1 and the second capacitor electrode **423** of the second storage capacitor Cst2 are coupled to the data line **402** via the first transistor **410**. Two different voltages Vcom2, Vcom3 are respectively applied onto the second common electrode **414** of the first storage capacitor Cst1 and the third common electrode **424** of the second storage capacitor Cst2 such that the first and second storage capacitors Cst1, Cst2 have voltage levels different from each other.

[0057] In the second embodiment, since the first and second storage capacitors Cst1 and Cst2 have different voltage levels, when the pixel unit **40** is under the operation, the first pixel electrode **411** and the second pixel electrode **421** may receive the voltage levels different from each other so as to result in two electric fields with differing strength. Thus, the orientation of the crystal molecules at the different domains differs from each other under the influence of the different electric fields.

[0058] Each of the first and second pixel electrodes **411**, **421** has a pattern scattered from a center in such a manner to form four domains. The increased domains of the pattern in each of the first and second pixel electrodes **411**, **421** from four to eight domains magnificently lower the color-shift in the changing view angle and the washout phenomenon, which, in turn, provides a better display ability.

[0059] In addition, by applying two different voltage levels Vcom2, Vcom3 respectively on the second and third common electrodes **414**, **424**, the voltage and the strength of the electric fields at the first and second pixel electrodes **411**, **421** can be controlled and adjusted so as to reduce the DC biasing on the first and second pixel electrodes **411**, **421**, and thereby to reduce the image-sticking phenomenon.

[0060] FIG. 7 is a top view of the third embodiment of the pixel unit in the PSA (polymer stabilized alignment) LCD panel according to the present invention. FIG. 8 illustrates a circuit diagram representing the third embodiment shown in FIG. 7. FIGS. 9A and 9B are cross-sectional views of the third embodiment taken along the line **5a-5a'** and the line **5b-5b'** in FIG. 7.

[0061] As illustrated, each pixel unit **50** can be divided into two subpixels. The pixel unit **50** includes a scan line **501**, a data line **502**, a first transistor **510**, a third transistor **530**, a first crystal capacitor Clc1, a first storage capacitor Cst1, a second crystal capacitor Clc2 and a second storage capacitor Cst2.

[0062] The scan line **501** is used for transmitting a scan signal. The data line **502** is used for transmitting a voltage signal. The first transistor **510** is adapted to be switched on in response to the scan signal for transmitting the voltage signal to the first pixel electrode **511**. The second transistor **520** is adapted to be switched on in response to the scan signal so as to transmit the voltage signal to the second pixel electrode **521**. In one preferred embodiment, the first and second pixel electrodes **511**, **521** are coupled directly and respectively to the first and third transistor **510**, **530** in order to receive the voltage signal.

[0063] The first crystal capacitor Clc1 is formed by the first pixel electrode **511**, the crystal layer **540** and the first common electrode **512**. The first crystal capacitor Clc1 is

coupled to the first transistor **510** for receiving the voltage signal. It is noted that the first common electrode **512** is formed on the upper substrate **500**.

[0064] The first storage capacitor Cst1 is formed by the first capacitor electrode **513**, the first dielectric layer **560** and the second common electrode **514**. The first storage capacitor Cst1 is coupled to the first crystal capacitor Clc1 in parallel and coupled to the first transistor **510** for receiving the voltage signal. As illustrated in FIG. 7, the first transistor **510** has a gate coupled to the scan line **501**, a source/drain terminal coupled to the data line **502** and another source/drain terminal coupled to the first pixel electrode **511** and the first capacitor electrode **513**.

[0065] The second crystal capacitor Clc2 is formed by the second pixel electrode **521**, the liquid crystal layer **540** and the first common electrode **512**. The second crystal capacitor Clc2 is further coupled to the data line **502**, wherein the first and second pixel electrode **511**, **521** are separated from each other and are disconnected directly.

[0066] The second storage capacitor Cst2 is formed by the second capacitor electrode **523**, the first dielectric layer **560** and the third common electrode **524**. The second storage capacitor Cst2 is further coupled to the second crystal capacitor Clc2 in parallel. As illustrated in FIG. 7, the third transistor **530** has a gate coupled to the scan line **501**, a source/drain terminal coupled to the data line **502** and another source/drain coupled to the second pixel electrode **521** and the second capacitor electrode **523**. In other words, the third transistor **530** is adapted to be switched on in response to the scan signal so as to transmit the voltage signal from the data line **502** to the second crystal capacitor Clc2 and the second storage capacitor Cst2.

[0067] Referring to FIG. 9A and FIG. 9B, the pixel unit **50** further includes the second dielectric layer **570** sandwiched between the respective pixel electrode and the respective capacitor electrode, namely between the liquid crystal layer **540** and the first dielectric layer **560**. The first capacitor electrode **513** is coupled to the first pixel electrode **511** via a conducting hole formed through the second dielectric layer **570** while the second capacitor electrode **523** is coupled to the second pixel electrode **521** via another conducting hole formed through the second dielectric layer **570**.

[0068] Therefore, in the third embodiment, the pixel unit **50** includes two subpixels SP, each of the subpixels is formed by a transistor, a crystal capacitor and a storage capacitor separated from one another.

[0069] It is noted that the pixel unit **50** of the PSA LCD panel has first and second pixel electrodes **511**, **521** separated from each other. Referring to FIG. 7, each of the first and second pixel electrodes **511**, **521** has a pattern scattered from a center in such a manner to form four domains. Each of the four domains of a respective one of the first and second pixel electrodes **511**, **521** includes a plurality of parallel ribs extending in the predetermined inclined direction.

[0070] In each pixel unit, the first and second transistors **510**, **520** are adapted to be switched on in response to the scan signal so as to permit the voltage signal to be transmitted from the data line **502** to the first and second pixel electrodes **511**, **521**, thereby driving the respective display domains. At this time, since different voltage levels Vcom2, Vcom3 can be applied respectively on the second common electrode **514** of the first storage capacitor Cst1 and the third

common electrode **524** of the second storage capacitors **Cst2**, the two subpixels SP may have voltage levels different from each other.

[0071] Once the scan line **501** ceases to transmit the scan signal, the voltage levels **Vcom2**, **Vcom3** of the second and third common electrodes **514**, **524** can be adjusted in order to form a periodic oscillation, thereby in each of the subpixels SP such that the inclination angle of the crystal molecules in one subpixel SP is different from that of another subpixel SP.

[0072] Moreover, the increased domains of the pattern of the first and second pixel electrodes **511**, **522** from four to eight domains magnificently lower the color-shift in the changing view angle and the washout phenomenon, which, in turn, provides a better display ability.

[0073] With the example and explanations above, the features and spirits of the invention are hopefully well described. Those skilled in the art will readily observe that numerous modifications and alterations of the device may be made while retaining the teaching of the invention. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.

What is claimed is:

1. A PSA (polymer stabilized alignment) LCD panel comprising:

a plurality of pixel units, each of said pixel units including a first pixel electrode and a second pixel electrode separated from said first pixel electrode, each of said first and second pixel electrodes having a pattern scattered to form at least four domains.

2. The PSA LCD panel according to claim 1, wherein each of said four domains in a respective one of said first and second pixel electrodes includes a plurality of parallel ribs extending in a predetermined direction.

3. The PSA LCD panel according to claim 2, wherein said parallel ribs in said four domains respectively define four azimuth angles ranging of 40 to 50 degrees, 130 to 140 degrees, 220 to 230 degrees and 310 to 320 degrees.

4. The PSA LCD panel according to claim 1, wherein each of said pixel units further includes a first transistor adapted to be switched on in response to a scan signal for transmitting a voltage signal.

5. The PSA LCD panel according to claim 4, wherein said first pixel electrode is coupled to said first transistor in order to receive said voltage signal.

6. The PSA LCD panel according to claim 5, wherein each of said pixel units further includes a coupling capacitor having a first end electrically coupled to said first pixel electrode, said second pixel electrode being coupled to said first transistor via said coupling capacitor such that said first and second pixel electrodes have voltage levels different from each other.

7. The PSA LCD panel according to claim 6, wherein each of said pixel units further includes a second transistor adapted to be switched on in response to said scan signal for establishing a communication between a data line and said second pixel electrode.

8. The PSA LCD panel according to claim 5, wherein each of said pixel units further includes a third transistor adapted to be switched on in response to said scan signal for transmitting said voltage signal, said second pixel electrode being connected directly said third transistor for receiving said voltage signal.

9. The PSA LCD panel according to claim 4, wherein each of said pixel units further includes first and second storage capacitors that are electrically connected respectively to said first and second pixel electrodes in parallel, and said first and second storage capacitors have first ends respectively electrically connected to said data line via said first transistor and two second ends respectively for receiving two different voltages such that said first and second storage capacitors have different voltage levels.

10. A PSA (polymer stabilized alignment) LCD panel comprising:

a first common electrode;

a second pixel electrode separated from each other the first common electrode;

a first pixel electrode;

a crystal layer disposed between the first common electrode and the first pixel electrode, wherein the first pixel electrode, the crystal layer and the first common electrode form a first crystal capacitor, and wherein the second pixel electrode, said crystal layer and said first common electrode form a second crystal capacitor;

a scan line for transmitting a scan signal;

a data line for transmitting a voltage signal;

a first transistor adapted to be switched on in response to said scan signal for transmitting said voltage signal, wherein the first pixel electrode is electrically connected to said first transistor for receiving said voltage signal;

a first capacitor electrode electrically connected to the first transistor for receiving said voltage signal;

a second common electrode;

a first dielectric layer disposed between the first capacitor electrode and the second common electrode, wherein the first capacitor electrode, the second common electrode and the first dielectric layer form a first storage capacitor being coupled to said first crystal capacitor in parallel;

a second capacitor electrode; and

a third common electrode, wherein the second capacitor electrode, the dielectric layer and the third common electrode form a second storage capacitor being coupled to said second crystal capacitor in parallel.

11. The PSA LCD panel according to claim 10, wherein said first pixel electrode includes a plurality of parallel ribs extending in four predetermined directions to form four domains.

12. The PSA LCD panel according to claim 10, wherein said second pixel electrode includes a plurality of parallel ribs extending in four predetermined directions to form four domains.

13. The PSA LCD panel according to claim 10, further comprising:

a first electrode electrically connected to the first transistor;

a second electrode; and

a second dielectric layer disposed between the first electrode and the second electrode, wherein the first electrode, the second electrode and the second dielectric layer form a coupling capacitor so as to form a voltage difference between said first crystal capacitor and said second crystal capacitor.

14. The PSA LCD panel according to claim 13, wherein the second electrode is electrically connected to said second pixel electrode and said second capacitor electrode.

15. The PSA LCD panel according to claim 13, further comprising a second transistor having a gate coupled to said scan line and source/drain terminals coupled respectively to said data line and said second pixel electrode so as to enable said second transistor to discharge the accumulated charge from said second pixel electrode via said scan line.

16. The PSA LCD panel according to claim 10, wherein different voltage levels are applied onto said second and third common electrodes such that said first and second storage capacitors have voltage levels different from each other.

17. The PSA LCD panel according to claim 10, further comprising a third transistor adapted to be switched on in response to said scan signal for transmitting said voltage

signal on said data line to said second crystal capacitor and said second storage capacitor.

18. The PSA LCD panel according to claim 17, wherein said third transistor has a gate coupled to said scan line, a source/drain terminal coupled to said data line and another source/drain terminal coupled to said second pixel electrode and said second capacitor electrode.

19. The PSA LCD panel according to claim 10, wherein said first transistor has a gate coupled to said scan line, a source/drain terminal coupled to said data line and another source/drain terminal coupled to said first pixel electrode and said first capacitor electrode.

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[标]申请(专利权)人(译)	友达光电股份有限公司		
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摘要(译)

PSA LCD面板包括多个像素单元。每个像素单元包括第一像素电极和与第一像素电极分离的第二像素电极。第一和第二像素电极中的每一个具有从中心散射的图案，以形成四个域。

