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(54) **LIQUID CRYSTAL DISPLAY DEVICE**

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(52) **U.S. Cl.**

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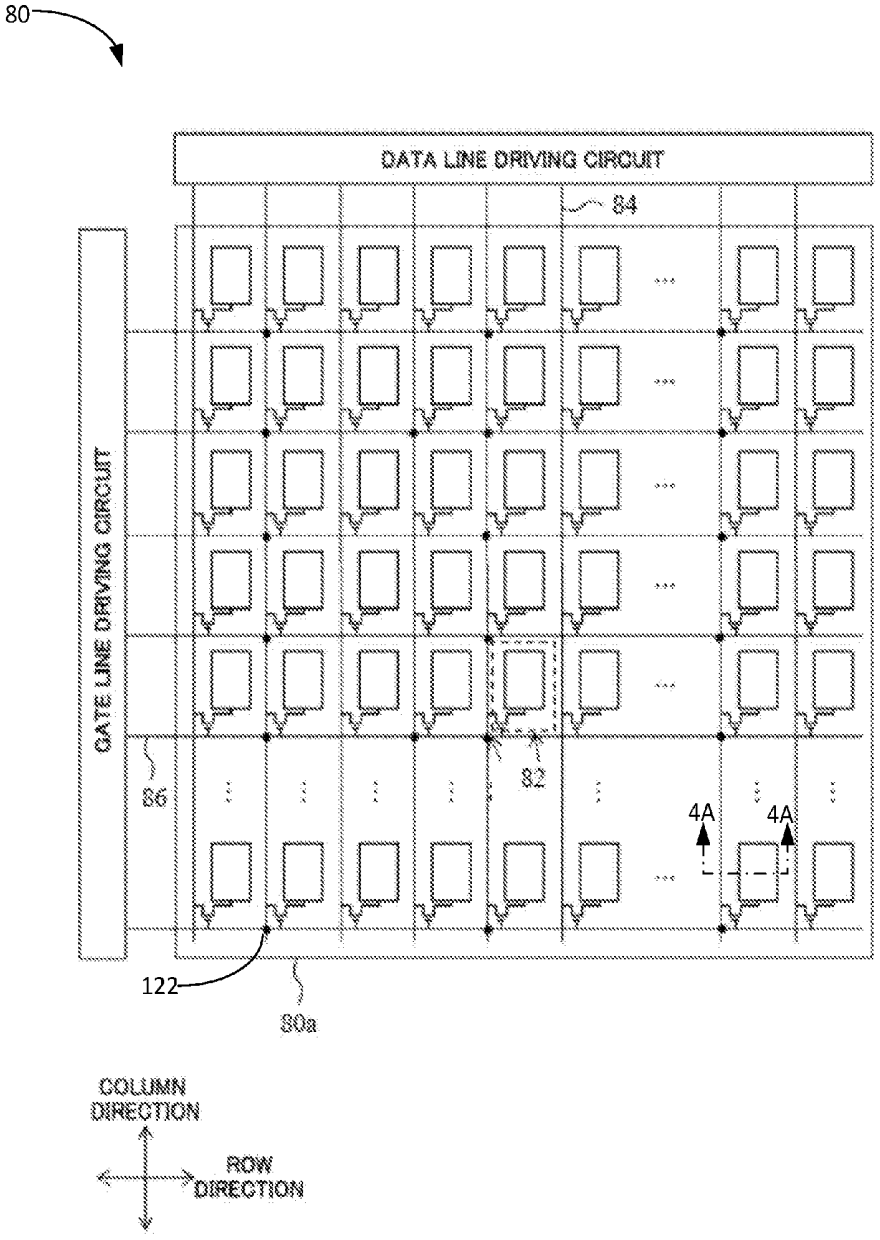
(57) **ABSTRACT**

A liquid crystal display device is disclosed. The liquid crystal display device includes a first substrate and a second substrate disposed opposite the first substrate. The first substrate includes a plurality of gate lines, a plurality of data lines, and a plurality of pixel electrodes. The second substrate includes a first colored region transmitting light of a first color and a second colored region transmitting light of a second color. A first light-blocking layer for blocking light is disposed in a boundary area between the first colored region and the second colored region. The first-light blocking layer is disposed between the first substrate and the second substrate.



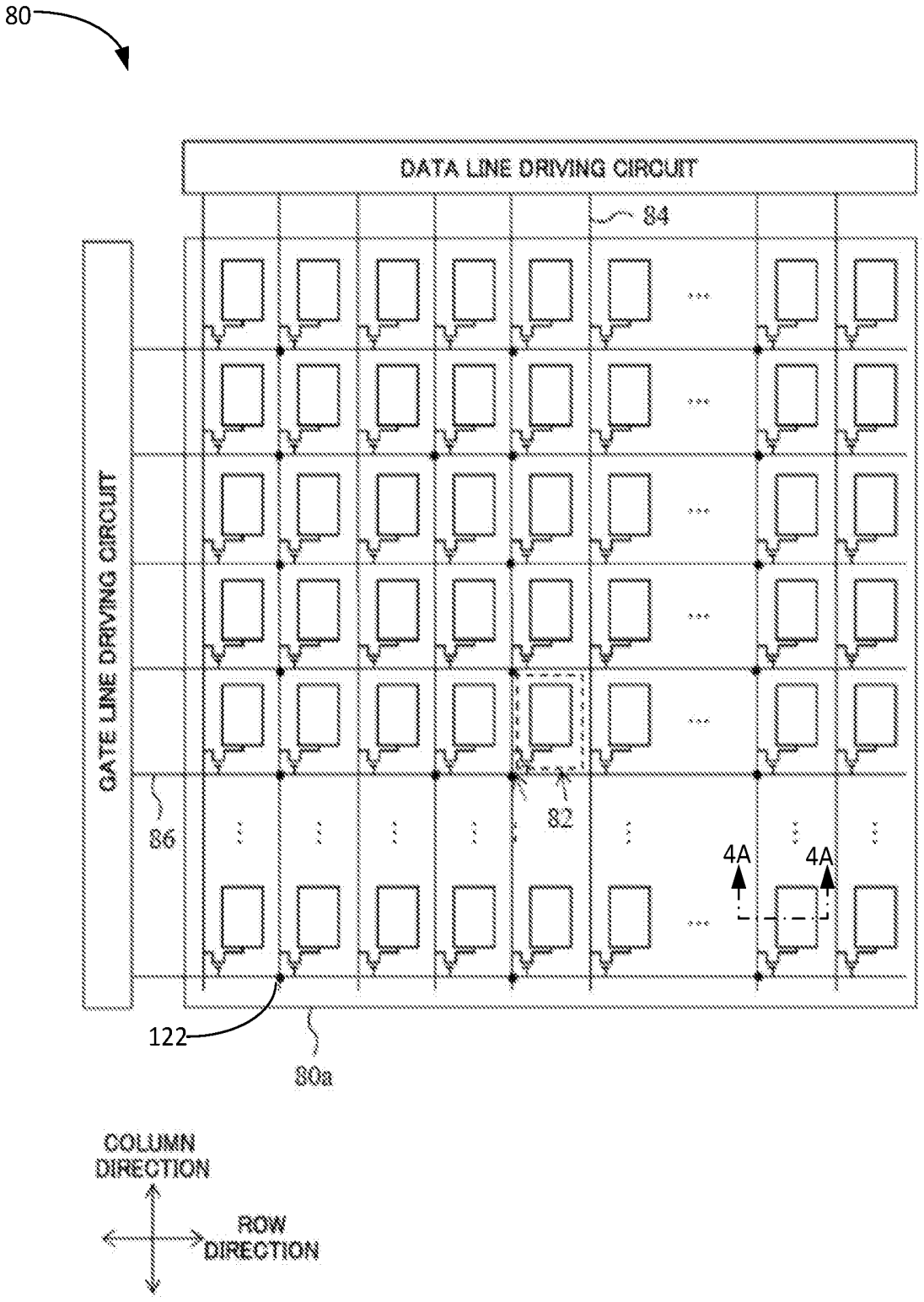

80
DATA LINE DRIVING CIRCUIT
84
GATE LINE DRIVING CIRCUIT
86
82
4A
4A
122
80a
COLUMN DIRECTION
ROW DIRECTION

Figure 1

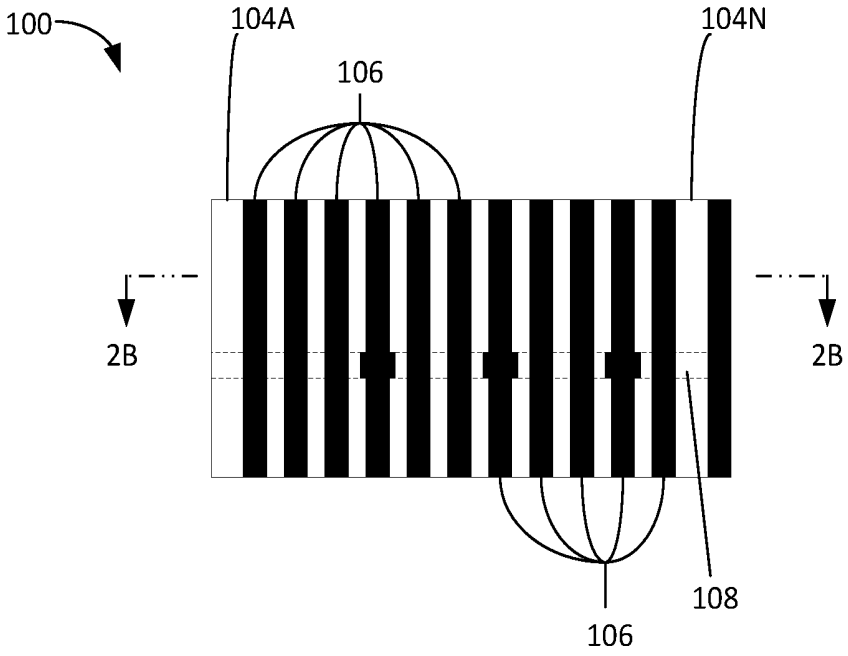


Figure 2A

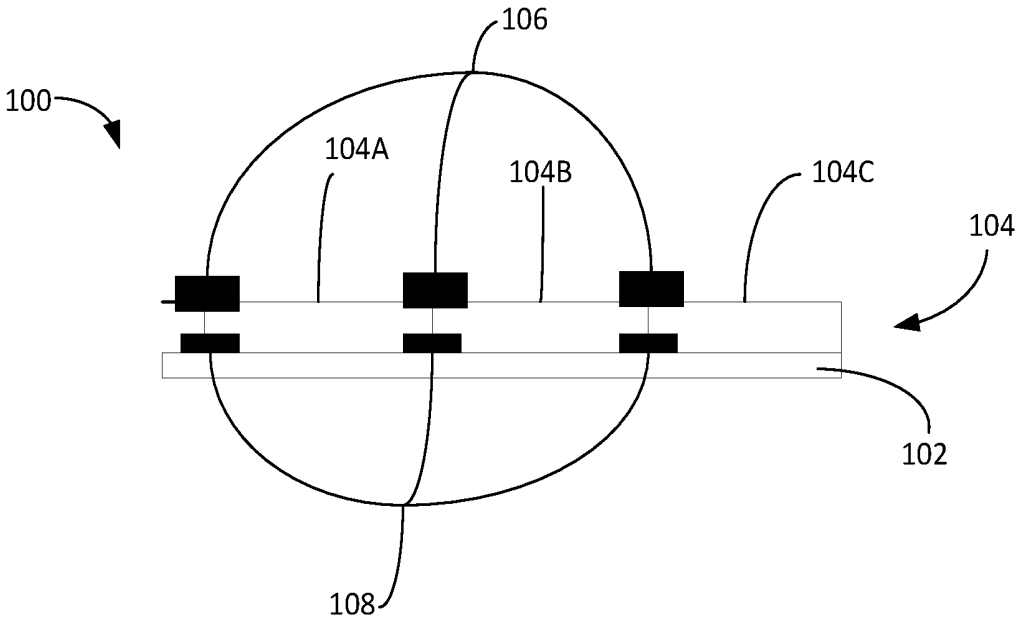


Figure 2B

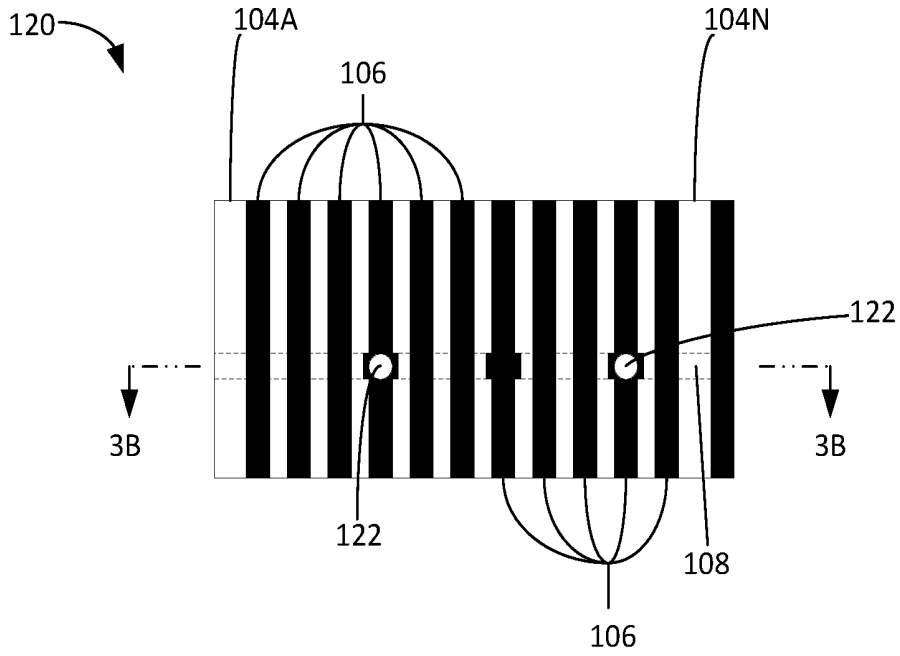


Figure 3A

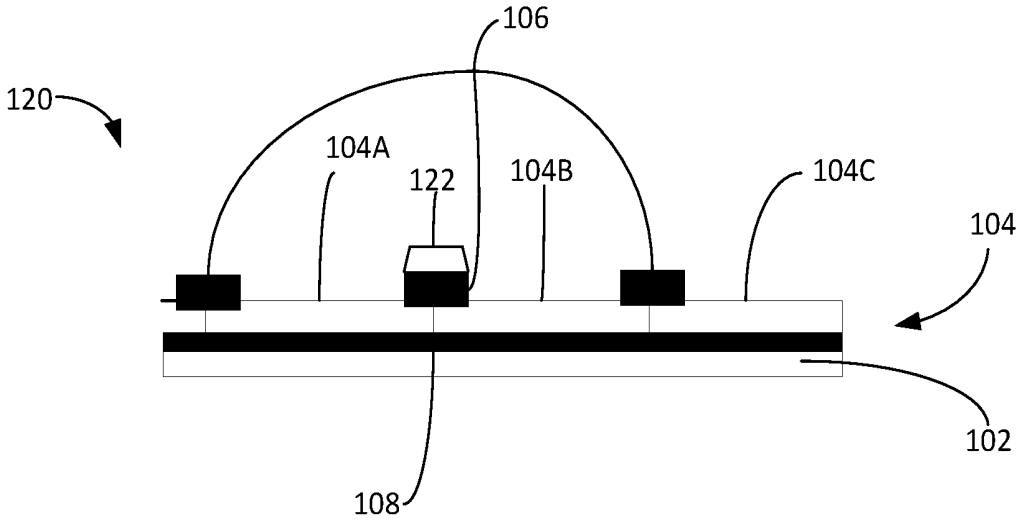


Figure 3B

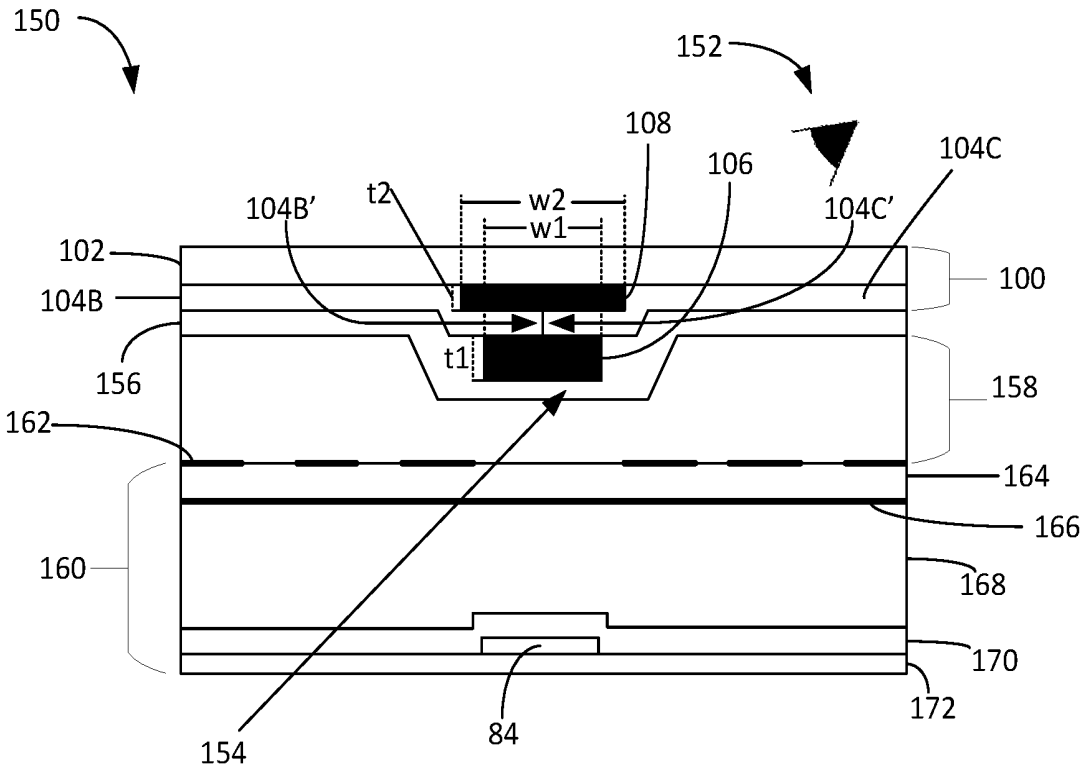

150
152
108
106
104C
104B'
t2
w2
w1
104C'
102
100
104B
156
t1
158
162
164
166
160
168
170
172
154
84

Figure 4A

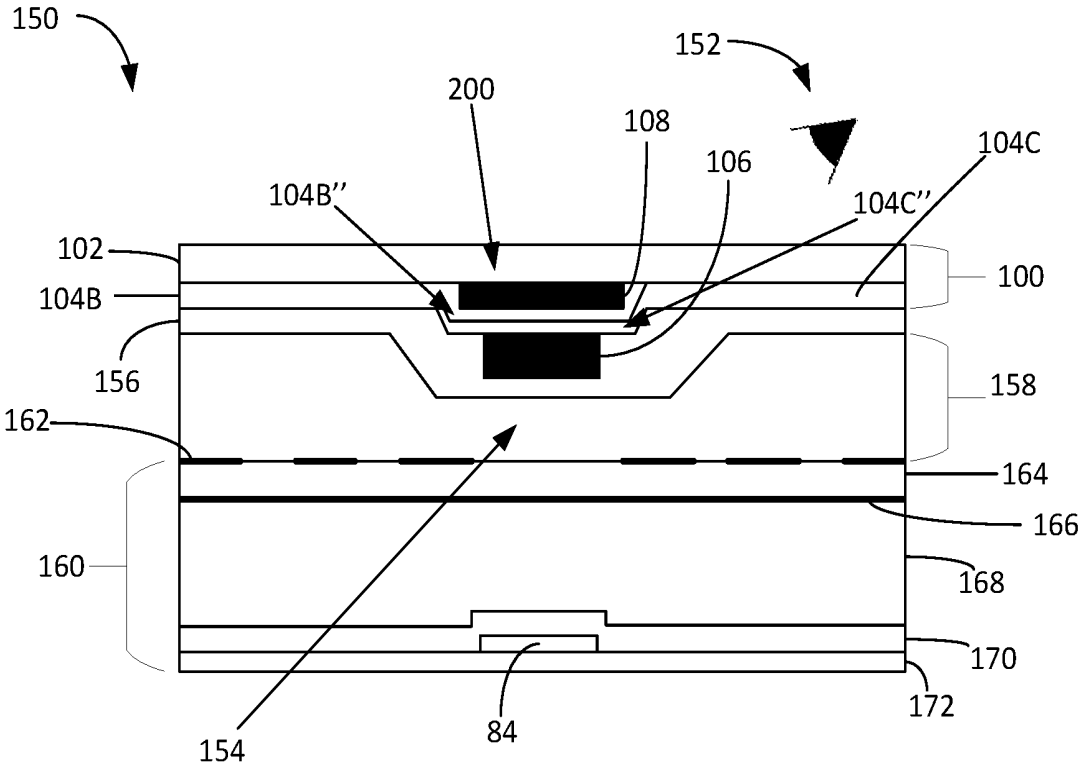

150
152
200
108
106
104C
104B''
104C''
102
104B
100
156
158
162
164
166
160
168
170
172
154
84

Figure 4B

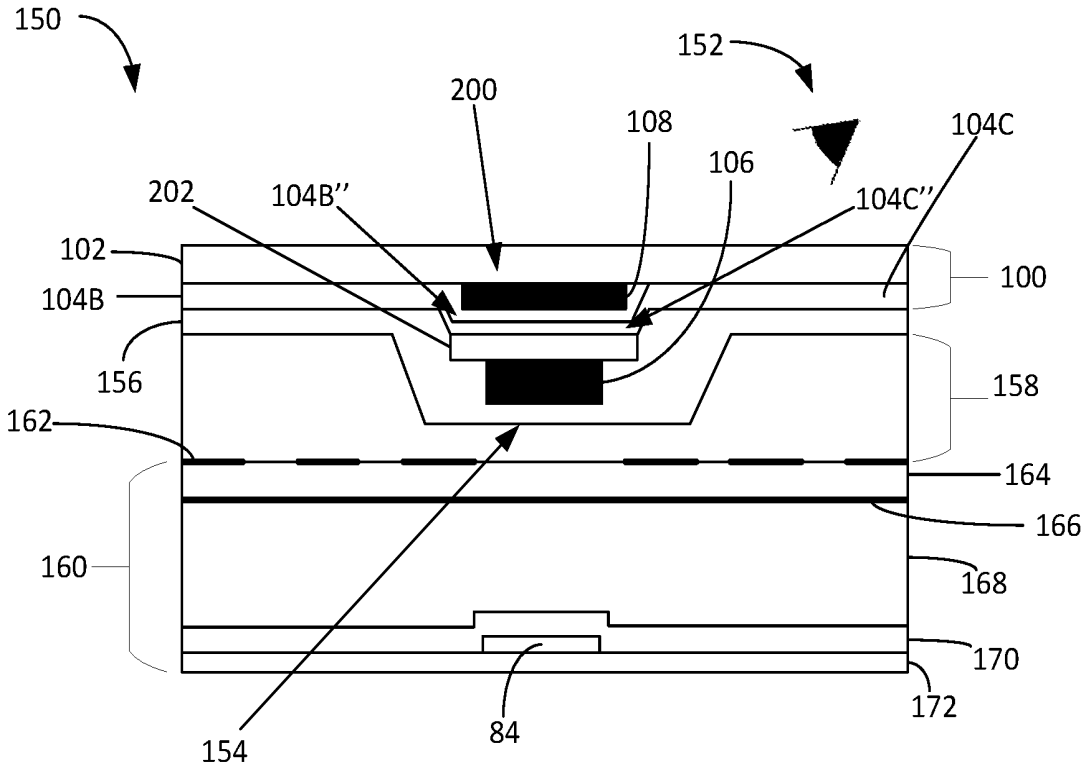

150
152
200
108
106
104C
202
104B''
104C''
102
100
104B
156
158
162
164
166
160
168
170
172
84
154

Figure 4C

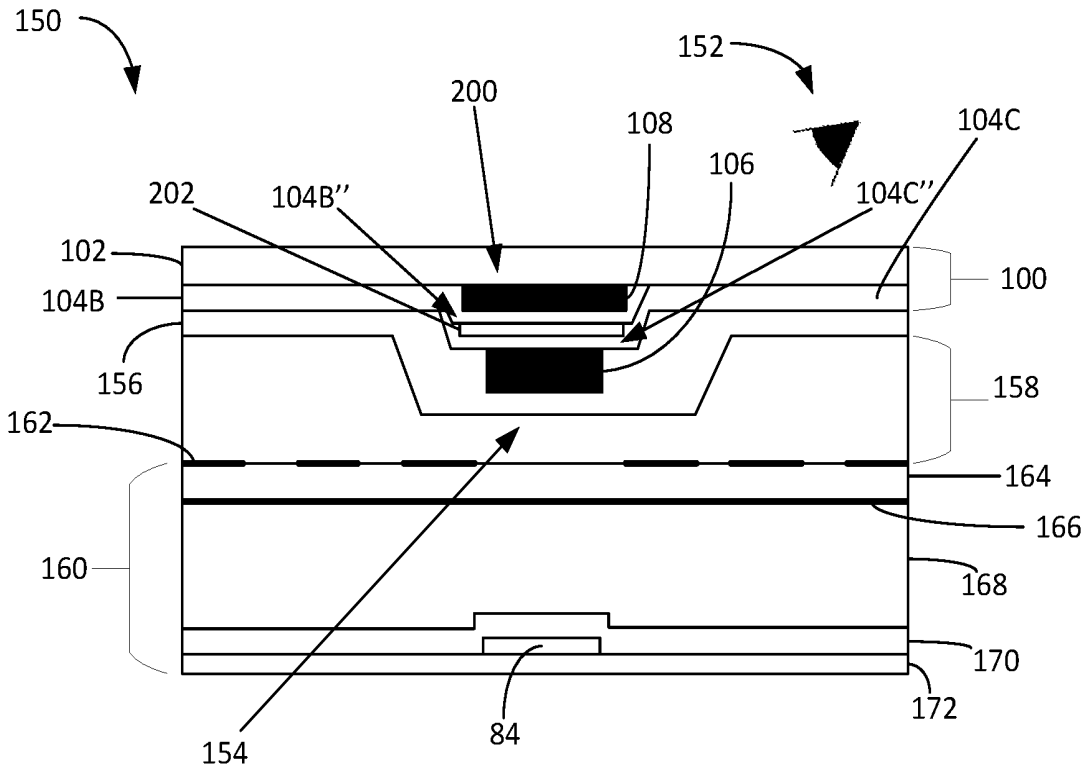

150
152
200
108
106
104C
104C''
202
104B''
102
104B
100
156
158
162
164
166
160
168
170
172
84
154

Figure 4D

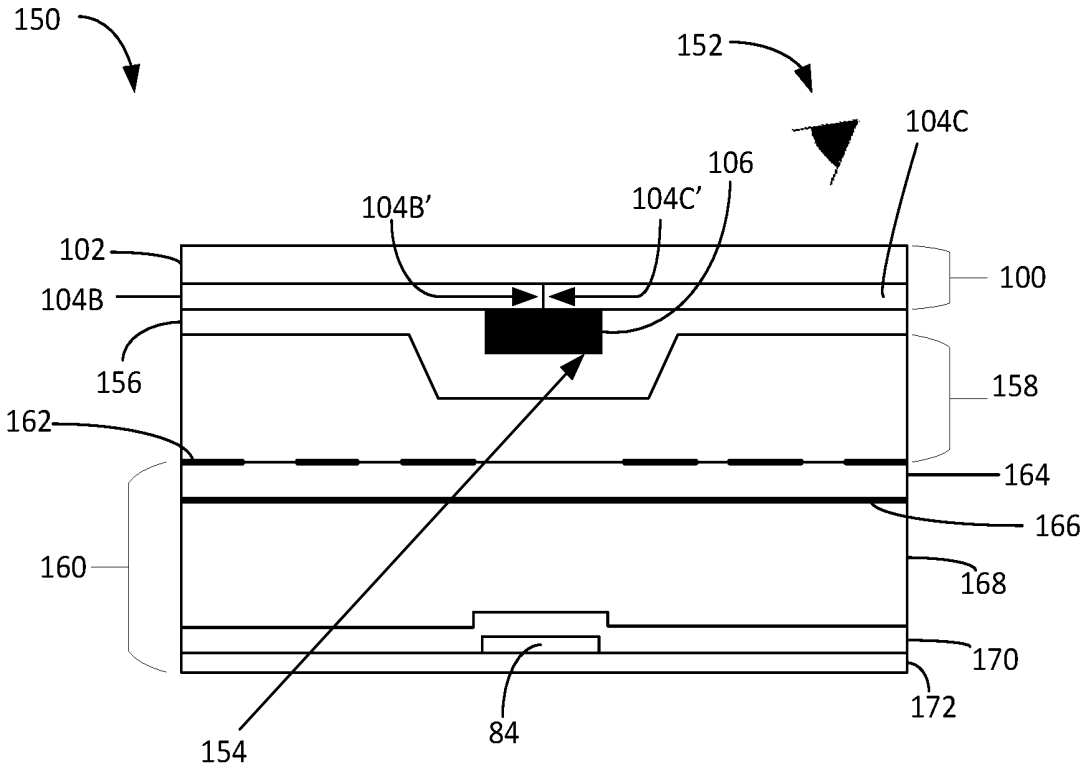

150
152
104C
106
104B'
104C'
102
104B
100
156
158
162
164
166
160
168
170
172
84
154

Figure 4E

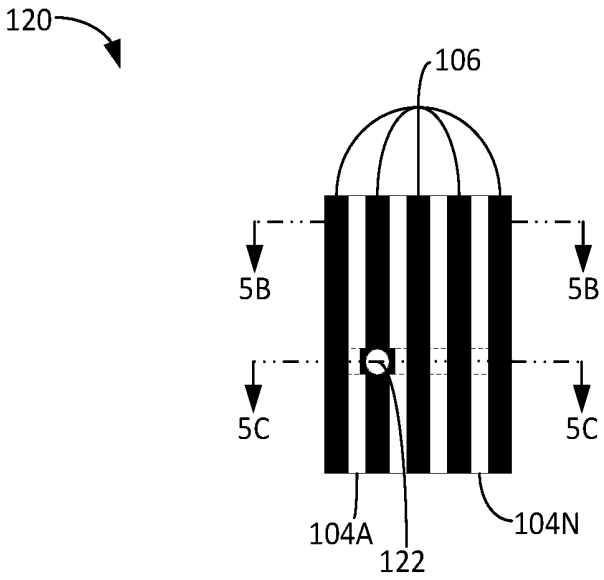


Figure 5A

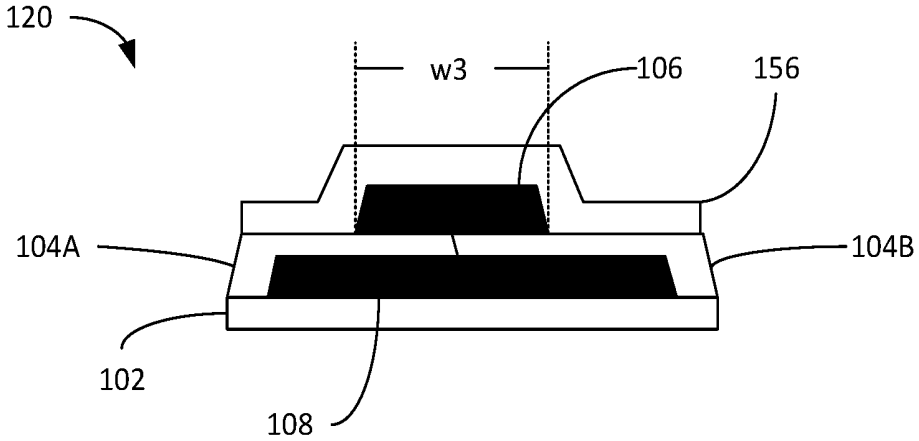


Figure 5B

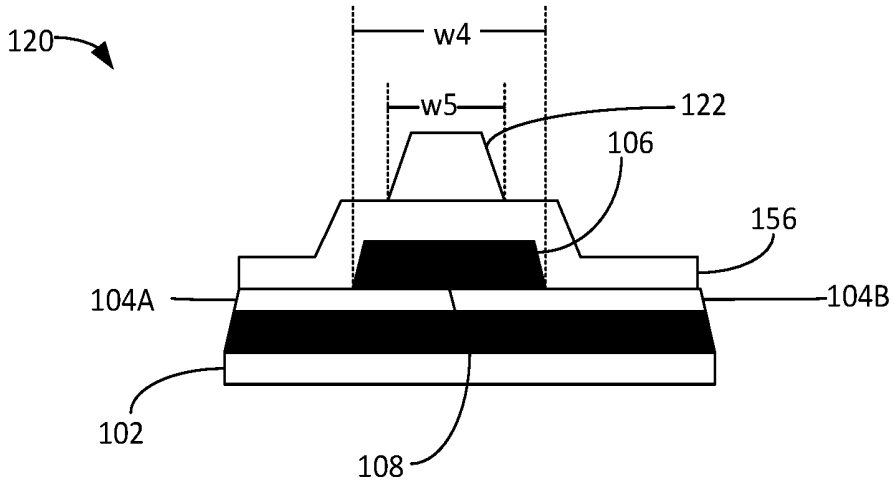


Figure 5C

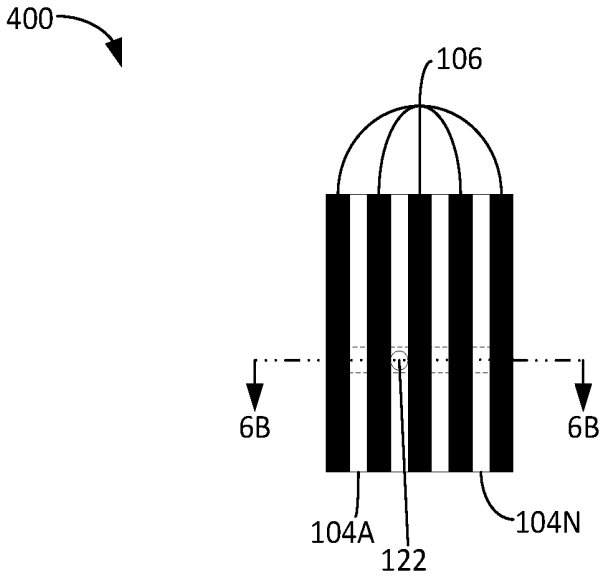


Figure 6A

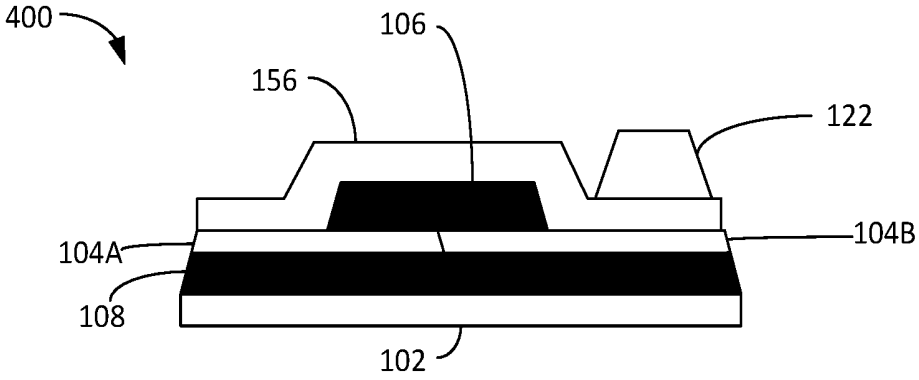


Figure 6B

LIQUID CRYSTAL DISPLAY DEVICE

FIELD

[0001] This disclosure relates to a liquid crystal display device.

BACKGROUND

[0002] A liquid crystal display (LCD) device is an electronic display that is widely used as a display for electronic devices such as, but not limited to, computers, televisions, cellular phones, and the like. An LCD device generally includes a thin film transistor (TFT) substrate and a color filter (CF) substrate. A liquid crystal layer is disposed between the TFT substrate and the CF substrate.

SUMMARY

[0003] This disclosure relates generally to an electronic display device. More specifically, the disclosure relates to an electronic display device such as, but not limited to, a liquid crystal display device.

[0004] In an embodiment, an electronic display device is a liquid crystal display device.

[0005] In an embodiment, the liquid crystal display device is an in-plane switching (IPS) mode liquid crystal display device.

[0006] In an embodiment, the electronic display device can be included as a display for an electronic device such as, but not limited to, a display for a laptop computer

[0007] A liquid crystal display device is disclosed. The liquid crystal display device includes a first substrate and a second substrate disposed opposite the first substrate. The first substrate includes a plurality of gate lines, a plurality of data lines, and a plurality of pixel electrodes. The second substrate includes a first colored region transmitting light of a first color and a second colored region transmitting light of a second color. A first light-blocking layer for blocking light is disposed in a boundary area between the first colored region and the second colored region. The first-light blocking layer is disposed between the first substrate and the second substrate.

[0008] A liquid crystal display device is disclosed. The liquid crystal display device includes a first substrate and a second substrate disposed opposite the first substrate. The first substrate includes a plurality of gate lines, a plurality of data lines, and a plurality of pixel electrodes. The second substrate includes a first colored region transmitting light of a first color and a second colored region transmitting light of a second color. A first light-blocking layer is disposed in a boundary area between the first colored region and the second colored region. The first-light blocking layer is disposed between the first substrate and the second substrate. The second substrate further includes a second light-blocking layer disposed in the boundary area between the first colored region and the second colored region. The first colored region and the second colored region are disposed between the first light-blocking layer and second light-blocking layer. The second light-blocking layer extends in a direction parallel to the plurality of data lines.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] References are made to the accompanying drawings that form a part of this disclosure, and which illustrate embodiments in which the systems and methods described in this specification can be practiced.

[0010] FIG. **1** illustrates a schematic diagram of a liquid crystal display device, according to an embodiment.

[0011] FIGS. **2**A and **2**B illustrate a color filter (CF) substrate, according to an embodiment.

[0012] FIGS. **3**A and **3**B illustrate a color filter (CF) substrate, according to an embodiment.

[0013] FIGS. **4**A-**4**E illustrate a structure of a portion of a display panel, according to an embodiment.

[0014] FIG. **5**A-**5**C illustrate a color filter (CF) substrate, according to an embodiment.

[0015] FIG. **6**A and **6**B illustrate a color filter (CF) substrate, according to another embodiment.

[0016] Like reference numbers represent like parts throughout.

DETAILED DESCRIPTION

[0017] This disclosure relates generally to an electronic display device. More specifically, the disclosure relates to an electronic display device such as, but not limited to, a liquid crystal display device.

[0018] A liquid crystal display device generally includes a thin film transistor (TFT) substrate and a color filter (CF) substrate. A liquid crystal layer is disposed between the TFT substrate and the CF substrate. The CF substrate includes a plurality of colored regions (e.g., a red portion, a green portion, and a blue portion) and one or more light blocking layers (e.g., a black matrix). The one or more light blocking layers may be arranged in a boundary region between the plurality of colored regions. This arrangement can have a color mixing problem that occurs when light (e.g., from a backlight of the liquid crystal display device) leaks between adjacent pixel regions of the liquid crystal display device. The color mixing may be most evident when viewing the liquid crystal display device from an angle (e.g., an oblique angle).

[0019] Embodiments described in this specification may reduce an amount of color mixing with limited reduction of an aperture ratio of the pixels.

[0020] FIG. **1** illustrates a schematic diagram of a liquid crystal display device, according to an embodiment. The liquid crystal display device includes display panel **80** that displays an image, a driving circuit (data line driving circuit, gate line driving circuit) that drives display panel **80**, a control circuit (not illustrated) that controls the driving circuit, and a backlight (not illustrated) that irradiates display panel **80** with light from a rear surface side.

[0021] In display region **80**a (e.g., the same as or similar to the display region **42** in FIGS. **2**A and **2**B) of display panel **80**, pixels **82** (each of which is surrounded by two adjacent data lines **84** and two adjacent gate lines **86**) are arrayed into a matrix shape in row and column directions. It is assumed that the column direction is a direction in which data line **84** extends, and that the row direction is a direction in which the gate line **86** extends.

[0022] FIGS. **2**A and **2**B illustrate a color filter (CF) substrate **100**, according to an embodiment. FIG. **2**A illustrates a plan view of the CF substrate **100**. FIG. **2**B illustrates an enlarged side sectional view of the CF substrate **100** when viewed along line **2**B-**2**B. FIGS. **2**A and **2**B will generally be referenced collectively for simplicity of this specification.

[0023] The CF substrate **100** includes a glass substrate **102** and colored portions **104** that are formed on the glass

substrate **102**. The colored portions **104** include a plurality of colored regions **104**A-**104**N. Each of the plurality of colored regions **104**A-**104**N is configured to transmit light of a corresponding color. For example, in FIG. **2**B, a first colored region **104**A (e.g., a blue color region), a second colored region **104**B (e.g., a green color region), and a third colored region **104**C (e.g., a red colored region) are shown. The first colored region **104**A can be configured to transmit light of a blue color. The second colored region **104**B can be configured to transmit light of a green color. The third colored region **104**C can be configured to transmit light of a red color.

[0024] It will be appreciated that the particular colors of the colored regions **104**A-**104**N and the arrangement of the colored regions **104**A-**104**N is an example and can vary according to principles described in this specification. FIG. **2**B includes only a portion of the CF substrate **100**. It will be appreciated that a full sectional view would include the plurality of colored regions **104**A-**104**N.

[0025] A first light-blocking layer (e.g., a black matrix) **106** that is distinct from the CF substrate **100** is disposed in a boundary area between the first colored region **104**A and the second colored region **104**B. The first light-blocking layer **106** is also disposed in a boundary area between the second colored region **104**B and the third colored region **104**C. The colored portions **104** are disposed between the first light-blocking layer **106** and the glass substrate **102**. The first light-blocking layer **106** can block oblique light being transmitted from the backlight (not shown) to reduce an amount of color mixing between the first colored region **104**A and the second colored region **104**B from light leakage. The first light-blocking layer **106** can also block oblique light being transmitted from the backlight (not shown) to reduce an amount of color mixing between the second colored region **104**B and the third colored region **104**C from light leakage. It will be appreciated that the first light-blocking layer **106** can block oblique light from being transmitted from the backlight to reduce color mixing between any two neighboring colored regions **104**A-**104**N within the plurality of colored regions **104**A-**104**N.

[0026] In an embodiment, a second-light blocking layer (e.g., a black matrix) **108** can be disposed in a boundary area between the first colored region **104**A and the second colored region **104**B. The second light-blocking layer **108** is also disposed in a boundary area between the second colored region **104**B and the third colored region **104**C. The second light-blocking layer **108** is disposed so that the plurality of colored regions **104**A-**104**N are disposed between the first light-blocking layer **106** and the second light-blocking layer **108**.

[0027] The second light-blocking layer **108** can block oblique light being transmitted from the backlight (not shown) to reduce an amount of color mixing between the first colored region **104**A and the second colored region **104**B from light leakage. The second light-blocking layer **108** can block oblique light being transmitted from the backlight (not shown) to reduce an amount of color mixing between the second colored region **104**B and the third colored region **104**C from light leakage.

[0028] It will be appreciated that the second light-blocking layer **108** can block oblique light from being transmitted from the backlight to reduce color mixing between any two neighboring colored regions **104**A-**104**N within the plurality of colored regions **104**A-**104**N.

[0029] The first light-blocking layer **106** extends in a direction parallel to the plurality of data lines (e.g., data lines **84** in FIG. **1**).

[0030] FIGS. **3**A and **3**B illustrate a CF substrate **120**, according to an embodiment. FIG. **3**A illustrates a plan view of the CF substrate **120**. FIG. **3**B illustrates an enlarged side sectional view of the CF substrate **120** when viewed along line **3**B-**3**B. FIGS. **3**A and **3**B will generally be referenced collectively for simplicity of this specification.

[0031] The CF substrate **120** in FIGS. **3**A and **3**B can include features that are the same as or similar to the features in the CF substrate **100** of FIGS. **2**A and **2**B. For simplicity of this specification, features which have previously been described with respect to FIGS. **2**A and **2**B will not be described in additional detail.

[0032] In addition to the features of the CF substrate **100** (FIGS. **2**A, **2**B), the CF substrate **120** is provided with a plurality of spacers **122**. In the illustrated embodiment, two spacers **122** are shown in FIG. **3**A. It will be appreciated that the number of spacers **122** can vary. For example, there can be one spacer **122** per particular area of the second light-blocking layer **108**. The spacers **122** are disposed to maintain a particular spacing (e.g., a gap) between a thin film transistor (TFT) substrate and the CF substrate **120**. In an embodiment, there may be one or more columns of the first light-blocking layer **106** that is not provided with the spacer **122**. In an embodiment, every column of the first light-blocking layer **106** can include the spacer **122**.

[0033] In the illustrated embodiment, the spacers **122** can be secured to the first light-blocking layer **106**. A particular location associated with the spacers **122** is discussed in additional detail with respect to FIGS. **5**A-**5**C below. The spacers **122** may be selected to be disposed in line with a gate line (e.g., gate lines **86** in FIG. **1**).

[0034] FIGS. **4**A-**4**E illustrate a structure of a portion of a display panel **150**, according to an embodiment. The display panel **150** can be the same as or similar to the display panel **80** as shown and described with respect to FIG. **1** above. In FIGS. **4**A-**4**E, a user's oblique viewing angle is represented by an eye image **152**. A light vector **154** from the backlight is illustrated. As can be seen in the illustration, the first light-blocking layer **106**, colored regions **104**B, **104**C, and the second light-blocking layer **108** are arranged to reduce an amount of color mixing from the oblique light vector **154** that is observed by the user (as represented by the eye image **152**).

[0035] FIG. **4**A illustrates the display panel **150**, according to an embodiment. In the embodiment of FIG. **4**A, edges **104**B' and **104**C' of neighboring colored regions **104**B, **104**C of the colored region **104** abut.

[0036] In the illustrated embodiment, the CF substrate **100** includes the glass substrate **102** and the colored portion **104** having the colored regions **104**B, **104**C. An overcoat layer **156** is disposed between the CF substrate **100** and a liquid crystal layer **158**. The overcoat layer **156** covers the first light-blocking layer **106** in a region between the first light-blocking layer **106** and the liquid crystal layer **158**. The liquid crystal layer **158** is sandwiched between the CF substrate **100** and a thin film transistor (TFT) substrate **160**.

[0037] The TFT substrate **160** includes pixel electrodes **162** formed on a first side of an upper layer insulating film **164** of the TFT substrate **160** that faces toward the liquid crystal layer **158**. A common electrode **166** is formed on a second side of the upper layer insulating film **164** of the TFT

substrate **160**. The second side of the upper layer insulating film **164** is opposite the first side of the upper layer insulating film **164**. An organic insulating film **168** and an insulating film **170** are formed over the data line **84** (FIG. **1**). A glass substrate **172** is formed under the data line **84** (FIG. **1**).

[0038] In the illustrated embodiment, the first light-blocking layer **106** and the second light-blocking layer **108** are both disposed in a region between the glass substrate **102** of the CF substrate **100** and the TFT substrate **160**. The first light-blocking layer **106** is disposed relatively closer to the TFT substrate **160** than the first light-blocking layer **106**. The colored regions **104**B, **104**C and the second light-blocking layer **108** are formed on the glass substrate **102** of the CF substrate **100**.

[0039] The first light-blocking layer **106** has a width w**1** and a thickness t**1**. In an embodiment, the width w**1** may be relatively larger than the thickness t**1**. The second light-blocking layer **108** has a width w**2** and a thickness t**2**. In an embodiment, the width w**2** may be relatively larger than the thickness t**2**. The width w**2** of the second light-blocking layer **108** may be relatively greater than the width w**1** of the first light-blocking layer **106**. In an embodiment, the thickness t**2** of the second light-blocking layer **108** may be relatively smaller than the thickness t**1** of the first light-blocking layer **106**. In an embodiment, this selection of relative widths w**1**, w**2** and thicknesses t**1**, t**2** of the first light-blocking layer **106** and the second light-blocking layer **108** may be effective for obtaining a relatively high aperture ratio and while effectively blocking oblique light. In an embodiment, this can, for example, reduce an amount of color mixing between the neighboring colored regions **104**B, **104**C.

[0040] It will be appreciated that while neighboring portions **104**B, **104**C are described, the relationship is also true between other neighboring portions (e.g., **104**A, **104**B) of the plurality of colored regions **104**A-**104**N.

[0041] FIG. **4**B illustrates the display panel **150**, according to an embodiment. In the embodiment of FIG. **4**B, neighboring colored regions **104**B, **104**C of the CF substrate **100** overlap in a region **200** between the first light-blocking layer **106** and the second light-blocking layer **108**.

[0042] In FIG. **4**B, end portions **104**B", **104**C" of the colored regions **104**B, **104**C are overlapped with each other in the region **200** between the first light-blocking layer **106** and the second light-blocking layer **108**. In an embodiment, the region **200** has a size that is relatively larger than the width of the first light-blocking layer **106**. That is, as shown in FIG. **4**B, an end of the colored region **104**B is disposed on a side of the colored region **104**C, and an end of the colored region **104**C is disposed on a side of the colored region **104**B.

[0043] In an embodiment, moving the first light-blocking layer **106** to be relatively closer to the TFT substrate **160** can increase an effectiveness of the first light-blocking layer **106** in blocking oblique light.

[0044] FIG. **4**C illustrates the display panel **150**, according to an embodiment. In the embodiment of FIG. **4**C, neighboring colored regions of the CF substrate **100** overlap and another colored region is disposed on a TFT substrate side of the CF substrate **100**.

[0045] Similar to the embodiment in FIG. **4**B, in the embodiment of FIG. **4**C, the neighboring colored regions overlap in the region **200** between the first light-blocking layer **106** and the second light-blocking layer **108**. In the embodiment of FIG. **4**C, another colored region **202** (e.g., colored region **104**A) is included on the overlapping region **200** of the neighboring colored regions **104**B, **104**C. In an embodiment, the another colored region **202** can cause the first light-blocking layer **106** to be relatively closer to the TFT substrate **160**, which can increase an effectiveness of the first light-blocking layer **106** in blocking oblique light.

[0046] It will be appreciated that in a display panel in which the colored regions **104**A-**104**N include three colors (e.g., red, green, blue), the another colored region **202** will be whichever colored region is not selected from the neighboring colored regions **104**B, **104**C. For example, if the neighboring colored regions **104**B, **104**C are red and green, then the another colored region **202** will be blue. If the neighboring colored regions **104**B, **104**C are green and blue, the another colored region **202** will be red. If the neighboring colored regions **104**B, **104**C are blue and red, the another colored region **202** will be green. In an embodiment, the another colored region **202** could be the same as one of the neighboring colored regions **104**B, **104**C.

[0047] FIG. **4**D illustrates the display panel **150**, according to an embodiment. In the embodiment of FIG. **4**D, the neighboring colored regions **104**B, **104**C of the CF substrate **100** overlap and another colored region is disposed between the ends of the colored regions **104**B, **104**C in the overlapping region.

[0048] Similar to the embodiment in FIG. **4**C, in the embodiment of FIG. **4**D, the neighboring colored regions overlap in the region **200** between the first light-blocking layer **106** and the second light-blocking layer **108**. In the embodiment of FIG. **4**D, another colored region **202** (e.g., colored region **104**A) is included on the overlapping region **200** of the neighboring colored regions **104**B, **104**C. Different from the embodiment of FIG. **4**C, in the embodiment in FIG. **4**D the another colored region is disposed between ends of the colored regions **104**B, **104**C. In an embodiment, the another colored region **202** can cause the first light-blocking layer **106** to be relatively closer to the TFT substrate **160**, which can increase an effectiveness of the first light-blocking layer **106** in blocking oblique light.

[0049] It will be appreciated that in a display panel in which the colored regions **104**A-**104**N include three colors (e.g., red, green, blue), the another colored region **202** will be whichever colored region is not selected from the neighboring colored regions **104**B, **104**C. For example, if the neighboring colored regions **104**B, **104**C are red and green, then the another colored region **202** will be blue. If the neighboring colored regions **104**B, **104**C are green and blue, the another colored region **202** will be red. If the neighboring colored regions **104**B, **104**C are blue and red, the another colored region **202** will be green.

[0050] FIG. **4**E illustrates the display panel **150**, according to an embodiment. In the embodiment of FIG. **4**E, the neighboring colored regions **104**B, **104**C of the CF substrate **100** abut each other.

[0051] In the embodiment of FIG. **4**E, only the first light-blocking layer **106** is included. That is, the second light-blocking layer **108** is omitted from the embodiment in FIG. **4**E. In the embodiment of FIG. **4**E, the end **104**B' of the colored region **104**B and the end **104**C' of the colored region **104**C abut. In an embodiment, this may result in an improved blocking of oblique light due to being placed on a TFT substrate side of the CF substrate **100**.

[0052] FIGS. **5**A-**5**C illustrate the CF substrate **120** from FIGS. **3**A and **3**B, according to an embodiment. FIG. **5**A illustrates a plan view of the CF substrate **120**. FIGS. **5**B and **5**C illustrate side sectional views of the CF substrate **120** when viewed along line different lines.

[0053] FIG. **5**A includes a single spacer **122**. It will be appreciated that there may be more than one spacer **122**. As shown in FIG. **5**A, the spacer **122** is disposed on the first light-blocking layer **106** in a location of the gate line (e.g., gate line **86**). The first light-blocking layer **106** is relatively widened at the location of the spacer **122** to accommodate the spacer **122**. A difference in the width of the first light-blocking layer **106** at the location of the spacer **122** is shown with reference to FIGS. **5**B and **5**C.

[0054] FIG. **5**B illustrates a sectional view of the CF substrate **120** when viewed along line **5**B-**5**B. In the sectional view of FIG. **5**B, the first light-blocking layer **106** has a width w**3**. No spacer **122** is visible in the sectional view since the line **5**B-**5**B is in a location away from the spacer **122**.

[0055] FIG. **5**C illustrates a sectional view of the CF substrate **120** when viewed along line **5**C-**5**C. In the sectional view of FIG. **5**C, the first light-blocking layer **106** has a width w**4**. The width w**4** is relatively greater than the width w**3** (in FIG. **5**B). The spacer **122** is also shown because of the location of the line **5**C-**5**C. In the sectional view of FIG. **5**C, a width w**5** of the spacer **122** is relatively shorter than the width w**4** of the first light-blocking layer **106**.

[0056] FIGS. **6**A and **6**B illustrate a CF substrate **400**, according to an embodiment. FIG. **6**A illustrates a plan view of the CF substrate **400**. FIG. **6**B illustrates an enlarged side sectional view of the CF substrate **400** when viewed along line **6**B-**6**B. FIGS. **6**A and **6**B will generally be referenced collectively for simplicity of this specification.

[0057] The CF substrate **400** in FIGS. **6**A and **6**B is similar to the CF substrate **120** as shown and described in FIGS. **5**A-**5**C. In the embodiment of FIGS. **6**A and **6**B, the spacer **122** is moved to a location that is between adjacent columns of the first light-blocking layer **106**. As a result, a width of the first light-blocking layer **106** is not modified to accommodate the spacer **122**. A single spacer **122** is shown, though it is to be appreciated that a plurality of spacers **122** can be provided on the CF substrate **400**.

[0058] Aspects:

[0059] It is noted that any of aspects 1-16 below can be combined with any of aspects 17-19.

[0060] Aspect 1. A liquid crystal display device, comprising: a first substrate, including a plurality of gate lines, a plurality of data lines, and a plurality of pixel electrodes; a second substrate disposed opposite the first substrate, the second substrate including a first colored region transmitting light of a first color, a second colored region transmitting light of a second color; and a first light-blocking layer for blocking light disposed in a boundary area between the first colored region and the second colored region, wherein the first-light blocking layer is disposed between the first substrate and the second substrate.

[0061] Aspect 2. The liquid crystal display device according to aspect 1, wherein the second substrate further includes a second light-blocking layer disposed in the boundary area between the first colored region and the second colored region, and the first colored region and the second colored region are disposed between the first light-blocking layer and second light-blocking layer.

[0062] Aspect 3. The liquid crystal display device according to aspect 2, wherein the second light-blocking layer extends in a direction parallel to the plurality of data lines.

[0063] Aspect 4. The liquid crystal display device according to aspect 2, wherein the first-light blocking layer has a width and a thickness, the width being larger than the thickness, and the second-light blocking layer has a width and a thickness, the width being larger than the thickness, wherein the width of the first-light blocking layer is relatively smaller than the width of the second-light blocking layer.

[0064] Aspect 5. The liquid crystal display device according to aspect 4, wherein the thickness of the first-light blocking layer is relatively larger than the thickness of the second-light blocking layer.

[0065] Aspect 6. The liquid crystal display device according to aspect 2, further comprising a spacer that holds a clearance between the first substrate and the second substrate.

[0066] Aspect 7. The liquid crystal display device according to aspect 6, wherein the spacer is disposed on the plurality of gate lines, wherein the second light-blocking layer is wider than the spacer at a location of the spacer.

[0067] Aspect 8. The liquid crystal display device according to aspect 7, wherein the spacer is disposed between adjacent two of the plurality of data lines.

[0068] Aspect 9. The liquid crystal display device according to aspect 7, wherein the spacer is disposed on the plurality of data lines.

[0069] Aspect 10. The liquid crystal display device according to aspect 6, wherein the spacer is disposed between adjacent two of the plurality of data lines.

[0070] Aspect 11. The liquid crystal display device according to any one of aspects 1-10, wherein the first substrate is a thin film transistor and the second substrate is a color filter substrate.

[0071] Aspect 12. The liquid crystal display device according to any one of aspects 1-11, wherein the first colored region and the second colored region abut.

[0072] Aspect 13. The liquid crystal display device according to any one of aspects 1-12, wherein the first colored region and the second colored region overlap.

[0073] Aspect 14. The liquid crystal display device according to aspect 13, wherein the second substrate further includes a third colored region overlapped on the first colored region and the second colored region.

[0074] Aspect 15. The liquid crystal display device according to aspect 14, wherein the third colored region is overlapped on the first light-blocking layer.

[0075] Aspect 16. The liquid crystal display device according to aspect 15, wherein the first light-blocking layer is disposed between the third colored region and the first substrate.

[0076] Aspect 17. A liquid crystal display device, comprising: a first substrate, including a plurality of gate lines, a plurality of data lines, and a plurality of pixel electrodes; a second substrate disposed opposite the first substrate, the second substrate including a first colored region transmitting light of a first color, a second colored region transmitting light of a second color; and a first light-blocking layer disposed in a boundary area between the first colored region and the second colored region, wherein the first-light blocking layer is disposed between the first substrate and the second substrate, wherein the second substrate further

includes a second light-blocking layer disposed in the boundary area between the first colored region and the second colored region, and the first colored region and the second colored region are disposed between the first light-blocking layer and second light-blocking layer, and wherein the second light-blocking layer extends in a direction parallel to the plurality of data lines.

[0077] Aspect 18. The liquid crystal display device according to aspect 17, further comprising a plurality of spacers, a first of the plurality of spacers is disposed on a first of the plurality of gate lines, wherein the first light-blocking layer is wider than the spacer at a location of the first of the plurality of spacers.

[0078] Aspect 19. The liquid crystal display device according to aspect 18, wherein the second light-blocking layer has a thickness at a location other than the first of the plurality of spacers that is relatively smaller than a thickness at the location of the first of the plurality of spacers.

[0079] The terminology used in this specification is intended to describe particular embodiments and is not intended to be limiting. The terms "a," "an," and "the" include the plural forms as well, unless clearly indicated otherwise. The terms "comprises" and/or "comprising," when used in this specification, specify the presence of the stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, and/or components.

[0080] With regard to the preceding description, it is to be understood that changes may be made in detail, especially in matters of the construction materials employed and the shape, size, and arrangement of parts without departing from the scope of the present disclosure. This specification and the embodiments described are exemplary only, with the true scope and spirit of the disclosure being indicated by the claims that follow.

1. A liquid crystal display device, comprising:

a first substrate, including a plurality of gate lines, a plurality of data lines, and a plurality of pixel electrodes;

a second substrate disposed opposite the first substrate, the second substrate including a first colored region transmitting light of a first color, a second colored region transmitting light of a second color; and

a first light-blocking layer for blocking light disposed in a boundary area between the first colored region and the second colored region, wherein the first-light blocking layer is disposed between the first substrate and the second substrate,

wherein the second substrate further includes a second light-blocking layer disposed in the boundary area between the first colored region and the second colored region,

the first colored region and the second colored region are disposed between the first light-blocking layer and second light-blocking layer, and

the first colored region and the second colored region are color filters.

2. (canceled)

3. The liquid crystal display device according to claim **1**, wherein the second light-blocking layer extends in a direction parallel to the plurality of data lines.

4. The liquid crystal display device according to claim **1**, wherein the first-light blocking layer has a width and a thickness, the width being larger than the thickness, and the second-light blocking layer has a width and a thickness, the width being larger than the thickness, wherein the width of the first-light blocking layer is relatively smaller than the width of the second-light blocking layer.

5. The liquid crystal display device according to claim **4**, wherein the thickness of the first-light blocking layer is relatively larger than the thickness of the second-light blocking layer.

6. The liquid crystal display device according to claim **1**, further comprising a spacer that holds a clearance between the first substrate and the second substrate.

7. The liquid crystal display device according to claim **6**, wherein the spacer is disposed on the plurality of gate lines, wherein the second light-blocking layer is wider than the spacer at a location of the spacer.

8. The liquid crystal display device according to claim **7**, wherein the spacer is disposed between adjacent two of the plurality of data lines.

9. The liquid crystal display device according to claim **7**, wherein the spacer is disposed on the plurality of data lines.

10. The liquid crystal display device according to claim **6**, wherein the spacer is disposed between adjacent two of the plurality of data lines.

11. The liquid crystal display device according to claim **1**, wherein the first substrate is a thin film transistor and the second substrate is a color filter substrate.

12. The liquid crystal display device according to claim **1**, wherein the first colored region and the second colored region abut.

13. The liquid crystal display device according to claim **1**, wherein the first colored region and the second colored region overlap.

14. The liquid crystal display device according to claim **13**, wherein the second substrate further includes a third colored region overlapped on the first colored region and the second colored region.

15. The liquid crystal display device according to claim **14**, wherein the third colored region is overlapped on the first light-blocking layer.

16. The liquid crystal display device according to claim **15**, wherein the first light-blocking layer is disposed between the third colored region and the first substrate.

17-19. (canceled)

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公开(公告)号	US20190265542A1	公开(公告)日	2019-08-29
申请号	US15/908127	申请日	2018-02-28
申请(专利权)人(译)	松下液晶显示CO.，LTD.		
当前申请(专利权)人(译)	松下液晶显示CO.，LTD.		
发明人	HIGASHIHARA, SHOHEI		
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摘要(译)

公开了一种液晶显示装置。液晶显示装置包括第一基板和与第一基板相对设置的第二基板。第一基板包括多条栅极线，多条数据线和多个像素电极。第二基板包括透射第一颜色光的第一着色区域和透射第二颜色光的第二着色区域。用于阻挡光的第一光阻挡层设置在第一着色区域和第二着色区域之间的边界区域中。第一光阻挡层设置在第一基板和第二基板之间。