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(54) **Pixel unit electrode structure and array substrate of liquid crystal display device with a fringe field switching mode**

Pixeleinheitselektrodenstruktur und Array-Substrat einer Flüssigkristallanzeigevorrichtung mit Streufeld-Schaltmodus

Substrat de réseau et structure d'électrode d'une unité de pixel de dispositif d'affichage à cristaux liquides à mode de commutation de champ de frange

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Description

Technical Field

[0001] The present invention relates to the field of liquid crystal display technologies, in particular to a pixel unit electrode structure and an array substrate of a liquid crystal display device with a Fringe Field Switching (FFS) mode.

Technical Background

[0002] In the Thin Film Transistor Liquid Crystal Display (TFT-LCD) product, the FFS technology can increase an aperture ratio and transmittance of a liquid crystal display device with an In-Plane-Switching (IPS) mode.

[0003] A liquid crystal display device with an FFS mode includes a common electrode and a pixel electrode, which are separated by an insulation layer and arranged overlapped, and a distance between the common electrode and the pixel electrode is controlled to be less than a distance between an upper glass substrate and a lower glass substrate, so as to form a fringe field between the common electrode and the pixel electrode, so that liquid crystal molecules above the pixel electrode can be controlled, and the defect that the liquid crystal molecules are uncontrollable due to the vertical electric field right above the pixel electrode in the traditional IPS liquid crystal display device can be overcome, thereby increasing the aperture ratio and the transmittance of the liquid crystal display device greatly.

[0004] Figure 1a is a schematic top view of a pixel unit of a liquid crystal display device with the FFS mode in the prior art. Figure 1b is a schematic sectional view of the pixel unit of the liquid crystal display device with the FFS mode along a line A-A' in Figure 1a in the prior art. As shown in Figures 1a and 1b, a pixel unit 10 includes a pectinate pixel electrode 11, a planar common electrode 12, and an insulation layer 13 disposed between the pectinate pixel electrode 11 and the planar common electrode 12. The pixel electrode 11 includes a plurality of branch electrodes 111 arranged in parallel and end electrodes 112 connecting to ends of the branch electrodes 111, where, the lower end electrode is used to connect the pixel electrode to a switching device. After a voltage is applied between the pixel electrode 11 and the common electrode 12, an electric field component E_Y is formed by the end electrodes 112 and the common electrode 12 in a Y direction (i.e. a direction in which the branch electrodes extend). The existence of such electric field component causes the arrangement instability of the liquid crystal molecules at the edge of the pixel unit, in particularly, the electric field component in the Y direction affects a rotation direction of the liquid crystal molecules in a X-Y plane, thereby causing a Disclination Lines (DLS) phenomenon.

[0005] Figure 2 is a schematic top view of a pixel unit of another existing liquid crystal display device with the FFS mode in the prior art. As shown in Figure 2, a pixel unit includes a pixel electrode 21 and a common electrode 22 which are insulated with each other. The pixel electrode 21 includes branch electrodes 211 and end electrodes 212, where the lower end electrode is used to connect the pixel electrode to a switching device. The branch electrode includes a body 211a, and an inclined connection part 211 b connected between an end of the body 211 a and the end electrode 212, and the extension direction of the inclined connection part 211 b is different from that of the body 211 a, thereby forming an angle between the inclined connection part 211b and the body 211a. Due to the existence of the inclined connection part 211b at an end of the branch electrode 21, the electric field component E_Y formed by the end electrode 112 and the common electrode 12 in the Y direction (i.e. the extension direction of the strip electrode) can be reduced in a certain degree, to suppress the DLS phenomenon at the end of the pixel unit. The suppression of the DLS phenomenon by the pixel unit can be adjusted by adjusting the angle between the body 211a and the inclined connection part 211b as well as a length of the inclined connection part 211b during a design stage. However, the suppression of the DLS phenomenon by the pixel unit in such structure is still limited, and the display performance of an array substrate is significantly affected due to a poor press present in a central region of a pixel when the pixel is pressed.

[0006] Document US 2010/0157228 discloses a pixel unit according to the preamble of claim 1. Document US 2010/0208184 discloses a pixel unit having pixel electrodes arranged in a zigzag fashion.

Summary of the Invention

[0007] An aspect of the present invention discloses a pixel unit electrode structure according to claim 1.

[0008] Another aspect of the present invention discloses an array substrate according to claim 6.

Description of Drawings

[0009]

Figure 1a is a schematic top view of a pixel unit of a liquid crystal display device with the FFS mode in the prior art;

Figure 1b is a schematic sectional view of the pixel unit of the liquid crystal display device with the FFS mode along a line A-A' in Figure 1a in the prior art;

Figure 2 is a schematic top view of a pixel unit of another liquid crystal display device with the FFS mode in the prior art;

Figure 3a is a schematic view of a pixel unit of a liquid crystal display device with the FFS mode according to a first embodiment of the invention;

Figure 3b is a schematic partial view of the pixel unit of the liquid crystal display device with the FFS mode according to the first embodiment of the invention;

Figure 4a is a schematic view showing the simulation result of brightness distribution of the pixel unit of the liquid crystal display device with the FFS mode in the prior art when a voltage of 5V is applied;

Figure 4b is a schematic view showing the simulation result of brightness distribution of the pixel unit of the liquid crystal display device with the FFS mode according to the first embodiment of the invention under the same condition (i.e. when a voltage of 5V is applied);

Figure 5 is a graph of rotation angles of the liquid crystal molecules at a point C of the pixel unit with a variation of the depth from an end of the body to the end electrode along extension direction of the body;

Figure 6 is a schematic comparison view of brightness distribution of the pixel unit when different voltage are applied between the pixel electrode and the common electrode;

Figure 7 is a schematic enlarged view of a portion enclosed by a rectangle in Figure 6;

Figure 8 is a graph comparing an area of the region suffering from the DLS phenomenon in the pixel unit in the prior art and that in the pixel unit in the first embodiment in the case of different voltage ;

Figure 9 is a schematic view of a pixel unit of a liquid crystal display device with the FFS mode according to a second embodiment of the invention;

Figure 10 is a schematic view of a pixel unit of a liquid crystal display device with the FFS mode according to a third embodiment of the invention; and

Figure 11 is a schematic view of an array substrate of a liquid crystal display device with the FFS mode according to a fourth embodiment of the invention.

Detailed description of the Preferred Embodiments

[0010] The technical solutions of the embodiments of present invention are further described by the following embodiments in conjunction with the accompanying drawings.

[0011] Figure 3a is a schematic top view of a pixel unit of a liquid crystal display device with the FFS mode according to a first embodiment of the invention. As shown in Figure 3a, a pixel unit includes a pixel electrode 31 and a common electrode 32, which are insulated from each other.

[0012] The pixel electrode 31 includes at least two branch electrodes 311 arranged in parallel and an end electrode 312 connecting with ends of the branch electrodes 311;

[0013] The branch electrode 311 includes a body 311a, and an inclined connection part 311b connected between an end of the body 311a and the end electrode 312, and the inclined connection part 311b and the body 311a extend in different directions and form an angle α therebetween. Preferably, in the first embodiment, the angle α is less than or equal to 60 degree.

[0014] At least one of the branch electrodes 311 further includes a protrusion 311c at an end of the body 311a, and the protrusion 311c is arranged opposite to the end electrode 312 along a direction different from the extension direction of the inclined connection part 311b. In this embodiment, the protrusion 311c and the body 311a of the branch electrode 311 extend in the same direction, i.e., along the same line.

[0015] The protrusion 311c, the body 311a and the inclined connection part 311b may be transparent conductive patterns formed integrally on the same plane by a patterning process.

[0016] In this embodiment, each of the branch electrodes 311 except the rightmost branch electrode in Figure 3a

includes the protrusion 311c. That is, all the branch electrodes, each of which includes a body 311a with an end opposite to the end electrode 312, are provided with the protrusions 311c. It should be understood by those skilled in the art that if at least one branch electrode has the protrusion 311c, the DLS phenomenon can be suppressed with comparison with the prior art, thus, it is possible to arrange the protrusions 311c for only partial branch electrodes.

[0017] Figure 3b is a schematic partial view of the pixel unit of the liquid crystal display device with the FFS mode according to the first embodiment of the invention. The protrusion and the end electrode, which are arranged opposite to each other, form opposite electric field components in the Y direction (i.e. Y axis) with the common electrode, respectively, and the electric field component in the Y direction formed by the protrusion with the common electrode partially counteracts that formed by the end electrode with the common electrode to decrease the electric field component in the Y direction at an edge region of the pixel unit, thereby suppressing the DLS phenomenon and decreasing area of the region suffering from the DLS phenomenon.

[0018] In this embodiment, the common electrode 32 is a planar electrode covering a pixel region. Meanwhile, each of the pixel electrode 31 and the common electrode 32 is a transparent electrode, which may be made of Indium Tin Oxide (ITO), Indium Zinc Oxide (IZO), a combination thereof or other transparent conductive materials. An insulation layer can be disposed between the pixel electrode 31 and the common electrode 32 for insulating (not shown in Figure 3a or Figure 3b).

[0019] Figures 4-Figure 9 compare various simulated parameters of a pixel unit when a certain voltage is applied to the pixel electrode and the common electrode with respect to the structures of the pixel unit in the prior and that in this embodiment.

[0020] Figure 4a is a schematic view showing the simulation result of brightness distribution of the pixel unit of the liquid crystal display device with the FFS mode in the prior art when a voltage of 5V is applied. Figure 4b is a schematic view showing the simulation result of brightness distribution of the pixel unit of the liquid crystal display device with the FFS mode according to the first embodiment of the present invention under the same condition (i.e. when a voltage of 5V is applied). The gray scale at a position in the figures represents the brightness at the position. As can be seen from the comparison between Figure 4a and Figure 4b, in the case of the same position C at the edge region of the pixel unit, the brightness of the existing pixel unit at a point C in the position is significantly lower than that at the point C in the position of the pixel unit in this embodiment. Moreover, as can be seen from the comparison, the brightness at the edge region of the pixel unit of this embodiment is uniform, which indicates that the disclination and disorder of the liquid crystal molecules in the pixel unit are reduced greatly. However, the brightness of the existing pixel unit is not uniform at the edge region of the pixel unit, which indicates that the liquid crystal molecules of the existing pixel unit suffer from a serious DLS phenomenon.

[0021] Figure 5 is a graph of rotation angles of the liquid crystal molecules at the position of the point C in the pixel unit in Figure 4a or Figure 4b with a variation of the depth from an end of the body to the end electrode along extension direction of the body. As shown in Figure 5, the variation tendency of the rotation angle of the liquid crystal molecules at the point C of the existing pixel unit is contrary to that of the liquid crystal molecules at the point C of the pixel unit of this embodiment, which indicates the significant effect of suppressing the DLS phenomenon at the point C in this embodiment.

[0022] Figure 6 is a schematic comparison view of brightness distribution of the pixel unit when different voltages are applied to the pixel electrode and the common electrode. Figure 7 is a schematic enlarged view of a portion enclosed by a rectangle in Figure 6. The first row in Figure 6 represents the brightness distribution of the pixel unit in the prior art under different voltages, and the second row in Figure 6 represents the brightness distribution of the pixel unit of this embodiment under different voltage. It can be known from Figure 6 and Figure 7, an area of the region suffering from the DLS phenomenon can be reduced significantly and the DLS phenomenon at the pixel edge can be suppressed; furthermore, if the voltage is increased, the region suffering from the DLS phenomenon in the prior art extends gradually toward the center of a display region, but the region suffering from the DLS phenomenon in this embodiment almost does not change. As can be seen, in the case of the higher voltage applied, the better effect of suppressing the DLS phenomenon is provided in the present embodiment.

[0023] Figure 8 is a graph comparing an area of a region suffering from the DLS phenomenon of the pixel unit in the prior art and that of the pixel unit in the first embodiment in the case of different voltages. As shown in Figure 8, as for the voltage rising from 5V to 8V, an area of the region suffering from the DLS phenomenon of the embodiment is always smaller than that of the pixel unit in the prior art; furthermore, in the case of the larger voltage, the better effect of suppressing the DLS phenomenon is provided in the present embodiment, which is consistent with Figures 6 and 7. Corresponding to Figure 8, the specific values of the areas of the region suffering from the DLS phenomenon of the pixel unit in the art and those of the pixel unit in the embodiment in the case of different voltages are shown as follows.

	Area of region suffering from DLS phenomenon (um^2)	
Voltages	The prior art	The present embodiment
5V	0.702	0.354
6V	1.597	0.883
7V	2.21	1.973
8V	4.166	1.889

[0024] Figure 9 is a schematic view of a pixel unit of a liquid crystal display device with the FFS mode according to a second embodiment of the invention. As shown in Figure 9, a pixel electrode 91 of a pixel unit includes at least two branch electrodes 911 and end electrodes 912 connecting to ends of the branch electrodes 911, and the branch electrode 911 includes a body 911a, and an inclined connection part 911b connecting both ends of the body 911a to the respective end electrodes 912. In this embodiment, the body 911a is provided with not only a protrusion 911c at its upper end, but also a protrusion 911c at its lower end. The protrusions 911c and the body 911a of the branch electrode 911 extend in the same direction, i.e. along the same line.

[0025] In the embodiment, an additional protrusion is arranged at the lower end of the body that is connected with the inclined connection part, so that the DLS phenomenon at the lower edge of the pixel unit is suppressed, thereby increasing the aperture ratio of the pixel unit.

[0026] Figure 10 is a schematic view of a pixel unit of a liquid crystal display device with the FFS mode according to a third embodiment of the invention. As shown in Figure 10, a pixel electrode 101 of the pixel unit is a two-domain pixel electrode, and a branch electrode 1011 of the pixel electrode 101 includes a body 1011a of a polyline form and an inclined connection part 1011b connected between the body 1011a and an end electrode 1012. A protrusion 1011c is arranged at an end of the body 1011a, and the protrusion 1011c and the body 1011a near its end extend in the same direction, i.e. along the same line.

[0027] In the present embodiment, preferably, an additional protrusion 1011c may be further arranged at the lower end of the body 1011a.

[0028] Meanwhile, it should be understood by those skilled in the art that the body of the branch electrode may have an existing shape, such as a polyline shape, or a fishbone shape, as desired.

[0029] The structure of the protrusion for suppressing the DLS phenomenon is applied to a multiple-domain pixel unit in the embodiment, thereby optimizing the display performance of the multiple-domain pixel unit.

[0030] Figure 11 is a schematic top view of an array substrate of a liquid crystal display device with the FFS mode according to a fourth embodiment of the invention. As shown in Figure 11, an array substrate includes gate lines B1 and data lines B2 (as shown in dotted lines) intersecting with the gate lines B1, and pixel regions B3 are defined by the gate lines B1 and the data lines B2. The array substrate also includes switch devices B4 (as shown in dotted lines) arranged at intersection positions of the gate lines B1 and the data lines B2, pixel electrodes B5 in the pixel regions B3, and a common electrode B6 covering the array substrate, where the pixel electrodes B5 are insulated from the common electrode B6.

[0031] The pixel electrode B5 includes at least two branch electrodes B51 arranged in parallel and an end electrode B52 connecting with ends of the branch electrodes B51.

[0032] The branch electrode B51 includes a body B51a and an inclined connection part B51b, where the inclined connection part B51b is connected between an end of the body B51a and the end electrode B52, and the inclined connection part B51b and the body B51a extend along different directions and form an inclined angle α therebetween. In this embodiment, preferably, the angle α is less than or equal to 60 degree.

[0033] At least one of the branch electrodes B51 further includes a protrusion B51c at an end of the body B51a. The protrusion B51c is arranged opposite to the end electrode along a direction different from the extension direction of the inclined connection part B51b. The protrusion B51c, the body B51a and the inclined connection part B51b may be transparent conductive patterns integrally formed on a same plane through a patterning process.

[0034] In this embodiment, the protrusion B51c and the body B51a of the branch electrode B51 extend in the same direction, i.e. along the same line.

[0035] The protrusion B51c and the end electrode B52, which are arranged opposite to each other, form opposite electric field components in the Y direction (i.e. Y axis) with the common electrode, respectively, and the electric field component in the Y direction formed by the protrusion B51c with the common electrode partially counteracts that formed by the end electrode B52 with the common electrode, to decrease the electric field component in the Y direction at an edge region of the pixel unit, thereby suppressing the DLS phenomenon and decreasing an area of the region suffering from the DLS phenomenon.

[0036] In this embodiment, the common electrode B6 is a planar electrode. Meanwhile, both the pixel electrode B5

and the common electrode B6 may be transparent electrodes, which may be made of Indium Tin Oxide (ITO), Indium Zinc Oxide (IZO), a combination thereof or other transparent conductive materials. An insulation layer can be disposed between the pixel electrode B5 and the common electrode B6 for insulating (not shown in Figure 11).

[0037] The structure of the pixel electrode of the array substrate described in this embodiment is the same as that of the pixel electrode in the pixel unit in the first embodiment described above. However, it should be understood by those skilled in the art that the structures of the pixel electrodes of the pixel units described in the second embodiment and the third embodiment can be applied to the array substrate of the fourth embodiment, thereby suppressing the electric field component in the Y direction and decreasing an area of the region of the liquid display device that suffers from the DLS phenomenon.

[0038] In an aspect of the present invention, the protrusion is arranged at the connection position between the body and the inclined connection part of at least one branch electrode of the pixel electrode, and is used to suppress the electric field in the Y axis caused by the end electrode, thereby preventing the occurrence of the DLS phenomenon in the vicinity of the edge of the pixel unit.

[0039] The preferable embodiments of the present invention have been described above, but are not intended to limit the present invention. Various modifications and variations may be made to the present invention by those skilled in the art. Thus, all these modifications, substitutions and improvements are intended to be included in the present invention if they fall within the scope of the invention.

Claims

1. A pixel unit electrode structure, intended to be applied in a liquid crystal display device with a Fringe Field Switching mode, comprising a pixel electrode (31, 91, 101, B5) and a common electrode (32, B6), which are insulated from each other, wherein,
   the pixel electrode (31, 91, 101, B5) includes at least two branch electrodes (311, 911, 1011, B51) arranged in parallel and an end electrode (312, 912, 1012, B52) connecting to ends of the branch electrodes (311, 911, 1011, B51) ;
   each branch electrode (311, 911, 1011, B51) includes a body (311a, 911a, 1011a, B51a) and an inclined connection part (311b, 911b, 1011b, B51b), wherein, the inclined connection part (311b, 911b, 1011b, B51b) is connected between an end of the body (311a, 911a, 1011a, B51a) and the end electrode (312, 912, 1012, B52), and extends in a direction different from the extension direction of the body (311a, 911a, 1011a, B51a) ;
   characterized in that:

   at least one of the branch electrodes (311, 911, 1011, B51) further includes a protrusion (311c, 911c, 1011c, B51c) at an end of the body (311a, 911a, 1011a, B51a);
   the protrusion (311c, 911 c, 1011c, B51c) is arranged opposite to the end electrode (312, 912, 1012, B52) along the extension direction of the body (311a, 911a, 1011a, B51a).

2. The pixel unit electrode structure of claim 1, wherein, the protrusion (311c, 911c, 1011c, B51 c) is provided for each of the branch electrodes (311, 911, 1011, B51), which includes the body (311a, 911a, 1011a, B51a) with an end opposite to the end electrode (312, 912, 1012, B52).

3. The pixel unit electrode structure of claim 1, wherein, an angle formed between an extension direction of the body (311a, 911a, 1011a, B51a) and an extension direction of the inclined connection part (311b, 911b, 1011b, B51b) is less than or equal to 60 degree.

4. The pixel unit electrode structure of claim 1, wherein, the body (311a, 911a, 1011a, B51a) of the branch electrode (311, 911, 1011, B51) has a strip shape, a zigzag shape, or a fishbone shape.

5. The pixel unit electrode structure of claim 1, wherein, each of the pixel electrode (31, 91, 101, B5) and the common electrode (32, B6) is a transparent electrode.

6. An array substrate, intended to be applied in a liquid crystal display device with a Fringe Field Switching mode , comprising:

   a plurality of pixel unit electrode structures according to one of claims 1-5, and gate lines (B1) and data lines (B2) intersecting with the gate lines (B1), the gate lines (B1) and the data lines (B2) defining pixel regions (B3);
   switch devices (B4) arranged at intersection positions of the gate lines (B1) and the data lines (B2) ; wherein

the pixel electrode (31, 91, 101, B5) of each pixel unit electrode structure is located in a respective pixel region (B3) ; and
the common electrode (32, B6) of each pixel unit electrode structure covers the respective pixel region where the pixel electrode (31, 91, 101, B5) is insulated from the common electrode (32, B6).

Patentansprüche

1. Pixeleinheitselektrodenstruktur, die in einer Flüssigkristallanzeigevorrichtung mit einem Fringe-Field-Switching-Modus eingesetzt werden soll, umfassend eine Pixelelektrode (31, 91, 101, B5) und eine gemeinsame Elektrode (32, B6), die voneinander isoliert sind, wobei
die Pixelelektrode (31, 91, 101, B5) wenigstens zwei Abzweigelektroden (311, 911, 1011, B51), die parallel angeordnet sind, und eine Abschlusselektrode (312, 912, 1012, B52) umfasst, die mit den Enden der Abzweigelektroden (311, 911, 1011, B51) verbunden ist; und
jede Abzweigelektrode (311, 911, 1011, B51) einen Körper (311 a, 911 a, 1011 a, B51a) und einen geneigten Verbindungsteil (311 b, 911 b, 1011 b, B51b) umfasst, wobei der geneigte Verbindungsteil (311 b, 911 b, 1011 b, B51b) zwischen einem Ende des Körpers (311 a, 911 a, 1011 a, B51a) und der Abschlusselektrode (312, 912, 1012, B52) angeschlossen ist und sich in einer Richtung erstreckt, die sich von der Ausdehnungsrichtung des Körpers (311 a, 911 a, 1011 a, B51a) unterscheidet;
dadurch gekennzeichnet, dass:

wenigstens eine der Abzweigelektroden (311, 911, 1011, B51) weiterhin einen Vorsprung (311c, 911c, 1011c, B51c) an einem Ende des Körpers (311 a, 911 a, 1011 a, B51a) umfasst und
der Vorsprung (311 c, 911 c, 1011 c, B51c) gegenüberliegend der Abschlusselektrode (312, 912, 1012, B52) entlang der Ausdehnungsrichtung des Körpers (311 a, 911 a, 1011 a, B51a) angeordnet ist.

2. Pixeleinheitselektrodenstruktur nach Anspruch 1, bei der der Vorsprung (311 c, 911 c, 1011 c, B51c) für jede der Abzweigelektroden (311, 911, 1011, B51) vorgesehen ist, die den Körper (311 a, 911 a, 1011 a, B51a) mit einem Ende umfasst, das der Abschlusselektrode (312, 912, 1012, B52) gegenüberliegt.

3. Pixeleinheitselektrodenstruktur nach Anspruch 1, bei der ein Winkel, der zwischen einer Ausdehnungsrichtung des Körpers (311 a, 911 a, 1011 a, B51a) und einer Ausdehnungsrichtung des geneigten Verbindungsteils (311 b, 911 b, 1011 b, B51b) ausgebildet ist, kleiner oder gleich 60 Grad-Winkel ist.

4. Pixeleinheitselektrodenstruktur nach Anspruch 1, bei der der Körper (311 a, 911 a, 1011 a, B51a) der Abzweigelektrode (311, 911, 1011, B51) eine Streifenform, eine Zickzackform oder eine Grätenform hat.

5. Pixeleinheitselektrodenstruktur nach Anspruch 1, bei der jeweils die Pixelelektrode (31, 91, 101, B5) und die gemeinsame Elektrode (32, B6) eine transparente Elektrode sind.

6. Array-substrat, das in einer Flüssigkristallanzeigevorrichtung mit einem Fringe-Field-Switching-Modus eingesetzt werden soll, umfassend:

eine Vielzahl von Pixeleinheitselektrodenstrukturen nach einem der Ansprüche 1 bis 5 und
Gate-Leitungen (B1) sowie Datenleitungen (B2), die sich mit den Gate-Leitungen (B1) schneiden, wobei die Gate-Leitungen (B1) und die Daten-Leitungen (B2) Pixelbereiche (B3) definieren; und
Umschaltvorrichtungen (B4), die an Schnittpositionen der Gate-Leitungen (B1) und der Daten-Leitungen (B2) angeordnet sind; wobei
sich die Pixelelektrode (31, 91, 101, B5) jeder Pixeleinheitselektrodenstruktur in einem entsprechenden Pixelbereich (B3) befindet; und
die gemeinsame Elektrode (32, B6) jeder Pixeleinheitselektrodenstruktur den jeweiligen Pixelbereich bedeckt, wo die Pixelelektrode (31, 91, 101, B5) von der gemeinsamen Elektrode (32, B6) isoliert ist.

Revendications

1. Structure d'électrode d'unité de pixel, destinée à être appliquée dans un dispositif d'affichage à cristaux liquides avec un mode de commutation de champ de frange, comprenant une électrode de pixel (31, 91, 101, B5) et une

électrode commune (32, B6) qui sont isolées l'une de l'autre, dans laquelle
l'électrode de pixel (31, 91, 101, B5) comprend au moins deux électrodes en branche (311, 911, 1011, B51) agencées en parallèle et une électrode d'extrémité (312, 912, 1012, B52) se connectant aux extrémités des électrodes en branche (311, 911, 1011, B51) ;
chaque électrode en branche (311, 911, 1011, B51) comprend un corps (311a, 911a, 1011a, B51a) et une partie de connexion inclinée (311b, 911b, 1011b, B51b), la partie de connexion inclinée (311b, 911b, 1011b, B51b) étant connectée entre une extrémité du corps (311a, 911a, 1011a, B51a) et l'électrode d'extrémité (312, 912, 1012, B52), et s'étendant dans une direction différente de la direction d'extension du corps (311a, 911a, 1011a, B51a) ; **caractérisée en ce que**
au moins une des électrodes en branche (311, 911, 1011, B51) comprend en outre une saillie (311c, 911c, 1011c, B51c) à une extrémité du corps (311a, 911a, 1011a, B51a) ;
la saillie (311c, 911c, 1011c, B51c) est agencée à l'opposé de l'électrode d'extrémité (312, 912, 1012, B52) le long de la direction d'extension du corps (311a, 911a, 1011a, B51a).

2. Structure d'électrode d'unité de pixel selon la revendication 1, dans laquelle la saillie (311c, 911c, 1011c, B51c) est présente pour chacune des électrodes en branche (311, 911, 1011, B51), qui comprend le corps (311a, 911a, 1011a, B51a) avec une extrémité opposée à l'électrode d'extrémité (312, 912, 1012, B52).

3. Structure d'électrode d'unité de pixel selon la revendication 1, dans laquelle un angle formé entre une direction d'extension du corps (311a, 911a, 1011a, B51a) et une direction d'extension de la partie de connexion inclinée (311b, 911b, 1011b, B51b) est inférieur ou égal à 60 degrés.

4. Structure d'électrode d'unité de pixel selon la revendication 1, dans laquelle le corps (311a, 911a, 1011a, B51a) de l'électrode en branche (311, 911, 1011, B51) a une forme de bande, une forme en zigzag ou une forme en arête de poisson.

5. Structure d'électrode d'unité de pixel selon la revendication 1, dans laquelle chacune de l'électrode de pixel (31, 91, 101, B5) et de l'électrode commune (32, B6) est une électrode transparente.

6. Substrat de réseau, destiné à être appliqué dans un dispositif d'affichage à cristaux liquides avec un mode de commutation de champ de frange, comprenant :

une pluralité de structures d'électrode d'unité de pixel selon l'une quelconque des revendications 1 à 5, et
des lignes de grille (B1) et des lignes de données (B2) coupant les lignes de grille (B1), les lignes de grille (B1) et les lignes de données (B2) définissant des régions de pixels (B3) ;
des dispositifs de commutation (B4) agencés à des positions d'intersection des lignes de grille (B1) et des lignes de données (B2) ; et
l'électrode de pixel (31, 91, 101, B5) de chaque structure d'électrode d'unité de pixel se trouvant dans une région de pixel respective (B3) ; et
l'électrode commune (32, B6) de chaque structure d'électrode d'unité de pixel couvrant la région de pixel respective où l'électrode de pixel (31, 91, 101, B5) est isolée de l'électrode commune (32, B6).

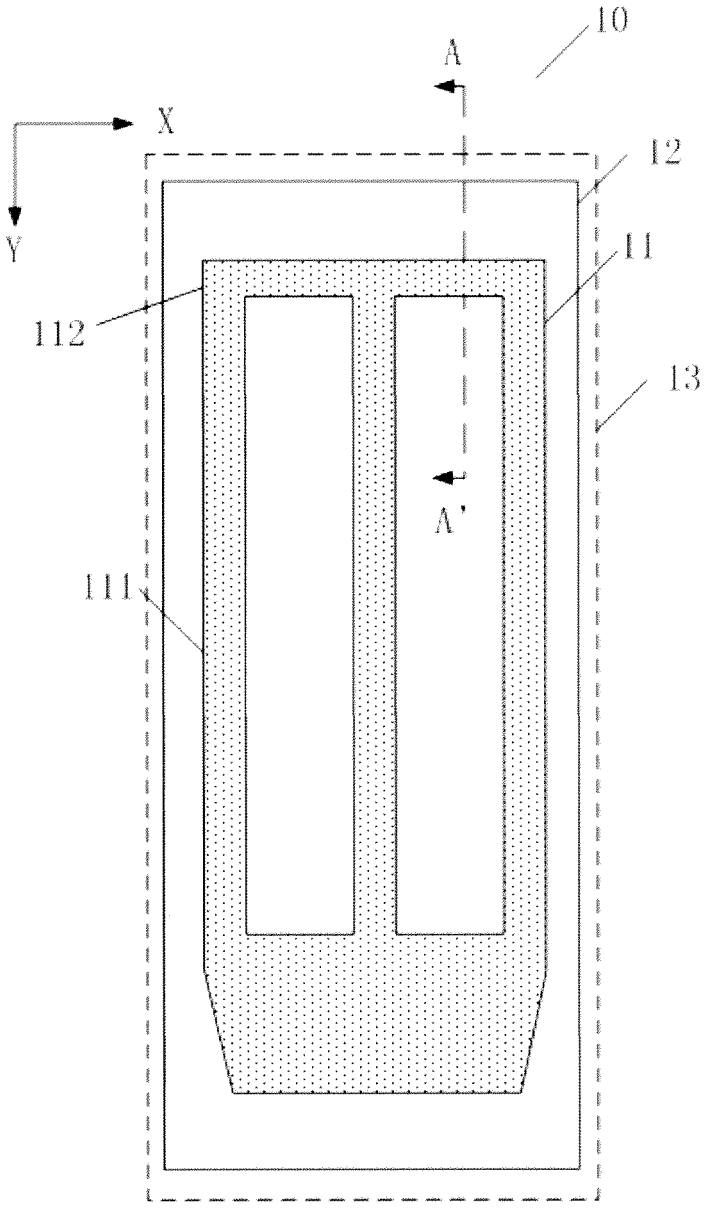

FIG.1a

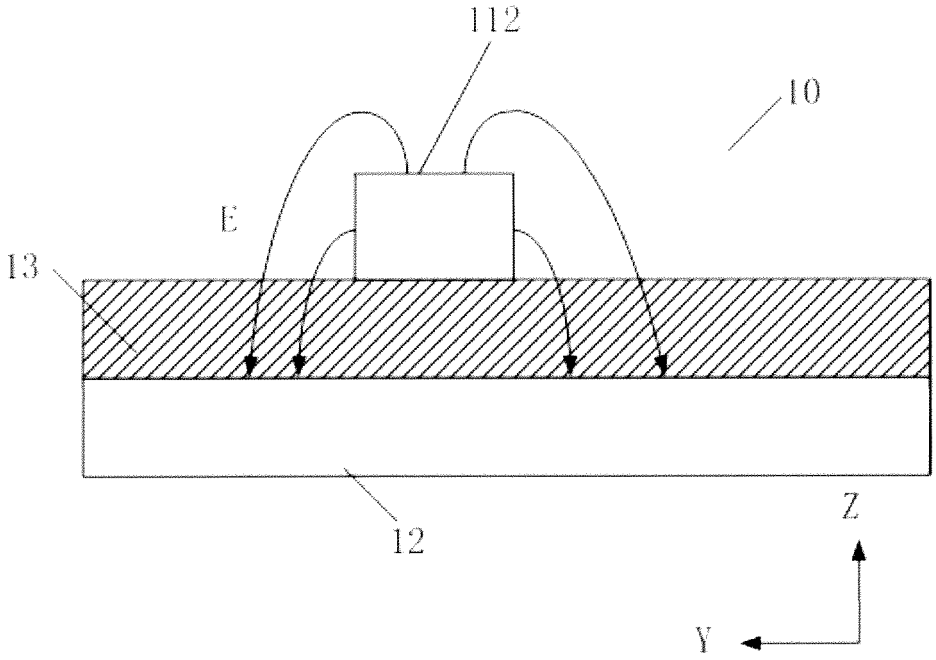

FIG.1b

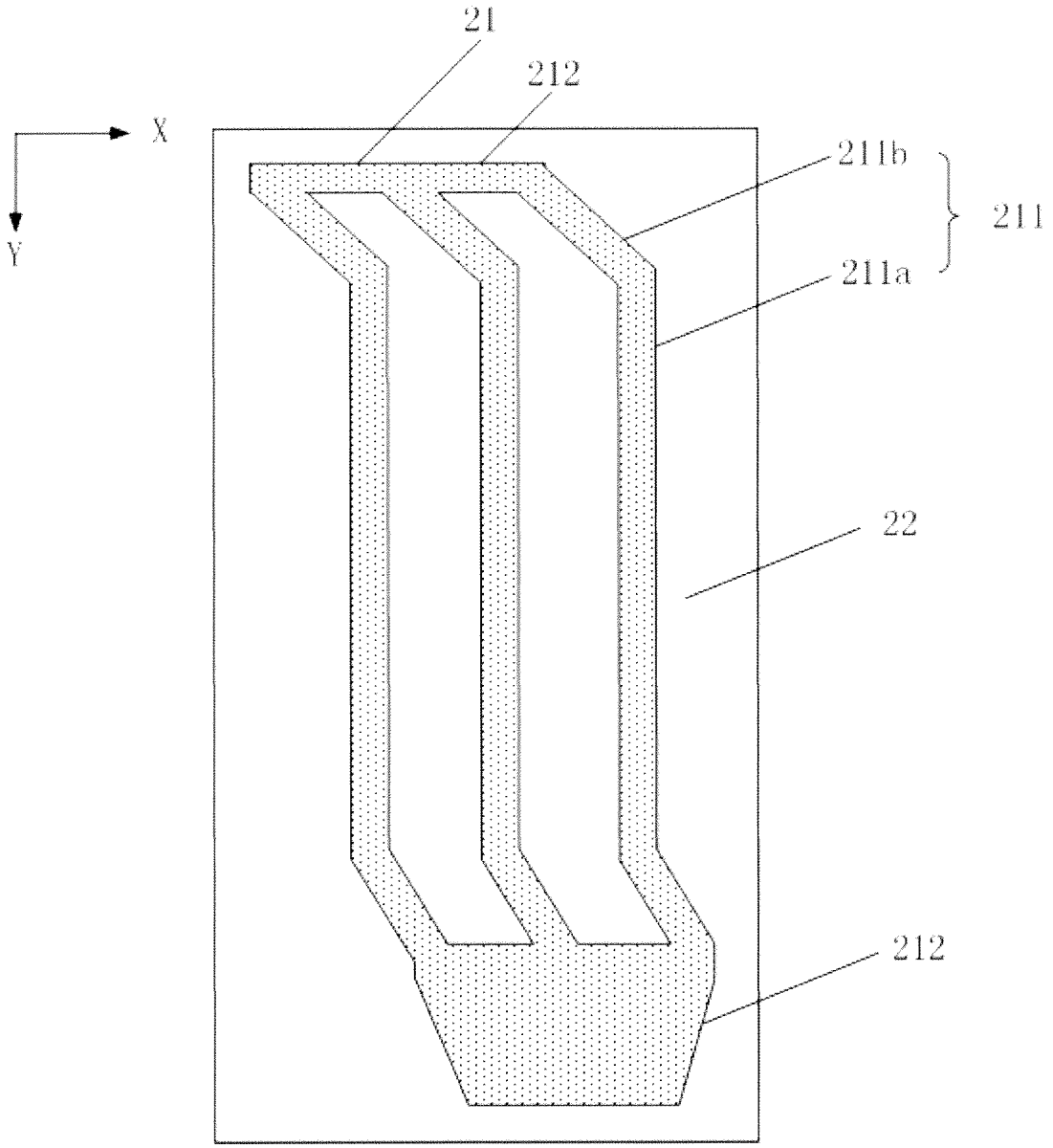

FIG.2

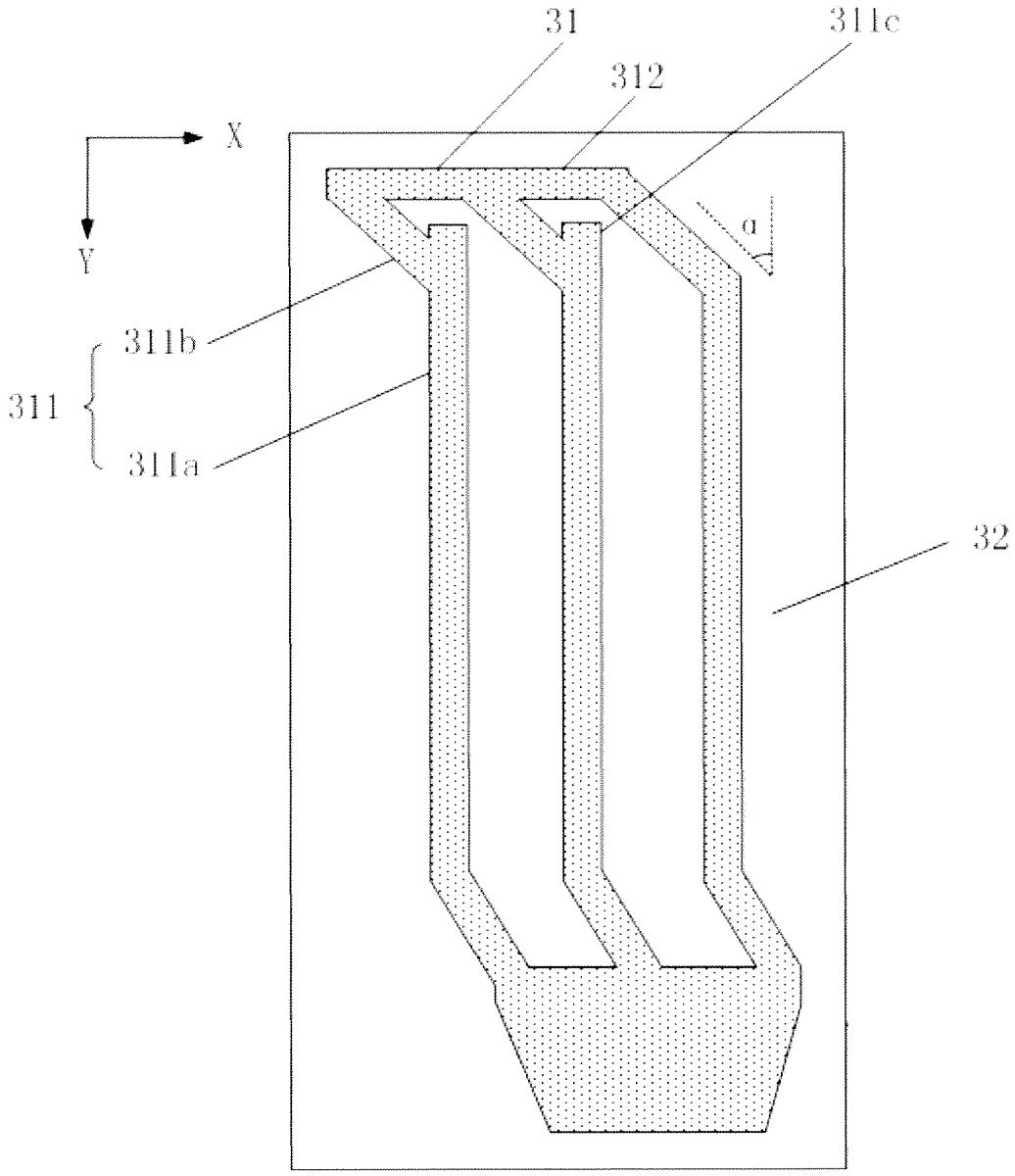

FIG.3a

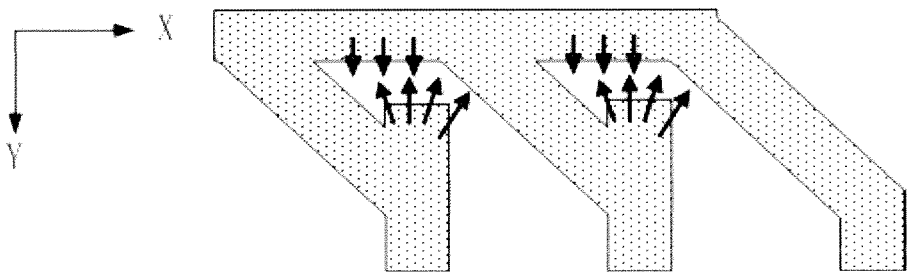

FIG.3b

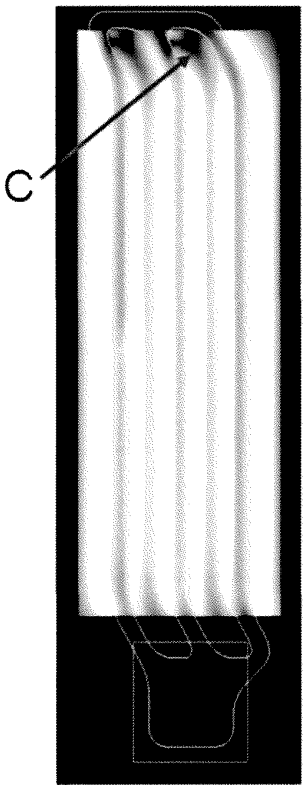

FIG.4a

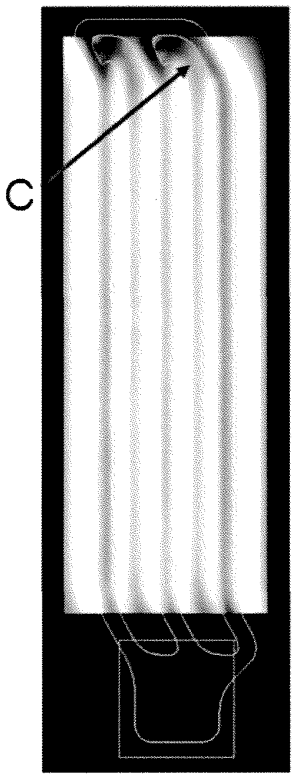

FIG.4b

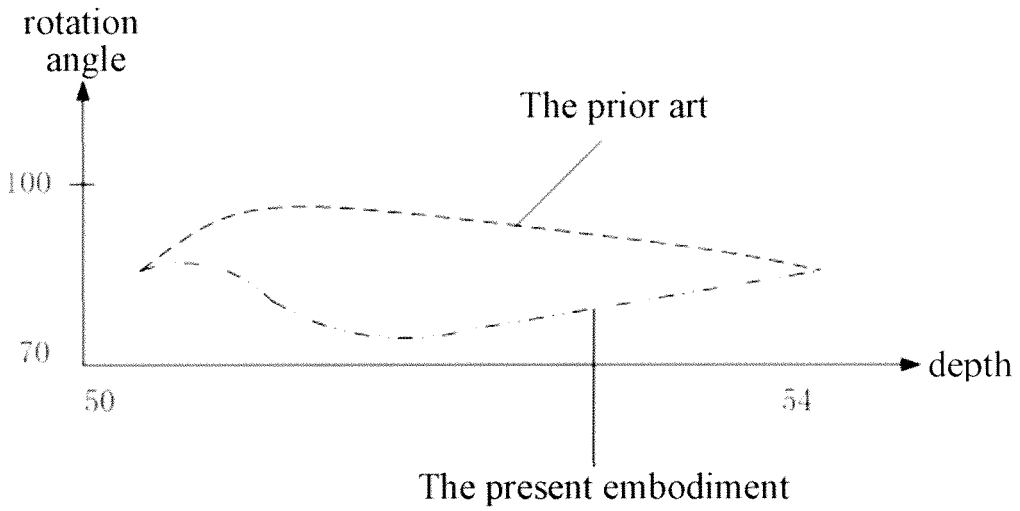
rotation
angle
The prior art
100
70
50
54
depth
The present embodiment

FIG.5

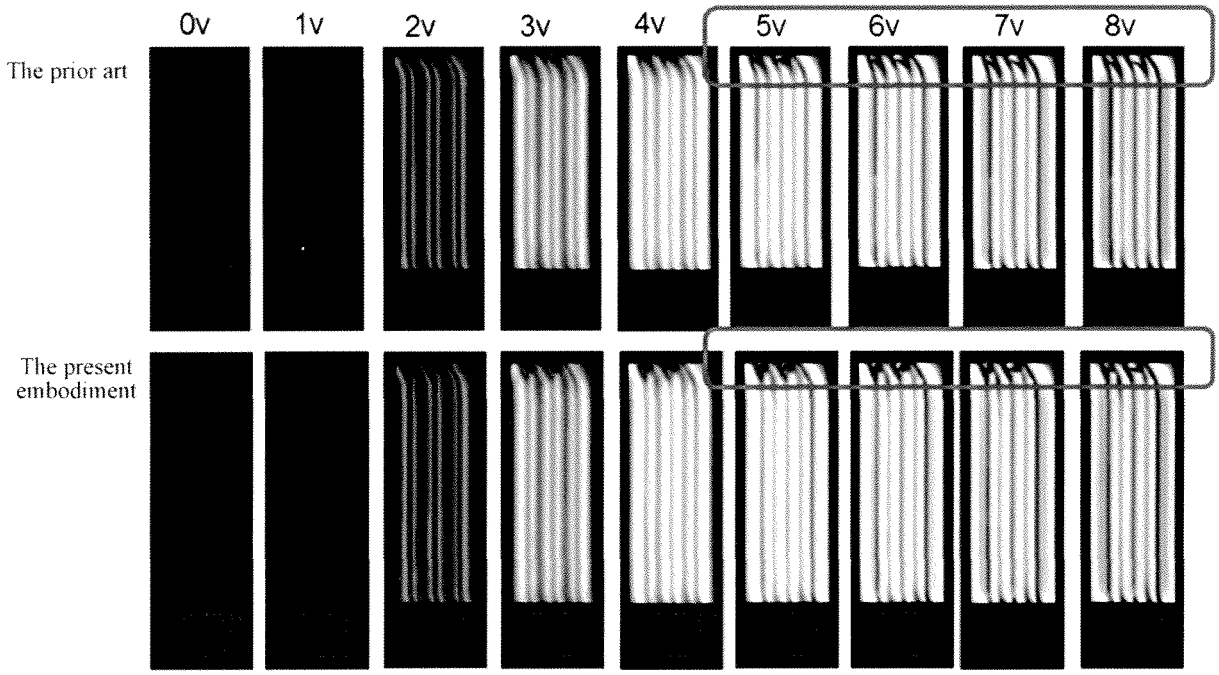
0v
1v
2v
3v
4v
5v
6v
7v
8v
The prior art
The present
embodiment

FIG.6

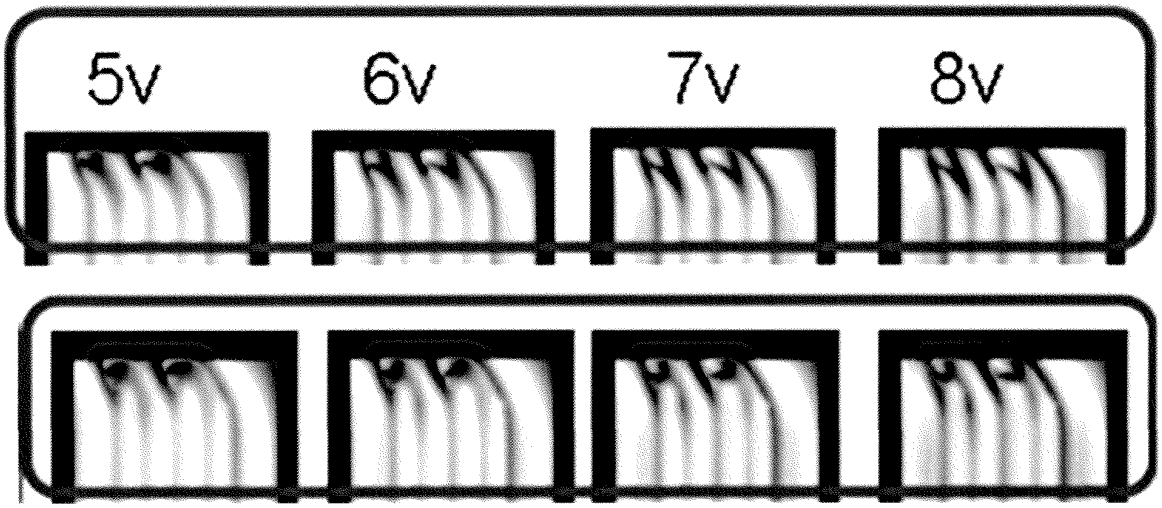
5v
6v
7v
8v

FIG.7

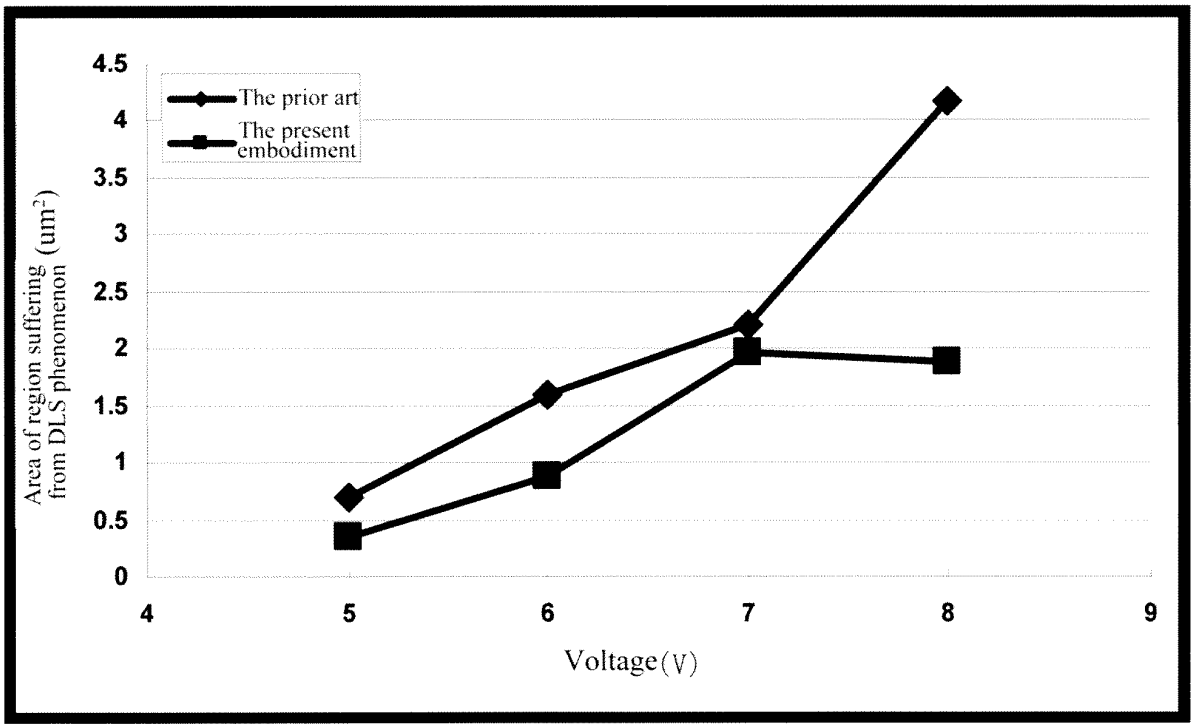
The prior art
The present embodiment
Area of region suffering from DLS phenomenon (um²)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
4
5
6
7
8
9
Voltage(V)

FIG.8

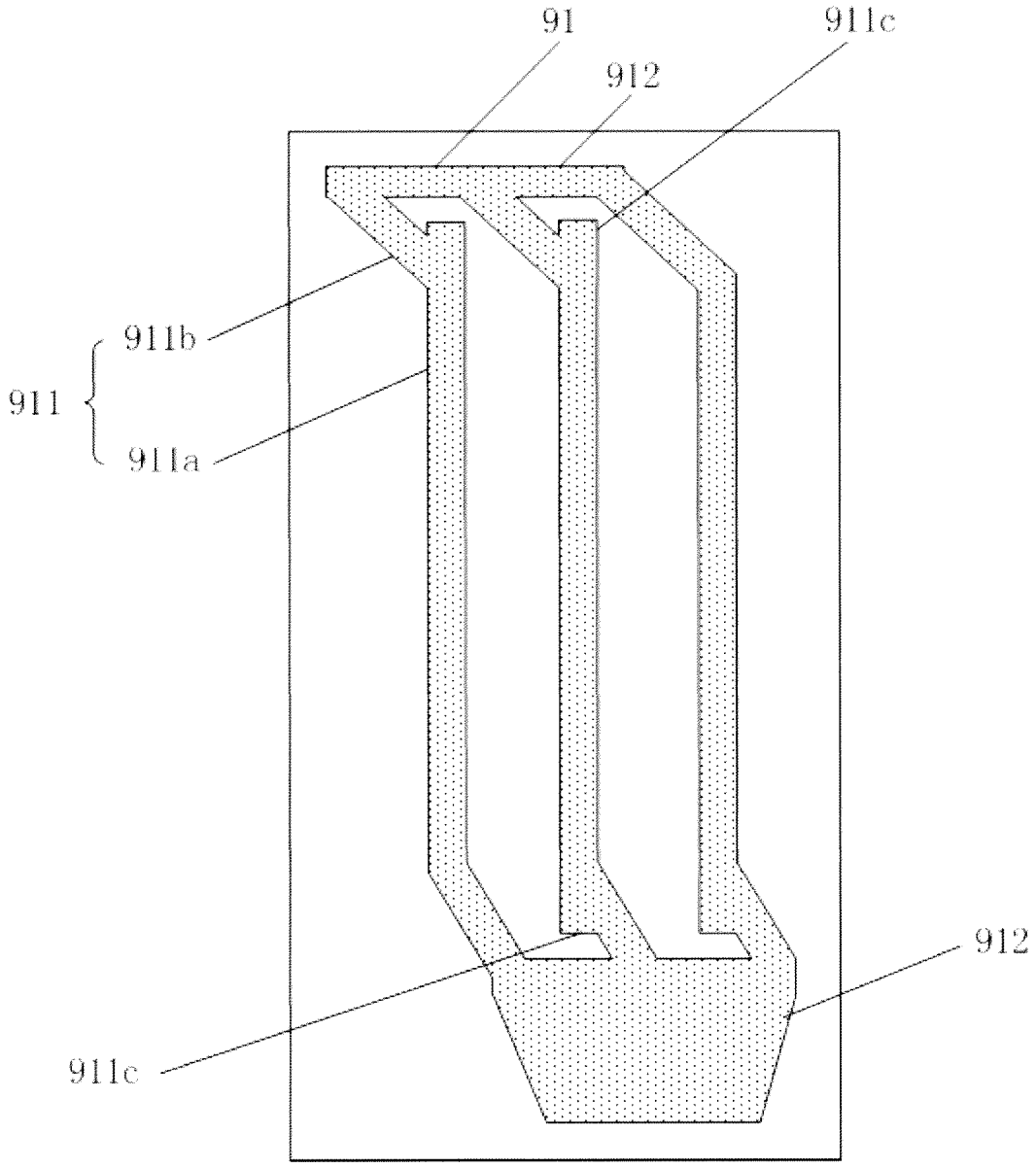

FIG.9

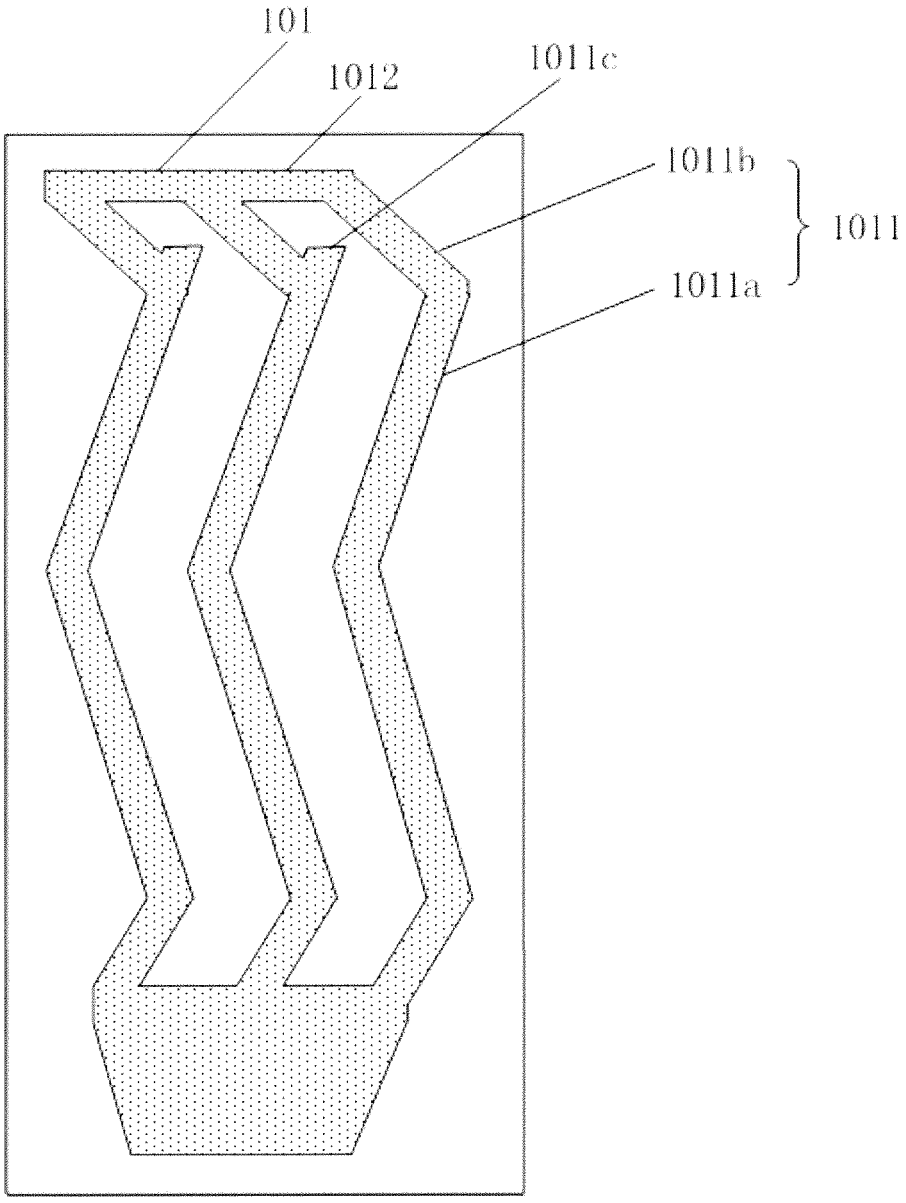

FIG.10

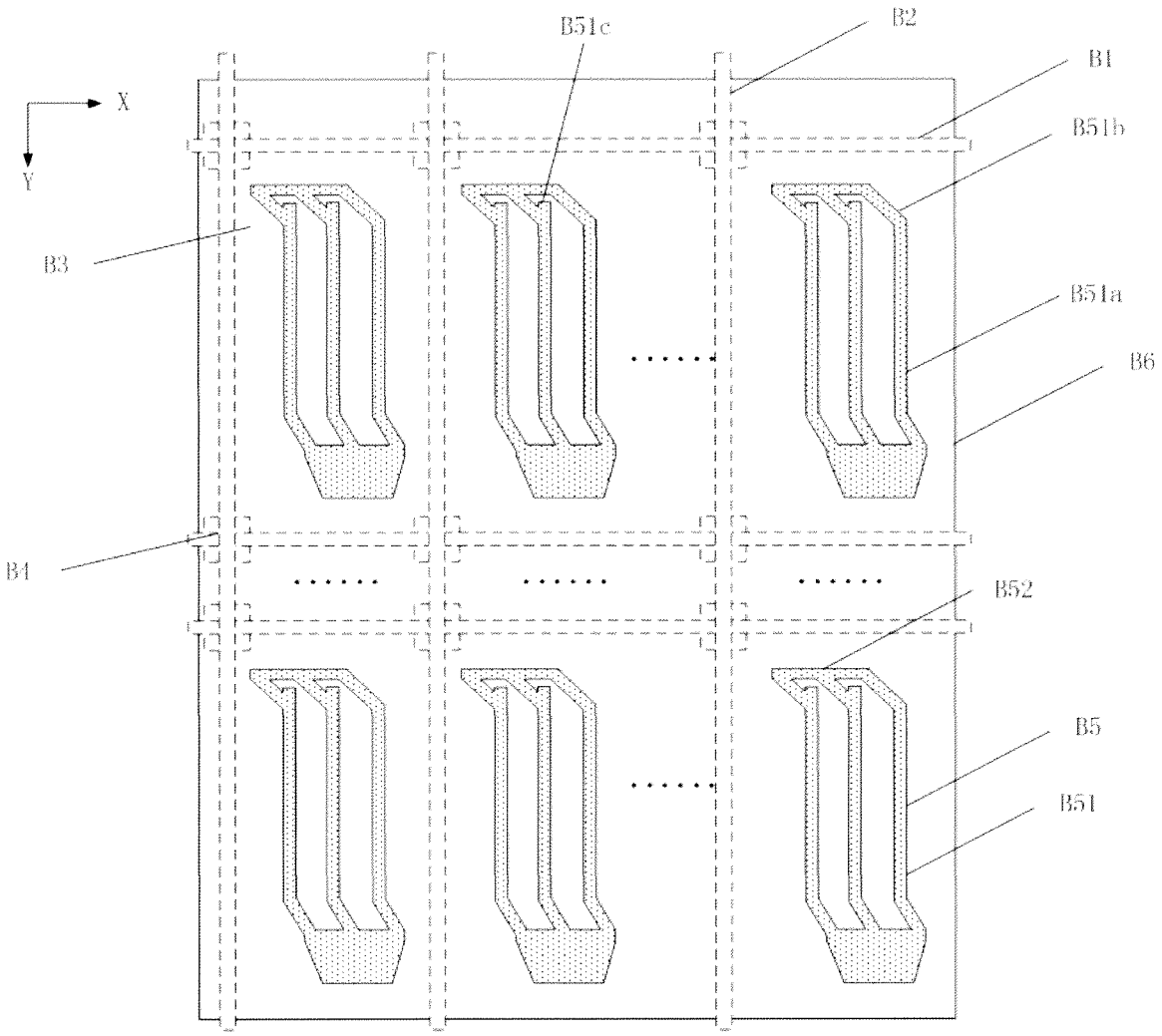

FIG.11

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 20100157228 A **[0006]**
- US 20100208184 A **[0006]**

专利名称(译)	具有边缘场切换模式的像素单元电极结构和液晶显示器件的阵列基板		
公开(公告)号	EP2770368B1	公开(公告)日	2016-02-03
申请号	EP2013193767	申请日	2013-11-21
[标]申请(专利权)人(译)	厦门天马微电子有限公司		
申请(专利权)人(译)	厦门天马微电子有限公司.		
当前申请(专利权)人(译)	厦门天马微电子有限公司.		
[标]发明人	ZHOU TING SHEN BOPING		
发明人	ZHOU, TING SHEN, BOPING		
IPC分类号	G02F1/1343 G02F1/1337		
CPC分类号	G02F1/134309 G02F1/134363 G02F2001/13373 G02F2001/134372		
优先权	201310059824.1 2013-02-26 CN		
其他公开文献	EP2770368A1		
外部链接	Espacenet		

摘要(译)

本发明公开了一种具有FFS模式的LCD装置的像素单元和阵列基板，该像素单元包括像素电极（31,91,101，B5）和彼此绝缘的公共电极（32，B6），像素电极（31,91,101，B5）包括至少两个平行排列的分支电极（311,911,1011，B51）和一个连接到分支电极（311,911,1011，B51）末端的端电极（312,912,1012，B52）;分支电极（311,911,1011，B51）包括主体（311a，911a，1011a，B51a）和倾斜连接部分（311b，911b，1011b，B51b），倾斜连接部分（311b，911b，1011b，B51b）连接在主体（311a，911a，1011a，B51a）的一端和端电极（312,912,1012，B52）之间，并且在与主体（311a，911a，1011a，B51a）的延伸方向不同的方向上延伸。;至少一个分支电极（311,911,1011，B51）包括位于主体（311a，911a，1011a，B51a）一端的突起（311c，911c，1011c，B51c）;突起（311c，911c，1011c，B51c）沿着主体（311a，911a，1011a，B51a）的延伸方向与端电极（312,912,1012，B52）相对设置。本发明抑制了LCD装置像素单元边缘的DLS现象，从而提高了显示性能。

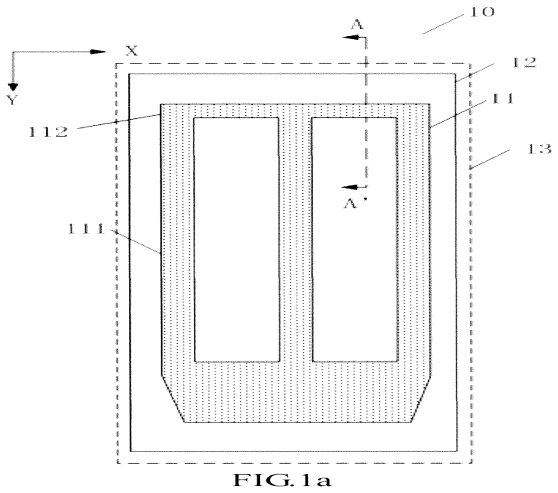

FIG.1a