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(54) **LIQUID CRYSTAL PANEL AND DISPLAY APPARATUS**

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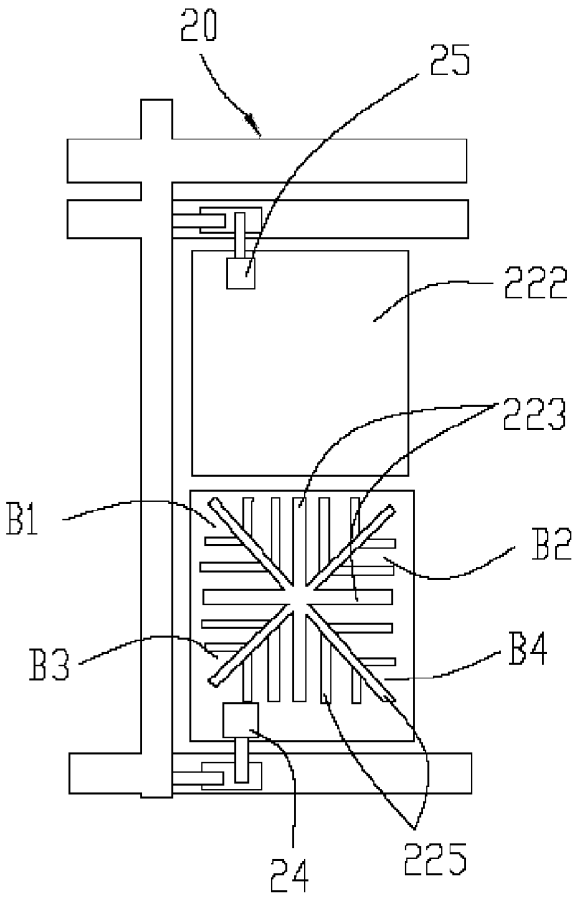
(57) **ABSTRACT**

The disclosure is related to a liquid crystal panel. The liquid crystal panel comprises a color filter substrate, an array substrate and a liquid crystal layer disposed between the color filter substrate and the array substrate. A common electrode layer is disposed at the side of the color filter substrate toward the liquid crystal layer. A pixel electrode layer is disposed at the side of the array substrate toward the liquid crystal layer. The common electrode layer and the pixel electrode layer are disposed symmetrically. The common electrode layer comprises a first common electrode region and a second common electrode region. The pixel electrode layer comprises a first pixel electrode region and a second pixel electrode region. Four domain regions are arranged in the first common electrode region and the first pixel electrode region. The disclosure further provides a display apparatus.



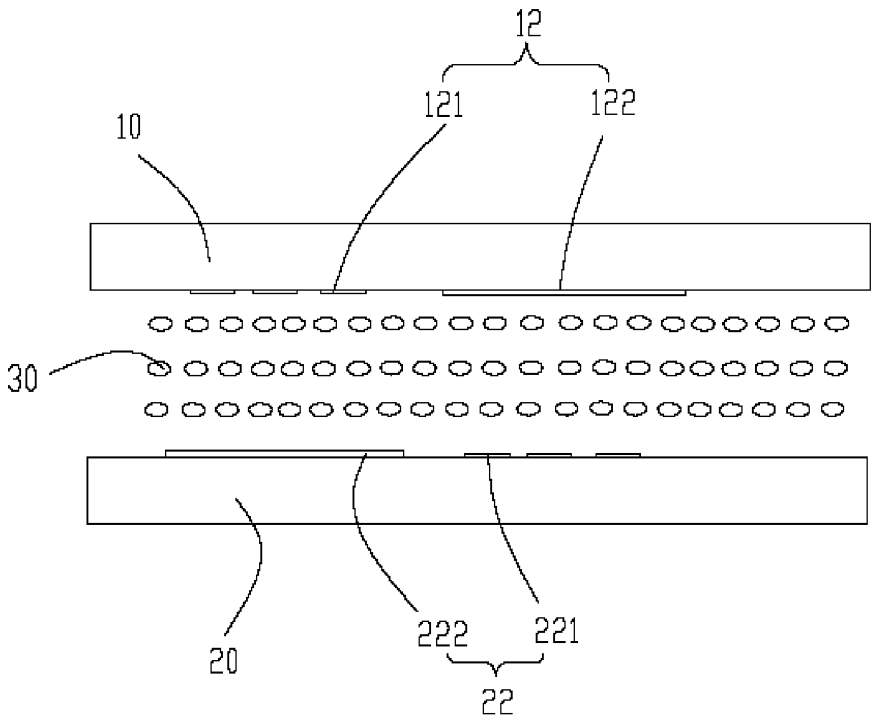


Fig. 1

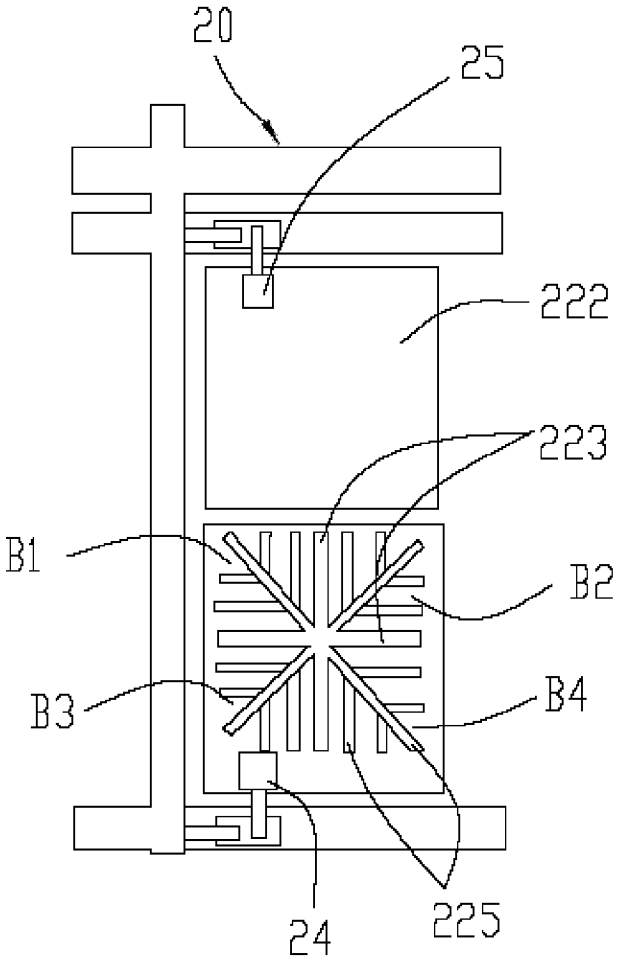


Fig. 2

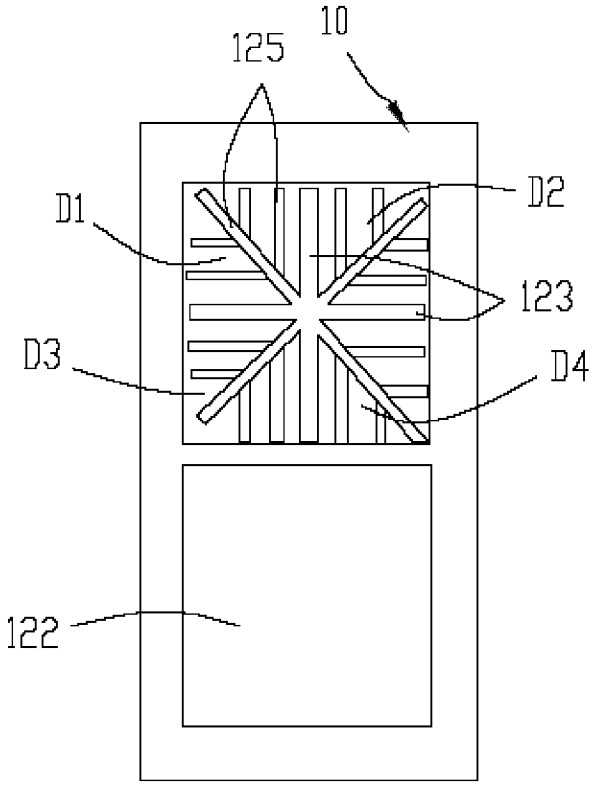


Fig. 3

LIQUID CRYSTAL PANEL AND DISPLAY APPARATUS

[0001] This application claims the benefit of, and priority to, Chinese Patent Application No. 201510204488.4, filed Apr. 27, 2015, titled "Liquid Crystal Panel and Display Apparatus", the entire contents of which are incorporated by reference herein in its entirety.

BACKGROUND

[0002] 1. Technical Field

[0003] The disclosure is related to the field of liquid crystal display technology, and more particularly to a liquid crystal panel and a display apparatus.

[0004] 2. Related Art

[0005] The liquid crystal display device as a display part of the electronic apparatus has been widely used in various electronic products at present. The display panel of the liquid crystal display device as well as visual angle, brightness and color, are related to the display effects of the liquid crystal display apparatus. Thin film transistors as switch devices are generally applied in liquid crystal display devices and other electronic devices. The present liquid crystal panel comprises a TFT array substrate and a color filter substrate disposed opposite to each other as well as a liquid crystal layer sandwiched between the array substrate and the color filter substrate. The plastic frame is formed between the color filter substrate and the array substrate to seal the liquid crystal.

[0006] A technique called Polymer Stabilized Vertical Alignment (PSVA) is developed by the industry. This technique is practiced by mixing the monomer compound in suitable concentration with the liquid crystal material and well shaking. Then, the mixed liquid crystal material is heated by the heater to achieve the Isotropy status. The liquid crystal mixture returns to the nematic status when the liquid crystal mixture cools down to the room temperature. After that, the liquid crystal mixture is injected into the liquid crystal cell and applied with the voltage. After the liquid crystal molecules are arranged stably by the applied voltage, the ultraviolet light or heating method is used to make the monomer compound polymerized to generate the polymer layer. Thereby, the purpose of the stable alignment of is achieved.

[0007] Generally speaking, the design with eight domain structures is usually adopted in the liquid crystal panel with PSVA in order to increase the visual angle. That is, the pixel electrode corresponding to each subpixel region is divided into a large region and a small region. The four-domain structure is disposed at the two electrode regions. Each electrode region is driven by a TFT. However, the asymmetric type of the electrode segmentation easily restful in occurrence of the color shifting. A TFT sharing switch is added in order to overcome the color shifting. However, the partial light is obscured by the added TFT sharing switch, and thereby, the aperture ratio of the display panel is affected.

SUMMARY

[0008] The embodiment of the disclosure provides a liquid crystal panel, so as to increase the aperture ratio of the liquid crystal display panel without having influence on the visual angle.

[0009] The embodiment of the disclosure further provides a display apparatus.

[0010] The embodiment of the disclosure provides a liquid crystal panel. The liquid crystal panel comprises a color filter substrate, an array substrate and a liquid crystal layer disposed between the color filter substrate and the array substrate. A common electrode layer is disposed at the side of the color filter substrate toward the liquid crystal layer. A pixel electrode layer is disposed at the side of the array substrate toward the liquid crystal layer. The common electrode layer and the pixel electrode layer are disposed symmetrically. The common electrode layer comprises a first common electrode region and a second common electrode region. The first common electrode region and the second common electrode region are separated through a gap and symmetrically disposed with the center line of the gap. The pixel electrode layer comprises a first pixel electrode region and a second pixel electrode region. The first pixel electrode region and the second pixel electrode region are separated through a gap and symmetrically disposed with the center line of the gap. Four domain regions are arranged in the first common electrode region. The first common electrode region and the second pixel electrode region are disposed opposite to each other. Four domain regions are arranged in the first pixel electrode region. The first pixel electrode region and the second common electrode region are disposed opposite to each other.

[0011] In some alternative embodiments, the first common electrode region and the second pixel electrode region are symmetrically disposed at the two sides of the liquid crystal layer; the second common electrode region and the first pixel electrode region are symmetrically disposed at the two sides of the liquid crystal layer.

[0012] In some alternative embodiments, a first groove in a cross shape is disposed in the first common electrode region; the first common electrode region is separated into the four domain regions by the first groove.

[0013] In some alternative embodiments, a second groove in a cross shape is disposed in the first pixel electrode region; the first pixel electrode region is separated into the four domain regions by the second groove.

[0014] In some alternative embodiments, a plurality of regularly arranged cracks are disposed in the four domain regions of the first common electrode region, and are arranged in parallel along the two sides of the first groove by way of an angle with the first groove, and thereby the four domain regions of the first common electrode region forms a "米" pattern; a plurality of regularly arranged cracks are disposed in the four domain regions of the first pixel electrode region, and are arranged in parallel along the two sides of the second groove by way of an angle with the second groove.

[0015] In some alternative embodiments, the array substrate further comprises a first metal electrode electrically connecting to the first pixel electrode region.

[0016] In some alternative embodiments, the array substrate further comprises a second metal electrode electrically connecting to the second pixel electrode region.

[0017] The embodiment of the disclosure further provides a display apparatus. The display apparatus comprises a liquid crystal panel, wherein the liquid crystal panel is a double-sided display panel. The liquid crystal panel comprises a color filter substrate, an array substrate and a liquid crystal layer disposed between the color filter substrate and

the array substrate. A common electrode layer is disposed at the side of the color filter substrate toward the liquid crystal layer. A pixel electrode layer is disposed at the side of the array substrate toward the liquid crystal layer. The common electrode layer and the pixel electrode layer are disposed symmetrically. The common electrode layer comprises a first common electrode region and a second common electrode region. The first common electrode region and the second common electrode region are separated through a gap and symmetrically disposed with the center line of the gap. The pixel electrode layer comprises a first pixel electrode region and a second pixel electrode region. The first pixel electrode region and the second pixel electrode region are separated through a gap and symmetrically disposed with the center line of the gap. Four domain regions are arranged in the first common electrode region. The first common electrode region and the second pixel electrode region are disposed opposite to each other. Four domain regions are arranged in the first pixel electrode region. The first pixel electrode region and the second common electrode region are disposed opposite to each other.

[0018] In some alternative embodiments, the first common electrode region and the second pixel electrode region are symmetrically disposed at the two sides of the liquid crystal layer; the second common electrode region and the first pixel electrode region are symmetrically disposed at the two side of the liquid crystal layer.

[0019] In some alternative embodiments, the array substrate further comprises a first metal electrode electrically connecting to the first pixel electrode region.

[0020] The first pixel electrode region and the second pixel electrode region are symmetrically disposed. Four domain regions are arranged in the first pixel electrode region. The first common electrode region and the second common electrode region are disposed opposite to each other. Four domain regions are arranged in the first common electrode region. The degree of visual angels generated by the uniform distribution method are the same no matter it adopts the side of the array substrate or the side of the color filter substrate for lighting emission. The color shifting is not generated by the uneven distribution of pixel electrodes. The first common electrode region of the liquid crystal panel is charged by the color filter. The first pixel electrode region is charged by the array substrate. Without affecting the charging efficiency, one switch of the pixel electrodes is reduced as compared with the current technique and the aperture ratio of the panel is increased.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] In order to more clearly illustrate the prior art or the embodiments or aspects of the practice of the disclosure, the accompanying drawings for illustrating the prior art or the embodiments of the disclosure are briefly described as below. It is apparently that the drawings described below are merely some embodiments of the disclosure, and those skilled in the art may derive other drawings according the drawings described below without creative endeavor.

[0022] FIG. **1** is a cross-section view of the liquid crystal display panel according to the embodiment of the disclosure;

[0023] FIG. **2** is a schematic of the array substrate of the liquid crystal panel as shown in FIG. **1**; and

[0024] FIG. **3** is a schematic of the color filter substrate of the liquid crystal panel as shown in FIG. **1**.

DETAILED DESCRIPTION

[0025] The following description with reference to the accompanying drawings is provided to clearly and completely explain the exemplary embodiments of the disclosure. It is apparent that the following embodiments are merely some embodiments of the disclosure rather than all embodiments of the disclosure. According to the embodiments in the disclosure, all the other embodiments attainable by those skilled in the art without creative endeavor belong to the protection scope of the disclosure.

[0026] The embodiment of the disclosure provides a display apparatus and a liquid crystal panel. The liquid crystal panel is a dual display panel and provides for displaying at dual side.

[0027] Refer to FIG. **1**. The liquid crystal panel comprises a color filter substrate **10**, an array substrate **20** and a liquid crystal layer **30** disposed between the color filter substrate **10** and the array substrate **20**. A common electrode layer **12** is disposed at the side of the color filter substrate **10** toward the liquid crystal layer **30**. A pixel electrode layer **22** is disposed at the side of the array substrate **20** toward the liquid crystal layer **30**. The common electrode layer **12** and the pixel electrode layer **22** are disposed symmetrically. The common electrode layer **12** comprises a first common electrode region **121** and a second common electrode region **122**. The first common electrode region **121** and the second common electrode region **122** are separated through a gap and symmetrically disposed with the center line of the gap. The pixel electrode layer **22** comprises a first pixel electrode region **221** and a second pixel electrode region **222**. The first pixel electrode region **221** and the second pixel electrode region **222** are separated through a gap and symmetrically disposed with the center line of the gap. Four domain regions are arranged in the first common electrode region **121**. The first common electrode region **121** and the second pixel electrode region **222** are disposed opposite to each other. Four domain regions are arranged in the first pixel electrode region **221**. The first pixel electrode region **221** and the second common electrode region **122** are disposed opposite to each other.

[0028] In the embodiment of the disclosure, the liquid crystal panel further comprises a plurality of pixel unit. Each pixel unit comprises a plurality of independent subpixel. Each subpixel is corresponding to a pixel electrode. In the embodiment, a subpixel is described as an example. The person skilled in the art understands that the subpixel in the embodiment described below with respect to other subpixel structures in the plurality of subpixels. The pixel electrode layer **22** is disposed corresponding to the subpixel. In the embodiment, the pixel electrode layer **22** is separated into two regions, which are a first pixel electrode region **221** and a second pixel electrode region **222**. The subpixel corresponding to the first pixel electrode region **221** is formed as a first subpixel. The subpixel corresponding to the second pixel electrode region **222** is formed as a second subpixel (not shown). The first pixel electrode region **221** and the first common electrode region **121** are disposed at two light exiting surfaces. In the embodiment, the first pixel electrode region **221** and the second pixel electrode region **222** are separated through a gap and symmetrically disposed with the center line of the gap. The first common electrode region **121** and the second common electrode region **122** are symmetrically formed on the common electrode layer **12** and correspond to the first subpixel and the second subpixel.

[0029] The liquid crystal layer between the first common electrode region **121** and the second pixel electrode region **222** arranged appropriately is driven by the electric driving field. The electric driving field is formed by the voltage generated between the first common electrode region **121** and the second pixel electrode region **222** of the liquid crystal panel. The liquid crystal layer between the first pixel electrode region **221** and the second common electrode region **122** arranged appropriately is driven by the electric driving field. The electric driving field is formed by the voltage generated between the first pixel electrode region **221** and the second common electrode region **122**. The first pixel electrode region **221** and the second pixel electrode region **222** are symmetrically disposed and the size of each region is exactly equal. Four domain regions are arranged in the first pixel electrode region **221**. The first common electrode region **121** and the second common electrode region **122** are symmetrically disposed and the size of each region is exactly equal. Four domain regions are arranged in the first common electrode region **121**. The degree of visual angels generated by the uniform distribution method are the same no matter it adopts the side of the array substrate **20** or the side of the color filter substrate **10** for light emission. The color shifting is not generated by the uneven distribution of pixel electrodes. The first common electrode region **121** of the liquid crystal panel is charged by the color filter **10**. The second pixel electrode region **222** is charged by the array substrate **20**. The first pixel electrode region **221** is charged by the array substrate **20**. The second common electrode region **122** of the liquid crystal panel is charged by the color filter **10**. Without affecting the charging efficiency, one switch of the pixel electrodes is reduced as compared with the current technique and the aperture ratio of the panel is increased.

[0030] Further, the first common electrode region **121** and the second pixel electrode region **222** are symmetrically disposed at the two sides of the liquid crystal layer **30**. The second common electrode region **122** and the first pixel electrode region **221** are symmetrically disposed at the two sides of the liquid crystal layer **30**. In the embodiment, the shape and the size of each directions of the second common electrode region **122** and the first pixel electrode region **221** are exactly equal. In other embodiments, the size of the first common electrode region **121** and the second pixel electrode region **222** could be different. The first common electrode region **121** is in the covered region of the second pixel electrode region **222**. The size of the second common electrode region **122** and the first pixel electrode region **221** could be different. The second common electrode region **122** is in the covered region of the first pixel electrode region **221**.

[0031] Further, the cracks disposed in the four domain regions of the first common electrode region **121** and the four domain regions of the first pixel electrode region **221** are regularly arranged. The snowflake-like pattern is formed by the four domain regions of the first common electrode region **121**. The snowflake-like pattern is formed by the four domain regions of the first pixel electrode region **221**.

[0032] Refer to FIG. **2** and FIG. **3**. A first groove **123** in a cross shape is disposed in the first common electrode region **121**. The first common electrode region **121** is separated into the four domain regions by the first groove **123**. In the embodiment, the four domain regions comprises an upper left region D**1**, an upper right region D**2**, a lower left region D**3** and lower right region D**4**. Cracks **125** are regularly arranged in the regions D**1**, D**2**, D**3** and D**4**. In the embodiment, D**1** as an example, the terminal of the cracks **125** started from the first groove **123** and arranged in parallel along the two sides of the first groove **123** by way of an angle with the first groove **123**. The cracks **125** in the regions D**1**, D**2**, D**3** and D**4** form a snowflake-like pattern or a "*" pattern. The cracks **125** in the regions D**1**, D**2**, D**3** and D**4** in the embodiment of the disclosure form a "*" pattern.

[0033] Further, a second groove **223** in a cross shape is disposed in the first pixel electrode region **221**. The first pixel electrode region **221** is separated into the four domain regions by the second groove **223**. In the embodiment, the four domain regions comprises an upper left region B**1**, an upper right region B**2**, a lower left region B**3** and lower right region B**4**. Cracks **225** are regularly arranged in the regions B**1**, B**2**, B**3** and B**4**. In the embodiment, B**1** as an example, the terminal of the cracks **225** started from the second grooves **223** and arranged in parallel along the two sides of the second groove **223** by way of an angle with the second groove **223**. The cracks **225** in the regions D**1**, D**2**, D**3** and D**4** form a snowflake-like pattern or a "*" pattern. The cracks **225** in the regions D**1**, D**2**, D**3** and D**4** in the embodiment of the disclosure form a "*" pattern.

[0034] Further, the array substrate **20** further comprises a first metal electrode **24** electrically connecting to the first pixel electrode **221**. The first metal electrode **24** provides an electric power to the first pixel electrode **221**. The array substrate **20** further comprises a second metal electrode **25** electrically connecting to the second pixel electrode **222**. The first pixel electrode **221** of the embodiment of the disclosure is only needed one first metal electrode **24** to provide the electric power.

[0035] The first pixel electrode region and the second pixel electrode region are symmetrically disposed. Four domain regions are arranged in the first pixel electrode region. The first common electrode region and the second common electrode region are disposed opposite to each other. Four domain regions are arranged in the first common electrode region. The degree of visual angels generated by the uniform distribution method are the same no matter it adopts the side of the array substrate or the side of the color filter substrate. The color shifting is not generated by the uneven distribution of pixel electrodes. The first common electrode region of the liquid crystal panel is charged by the color filter. The first pixel electrode region is charged by the array substrate. Without affecting the charging efficiency, one switch of the pixel electrodes is reduced as compared with the current technique and the aperture ratio of the panel is increased.

[0036] Note that the specifications relating to the above embodiments should be construed as exemplary rather than as limitative of the present disclosure. The equivalent variations and modifications on the structures or the process by reference to the specification and the drawings of the disclosure, or application to the other relevant technology fields directly or indirectly should be construed similarly as falling within the protection scope of the disclosure.

What is claimed is:

1. A liquid crystal panel, comprising:

a color filter substrate;

an array substrate;

a liquid crystal layer disposed between the color filter substrate and the array substrate;

a common electrode layer disposed at the side of the color filter substrate toward the liquid crystal layer; and

a pixel electrode layer disposed at the side of the array substrate toward the liquid crystal layer;

wherein the common electrode layer and the pixel electrode layer are disposed symmetrically;

the common electrode layer comprises a first common electrode region and a second common electrode region; the first common electrode region and the second common electrode region are separated through a gap and symmetrically disposed with the center line of the gap;

the pixel electrode layer comprises a first pixel electrode region and a second pixel electrode region; the first pixel electrode region and the second pixel electrode region are separated through a gap and symmetrically disposed with the center line of the gap;

four domain regions are arranged in the first common electrode region and the first pixel electrode region respectively; the first common electrode region and the second pixel electrode region are disposed opposite to each other; the first pixel electrode region and the second common electrode region are disposed opposite to each other.

2. The liquid crystal panel according to claim **1**, wherein the first common electrode region and the second pixel electrode region are symmetrically disposed at the two sides of the liquid crystal layer; the second common electrode region and the first pixel electrode region are symmetrically disposed at the two sides of the liquid crystal layer.

3. The liquid crystal panel according to claim **1**, wherein a first groove in a cross shape is disposed in the first common electrode region; the first common electrode region is separated into the four domain regions by the first groove.

4. The liquid crystal panel according to claim **3**, wherein a second groove in a cross shape is disposed in the first pixel electrode region; the first pixel electrode region is separated into the four domain regions by the second groove.

5. The liquid crystal panel according to claim **4**, wherein a plurality of regularly arranged cracks are disposed in the four domain regions of the first common electrode region, and are arranged in parallel along the two sides of the first groove by way of an angle with the first groove, and thereby the four domain regions of the first common electrode region forms a "＊" pattern; a plurality of regularly arranged cracks are disposed in the four domain regions of the first pixel electrode region, and are arranged in parallel along the two sides of the second groove by way of an angle with the second groove.

6. The liquid crystal panel according to claim **4**, wherein the array substrate further comprises a first metal electrode electrically connecting to the first pixel electrode region.

7. The liquid crystal panel according to claim **6**, wherein the array substrate further comprises a second metal electrode electrically connecting to the second pixel electrode region.

8. A display apparatus, comprising:

a liquid crystal panel, wherein the liquid crystal panel is a double side display panel; the liquid crystal panel comprises:

a color filter substrate;

an array substrate;

a liquid crystal layer disposed between the color filter substrate and the array substrate;

a common electrode layer disposed at the side of the color filter substrate toward the liquid crystal layer; and

a pixel electrode layer disposed at the side of the array substrate toward the liquid crystal layer;

wherein the common electrode layer and the pixel electrode layer are disposed symmetrically;

the common electrode layer comprises a first common electrode region and a second common electrode region; the first common electrode region and the second common electrode region are separated through a gap and symmetrically disposed with the center line of the gap;

the pixel electrode layer comprises a first pixel electrode region and a second pixel electrode region; the first pixel electrode region and the second pixel electrode region are separated through a gap and symmetrically disposed with the center line of the gap;

four domain regions are arranged in the first common electrode region and the first pixel electrode region respectively; the first common electrode region and the second pixel electrode region are disposed opposite to each other; the first pixel electrode region and the second common electrode region are disposed opposite to each other.

9. The display apparatus according to claim **8**, wherein the first common electrode region and the second pixel electrode region are symmetrically disposed at the two sides of the liquid crystal layer; the second common electrode region and the first pixel electrode region are symmetrically disposed at the two sides of the liquid crystal layer.

10. The display apparatus according to claim **9**, wherein the array substrate further comprises a first metal electrode electrically connecting to the first pixel electrode region.

* * * * *

专利名称(译)	液晶面板和显示装置		
公开(公告)号	US20160313611A1	公开(公告)日	2016-10-27
申请号	US14/765652	申请日	2015-05-14
[标]申请(专利权)人(译)	深圳市华星光电技术有限公司		
申请(专利权)人(译)	深圳市中国星光电科技有限公司.		
当前申请(专利权)人(译)	深圳市中国星光电科技有限公司		
[标]发明人	XU XIANGYANG		
发明人	XU, XIANGYANG		
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优先权	201510204488.4 2015-04-27 CN		
外部链接	Espacenet USPTO		

摘要(译)

本公开涉及液晶面板。液晶面板包括滤色器基板，阵列基板和设置在滤色器基板和阵列基板之间的液晶层。公共电极层设置在滤色器基板的朝向液晶层的一侧。像素电极层设置在阵列基板的朝向液晶层的一侧。公共电极层和像素电极层对称设置。公共电极层包括第一公共电极区域和第二公共电极区域。像素电极层包括第一像素电极区域和第二像素电极区域。四个畴区域布置在第一公共电极区域和第一像素电极区域中。本发明还提供一种显示装置。