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(54) **METHOD OF MANUFACTURING ONE DROP FILL LIQUID CRYSTAL DISPLAY PANEL**

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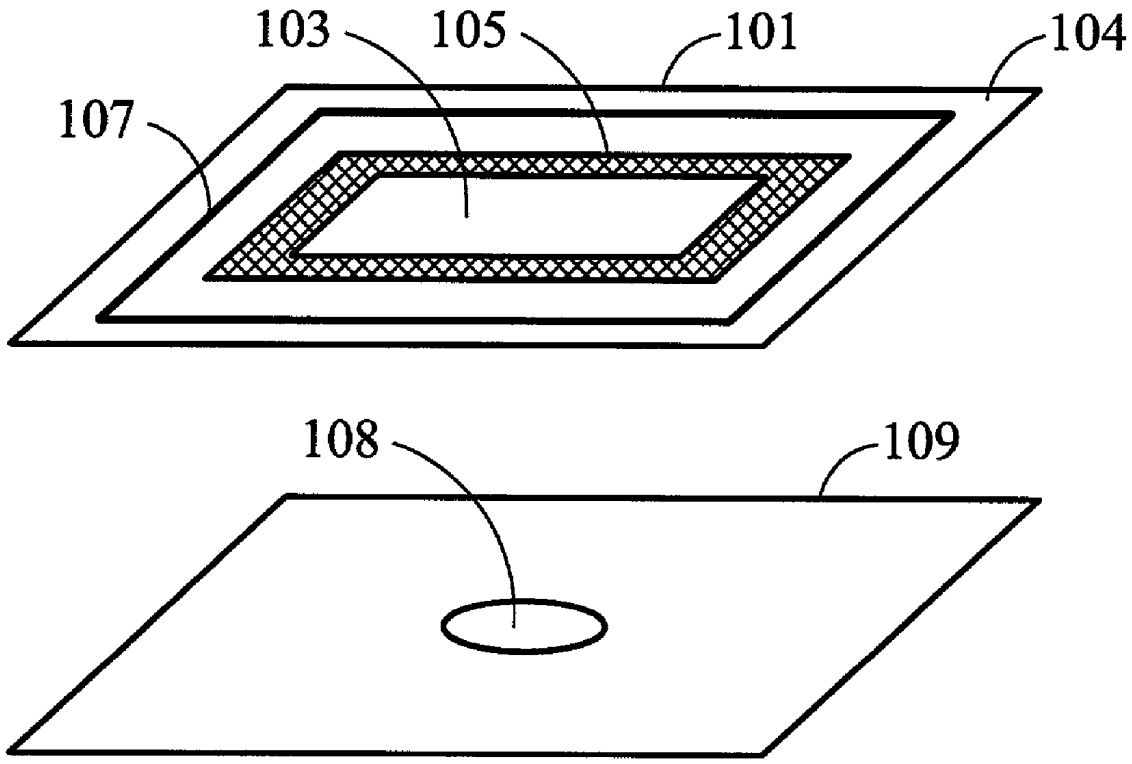
(52) **U.S. Cl.** **349/189**

(57) **ABSTRACT**

A method of manufacturing a one drop fill liquid crystal display (ODF LCD) panel is disclosed. By separating sealant and black matrix using a space or photo spacer, the sealant can be hardened by applying ultraviolet light from the side of the color filter substrate without light shielding problems. Moreover, this also completely hardens the sealant, thereby preventing pollution of the liquid crystal material. This further improves the efficiency of the liquid crystal material.



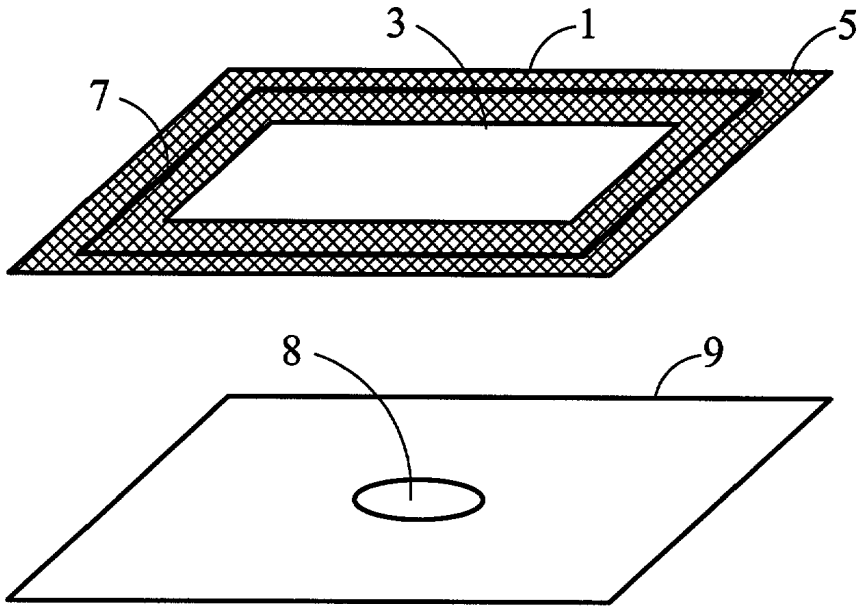


FIG. 1a (PRIOR ART)

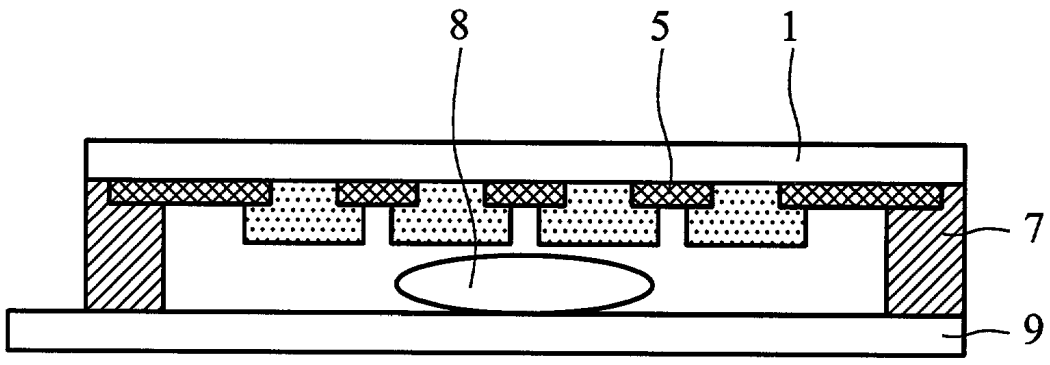


FIG. 1b (PRIOR ART)

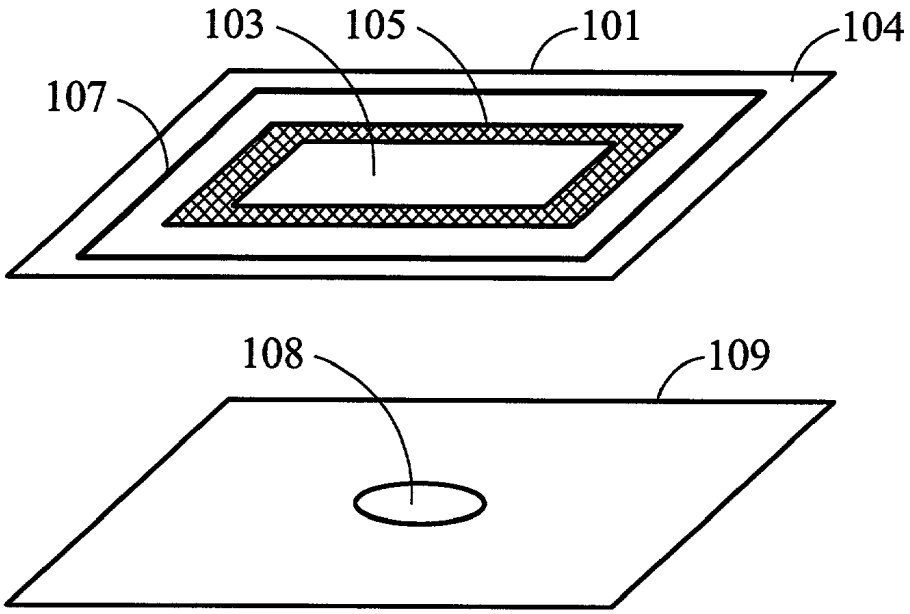


FIG. 2a

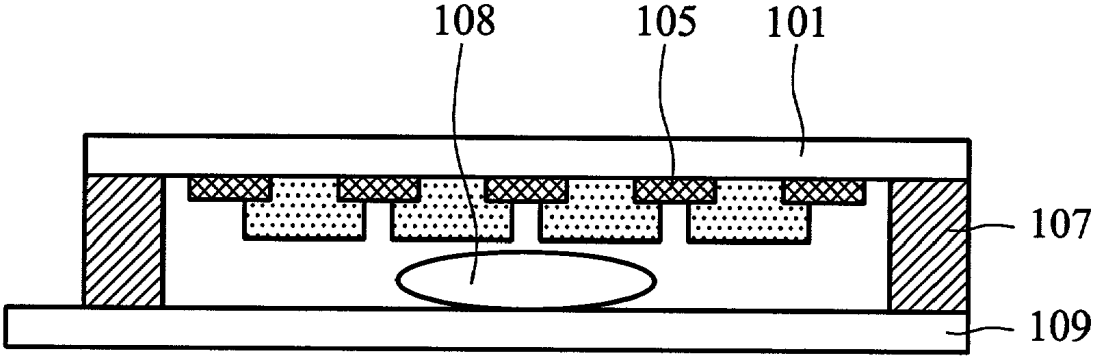


FIG. 2b

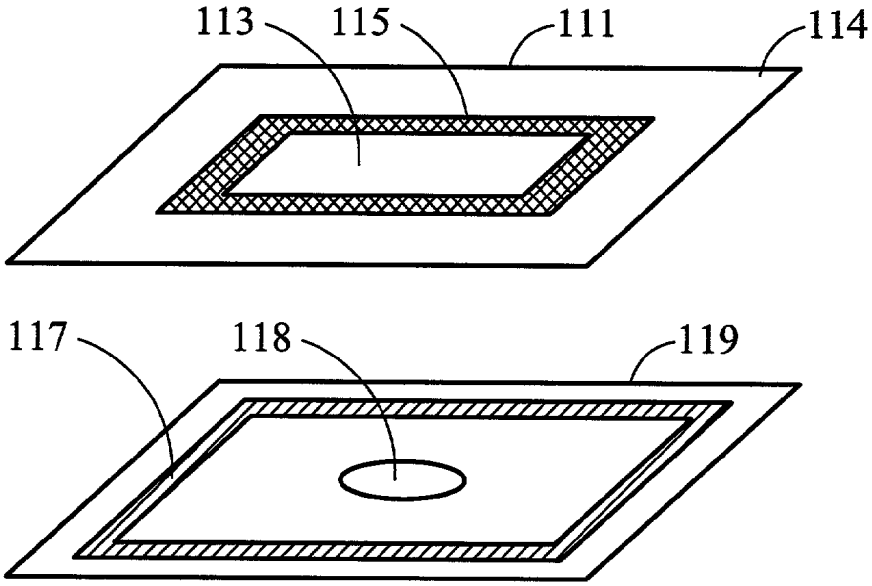


FIG. 23a

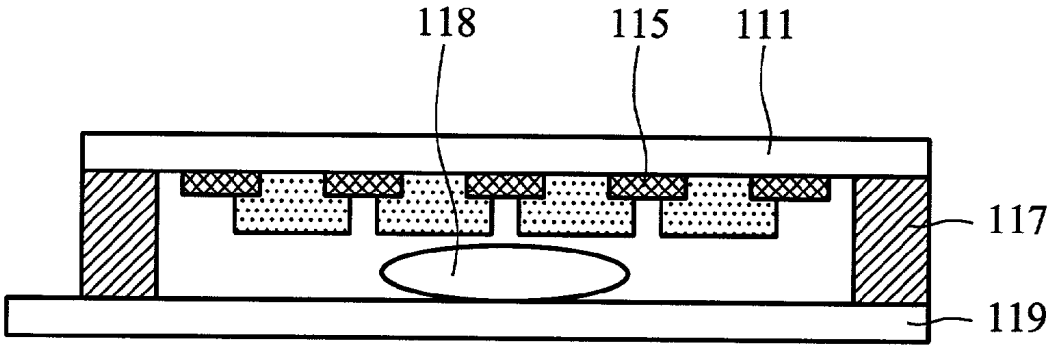


FIG. 3b

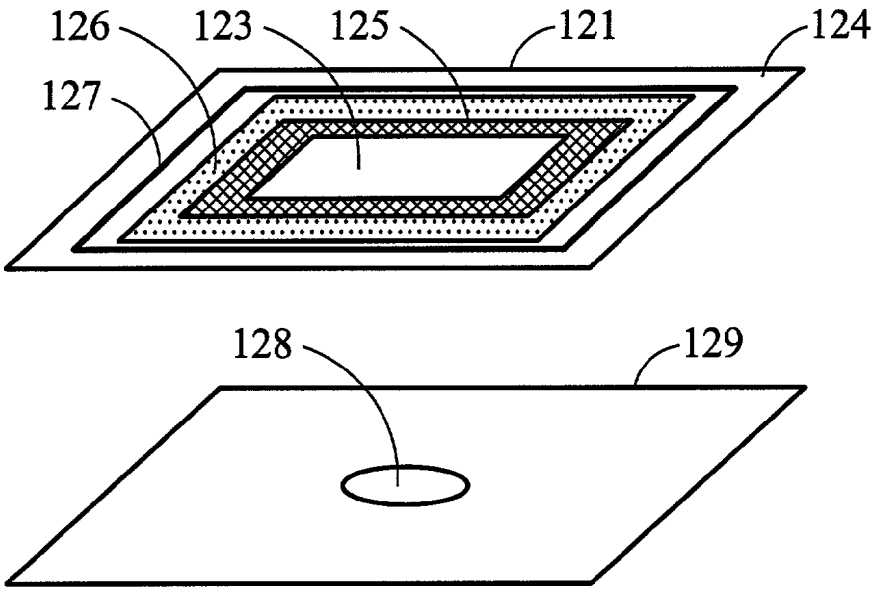


FIG. 4a

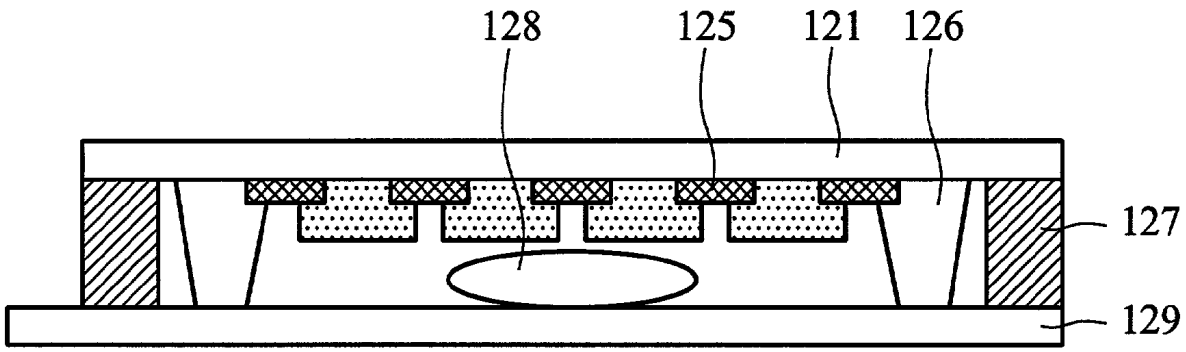


FIG. 4b

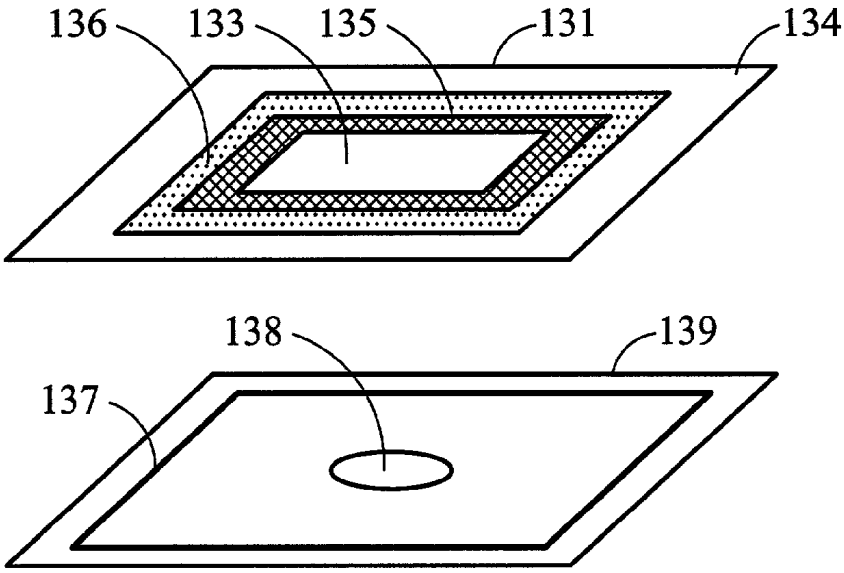


FIG. 5a

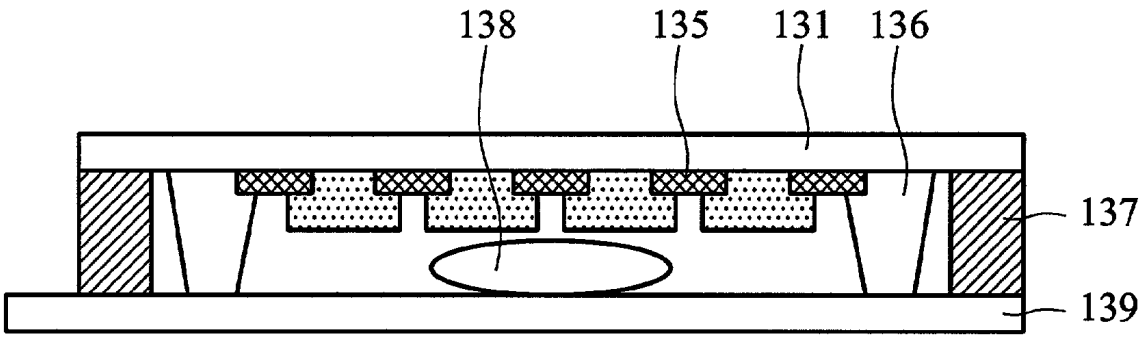


FIG. 5b

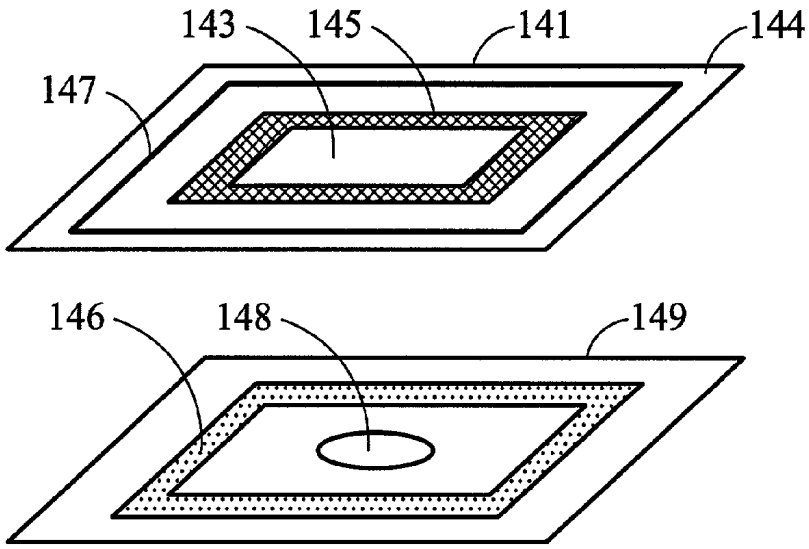


FIG. 6a

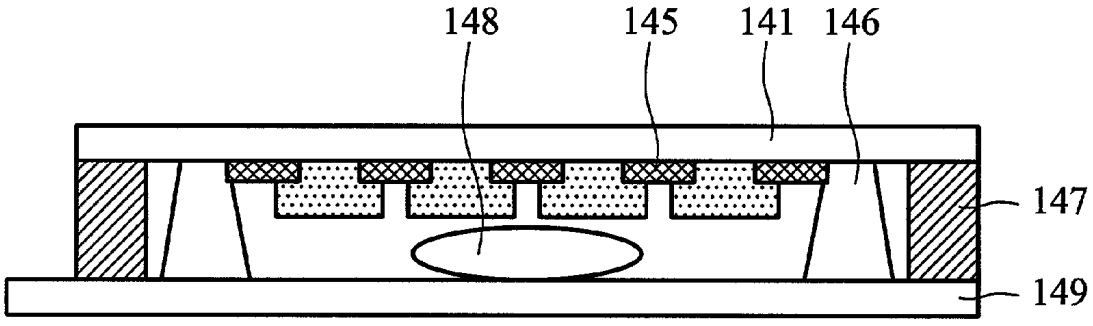


FIG. 6b

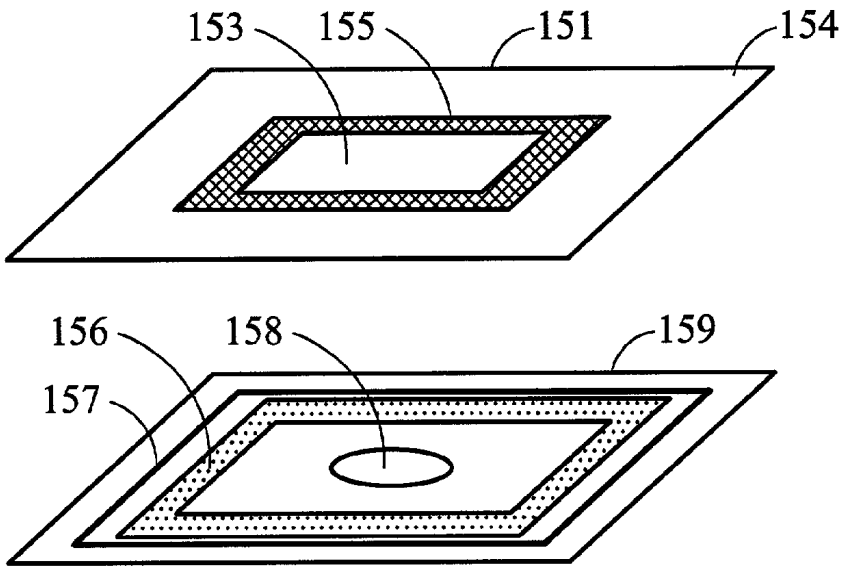


FIG. 7a

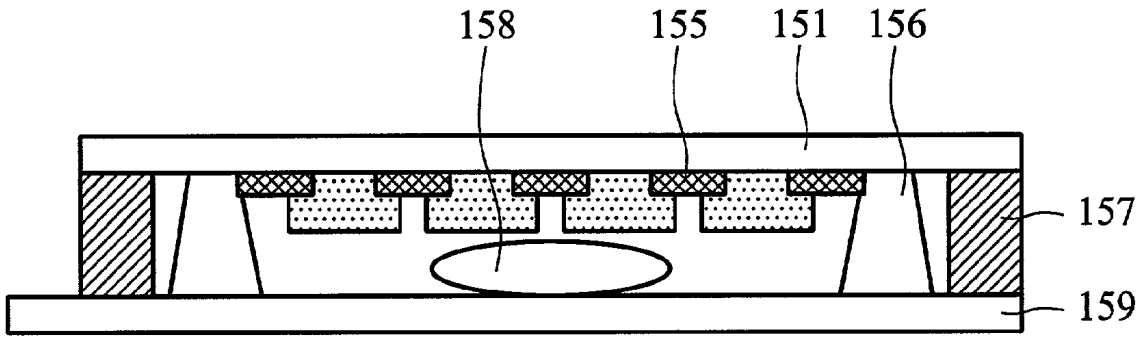


FIG. 7b

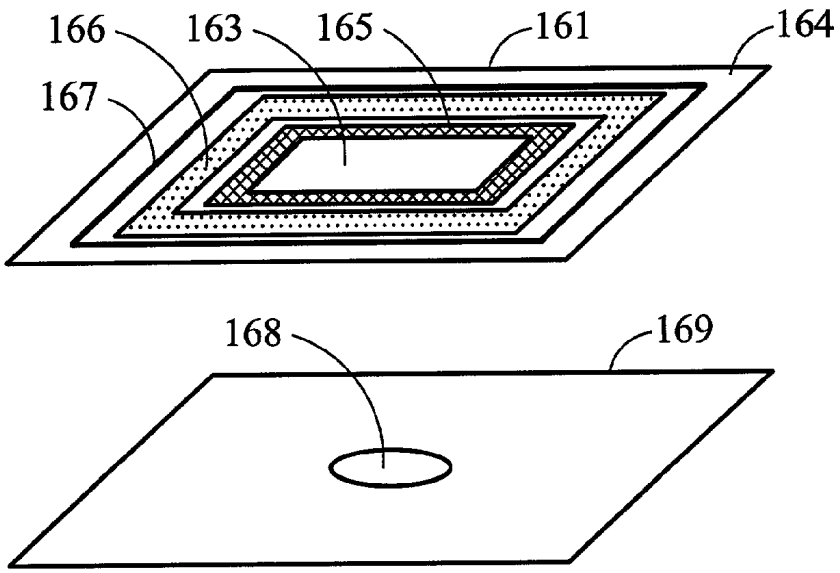


FIG. 8a

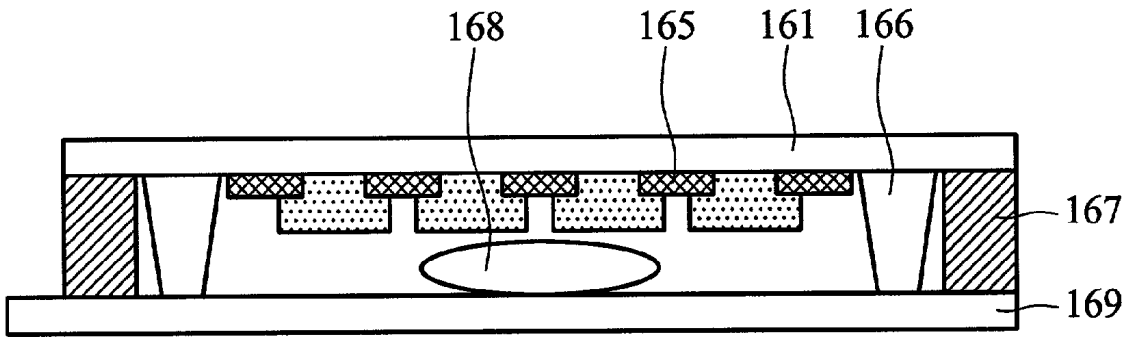


FIG. 8b

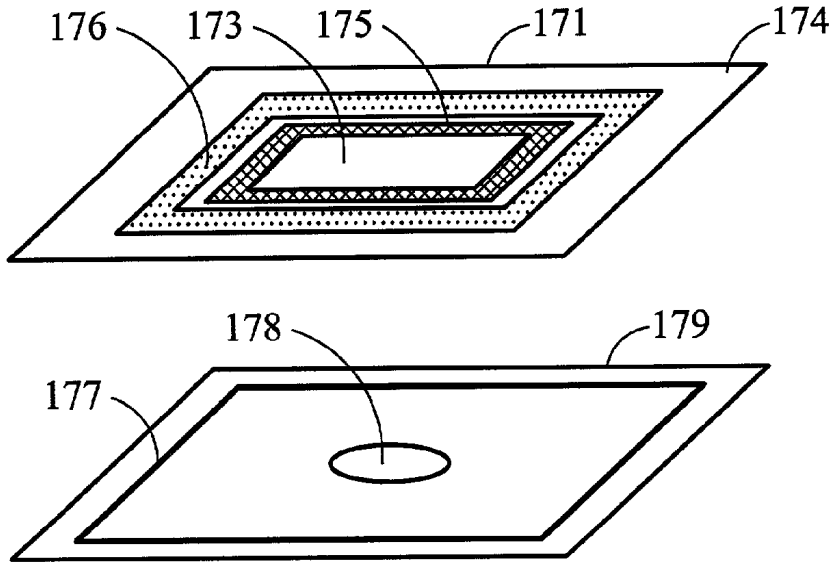


FIG. 9a

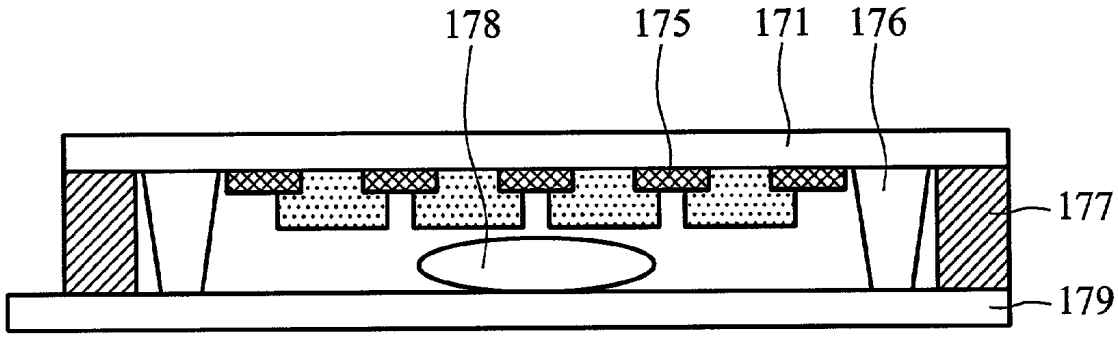


FIG. 9b

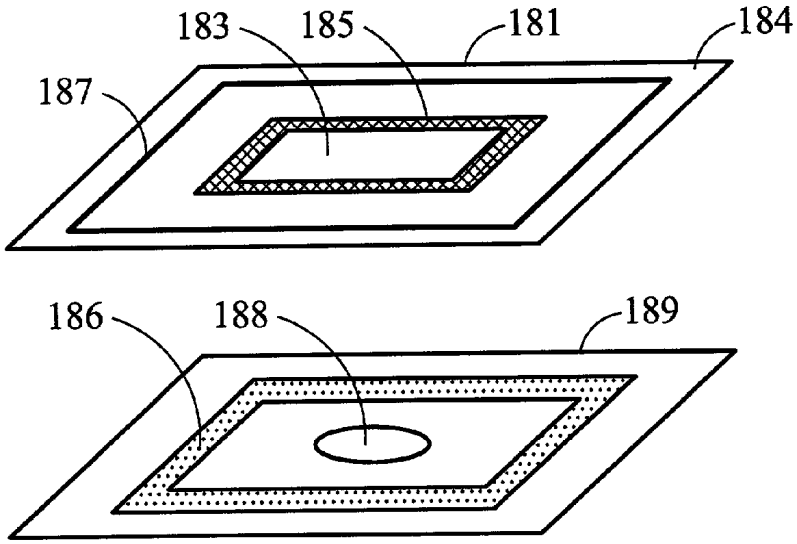


FIG. 10a

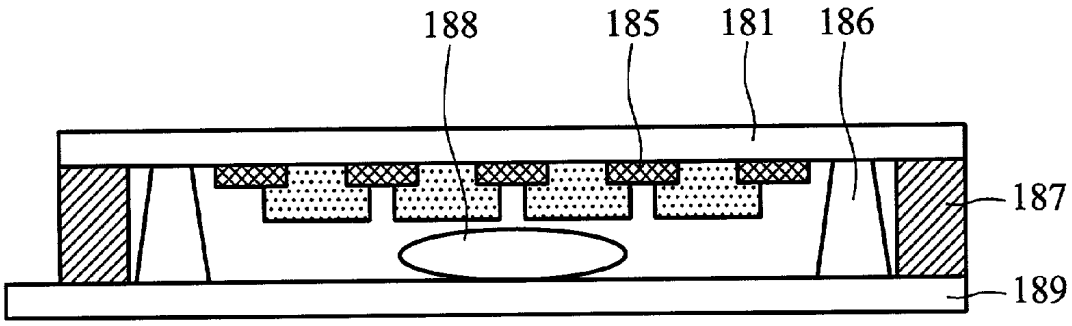


FIG. 10b

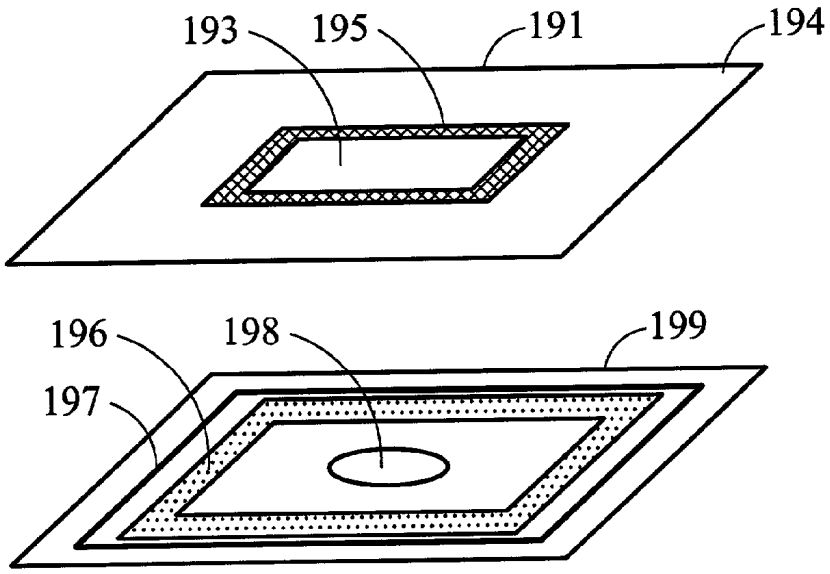


FIG. 11a

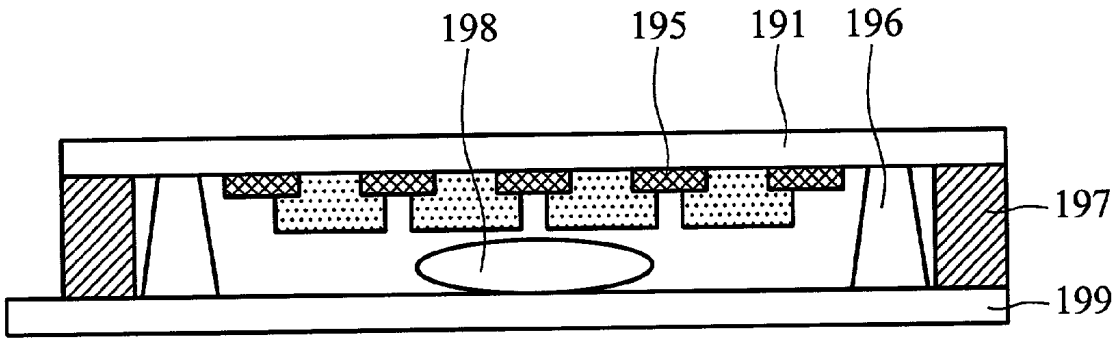


FIG. 11b

METHOD OF MANUFACTURING ONE DROP FILL LIQUID CRYSTAL DISPLAY PANEL

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates in general to a method of manufacturing a liquid crystal display (LCD) panel. In particular, the present invention relates to a method of manufacturing a one drop fill (ODF) LCD panel.

[0003] 2. Description of the Related Art

[0004] **FIG. 1***a* is a perspective view showing a conventional one drop fill liquid crystal display (ODF LCD) panel, **FIG. 1***b* is a sectional view showing the conventional ODF LCD panel. In **FIGS. 1***a* and **1***b*, a color pixel area **3**, a black matrix **5** and a sealant **7** are respectively positioned on the surface of a color filter substrate **1**, and a liquid crystal material **8** is located on a array substrate **9**. In the process of manufacturing a conventional ODF LCD panel, it is necessary to apply ultraviolet light (UV light, not shown) to harden the sealant **7** while superposing the color filter substrate **1** and the array substrate **9**. However, when the UV light is applied from the side of the array substrate **9**, the UV light is partly shielded by the circuits of the array substrate **9**. As a result, the sealant **7** can't completely harden. This may cause the liquid crystal material **8** to become polluted and decrease the efficiency of the liquid crystal material **8**. On the other hand, when the UV light is applied from the side of the color filter substrate **1**, the UV light is still partly shielded by the black matrix **5** of the color filter substrate **1**. As a result, the sealant **7** can't completely harden, once again raising the possibility that the liquid crystal material **8** will become polluted and decrease the efficiency of the liquid crystal material **8**.

SUMMARY OF THE INVENTION

[0005] The present invention is intended to overcome the above-described disadvantages.

[0006] The present invention provides a first method of manufacturing a one drop fill liquid crystal display panel, including the steps of: providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively; forming a sealant area on the first peripheral region, wherein the sealant area is located at the outside of the black matrix area and separated from the black matrix area by a predetermined space; dispersing at least one drop of a liquid crystal on the second central region; superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and curing the sealant area by applying ultraviolet light from a side of the first substrate.

[0007] The present invention further provides a second method of manufacturing a one drop fill liquid crystal display panel, including the steps of: providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively; forming a sealant area on the second peripheral region, wherein the sealant area is located opposite to the outside of the black matrix area and separated from the black matrix area by a predetermined space; dispersing at least one drop of a liquid crystal on the second central region; superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and curing the sealant area by applying ultraviolet light from a side of the first substrate.

[0008] The present invention further provides a third method of manufacturing a one drop fill liquid crystal display panel, including the steps of: providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively; forming a photo spacer area on the first peripheral region, wherein the photo spacer area overlaps the outside edge of the black matrix area; forming a sealant area on the first peripheral region, wherein the sealant area is located at the outside of the photo spacer area; dispersing at least one drop of a liquid crystal on the second central region; superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and curing the sealant area by applying ultraviolet light from a side of the first substrate.

[0009] The present invention further provides a fourth method of manufacturing a one drop fill liquid crystal display panel, including the steps of: providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively; forming a photo spacer area on the first peripheral region, wherein the photo spacer area overlaps the outside edge of the black matrix area; forming a sealant area on the second peripheral region, wherein the sealant area is located opposite to the outside of the photo spacer area; dispersing at least one drop of a liquid crystal on the second central region; superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and curing the sealant area by applying ultraviolet light from a side of the first substrate.

[0010] The present invention further provides a fifth method of manufacturing a one drop fill liquid crystal display panel, including the steps of: providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first

central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively; forming a photo spacer area on the second peripheral region, wherein the photo spacer area is located at a first position opposite to the outside edge of the black matrix area; forming a sealant area on the first peripheral region, wherein the sealant area is located at a second position opposite to the outside of the photo spacer area; dispersing at least one drop of a liquid crystal on the second central region; superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and curing the sealant area by applying ultraviolet light from a side of the first substrate.

[0011] The present invention further provides a sixth method of manufacturing a one drop fill liquid crystal display panel, including the steps of: providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively; forming a photo spacer area on the second peripheral region, wherein the photo spacer area is located opposite to the outside edge of the black matrix area; forming a sealant area on the second peripheral region, wherein the sealant area is located at the outside of the photo spacer area; dispersing at least one drop of a liquid crystal on the second central region; superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and curing the sealant area by applying ultraviolet light from a side of the first substrate.

[0012] The present invention further provides a seventh method of manufacturing a one drop fill liquid crystal display panel, including the steps of: providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively; forming a photo spacer area on the first peripheral region, wherein the photo spacer area is located at the outside of the black matrix area and separated from the black matrix area by a predetermined space; forming a sealant area on the first peripheral region, wherein the sealant area is located at the outside of the photo spacer area; dispersing at least one drop of a liquid crystal on the second central region; superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and curing the sealant area by applying ultraviolet light from a side of the first substrate.

[0013] The present invention further provides a eighth method of manufacturing a one drop fill liquid crystal display panel, including the steps of: providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively; forming a photo spacer area on the first peripheral region, wherein the photo spacer area is located at the outside of the black matrix area and separated from the black matrix area by a predetermined space; forming a sealant area on the second peripheral region, wherein the sealant area is located opposite to the outside of the photo spacer area; dispersing at least one drop of a liquid crystal on the second central region; superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and curing the sealant area by applying ultraviolet light from a side of the first substrate.

[0014] The present invention further provides a ninth method of manufacturing a one drop fill liquid crystal display panel, including the steps of: providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively; forming a photo spacer area on the second peripheral region, wherein the photo spacer area is located opposite to the outside of the black matrix area and separated from the black matrix area by a predetermined space; forming a sealant area on the first peripheral region, wherein the sealant area is located opposite to the outside of the photo spacer area; dispersing at least one drop of a liquid crystal on the second central region; superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and curing the sealant area by applying ultraviolet light from a side of the first substrate.

[0015] The present invention further provides a tenth method of manufacturing a one drop fill liquid crystal display panel, including the steps of: providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively; forming a photo spacer area on the second peripheral region, wherein the photo spacer area is located opposite to the outside of the black matrix area and separated from the black matrix area by a predetermined space; forming a sealant area on the second peripheral region, wherein the sealant area is located at the outside of the photo spacer area; dispersing at least one drop of a liquid crystal on the second central region; superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and curing the sealant area by applying ultraviolet light from a side of the first substrate.

[0016] By separating sealant and black matrix using a space or photo spacer according to above methods, the sealant can be hardened by applying ultraviolet light from the side of the color filter substrate without light shielding problems. Moreover, this also completely hardens the seal-

ant, thereby preventing pollution of the liquid crystal material. This further improves the efficiency of the liquid crystal material.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The present invention can be more fully understood by reading the subsequent detailed description in conjunction with the examples and references made to the accompanying drawings, wherein:

[0018] **FIG. 1***a* is a perspective view showing a conventional ODF LCD panel, and **FIG. 1***b* is a sectional view showing the conventional ODF LCD panel of **FIG. 1***a;*

[0019] **FIG. 2***a* is a perspective view showing an ODF LCD panel of the first embodiment of the present invention, and **FIG. 2***b* is a sectional view showing the ODF LCD panel of **FIG. 2***a;*

[0020] **FIG. 3***a* is a perspective view showing an ODF LCD panel of the second embodiment of the present invention, and **FIG. 3***b* is a sectional view showing the ODF LCD panel of **FIG. 3***a;*

[0021] **FIG. 4***a* is a perspective view showing an ODF LCD panel of the third embodiment of the present invention, and **FIG. 4***b* is a sectional view showing the ODF LCD panel of **FIG. 4***a;*

[0022] **FIG. 5***a* is a perspective view showing an ODF LCD panel of the fourth embodiment of the present invention, and **FIG. 5***b* is a sectional view showing the ODF LCD panel of **FIG. 5***a;*

[0023] **FIG. 6***a* is a perspective view showing an ODF LCD panel of the fifth embodiment of the present invention, and **FIG. 6***b* is a sectional view showing the ODF LCD panel of **FIG. 6***a;*

[0024] **FIG. 7***a* is a perspective view showing an ODF LCD panel of the sixth embodiment of the present invention, and **FIG. 7***b* is a sectional view showing the ODF LCD panel of **FIG. 7***a;*

[0025] **FIG. 8***a* is a perspective view showing an ODF LCD panel of the seventh embodiment of the present invention, and **FIG. 8***b* is a sectional view showing the ODF LCD panel of **FIG. 8***a;*

[0026] **FIG. 9***a* is a perspective view showing an ODF LCD panel of the eighth embodiment of the present invention, and **FIG. 9***b* is a sectional view showing the ODF LCD panel of **FIG. 9***a;*

[0027] **FIG. 10***a* is a perspective view showing an ODF LCD panel of the ninth embodiment of the present invention, and **FIG. 10***b* is a sectional view showing the ODF LCD panel of **FIG. 10***a;* and

[0028] **FIG. 11***a* is a perspective view showing an ODF LCD panel of the tenth embodiment of the present invention, and **FIG. 11***b* is a sectional view showing the ODF LCD panel of **FIG. 11***a;*

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0029] First Embodiment

[0030] Refer to **FIGS. 2***a* and **2***b*. A color pixel area **103** and a black matrix area **105** are preformed on a color filter substrate **101**. First, as shown in **FIG. 2***a,* a sealant area **107** is formed on a peripheral region **104** of the color filter substrate **101**, and the sealant area **107** is separated from the black matrix area **105** by a predetermined space. Secondly, at least one drop of a liquid crystal **108** is dripped down on an array substrate **109**. Next, the color filter substrate **101** and the array substrate **109** are superposed face-to-face as shown in **FIG. 2***a* under a vacuum condition. Further, the sealant area **107** is cured by applying ultraviolet light from a side of the color filter substrate **101**, and then an ODF LCD panel as shown in **FIG. 2***b* is obtained.

[0031] According to **FIG. 2***b,* because the sealant area **107** and the black matrix area **105** are separated by the space, the sealant area **107** is completely hardened while applying ultraviolet light from the side of the color filter substrate **101** without the light shielding problems resulting from the black matrix area **105**.

[0032] Furthermore, the above liquid crystal **108**, for example, is a mixture, and the mixture is preferably composed of liquid crystal materials and spacers.

[0033] Second Embodiment

[0034] Refer to **FIGS. 3***a* and **3***b*. A color pixel area **113** and a black matrix area **115** are preformed on a color filter substrate **111**. First, as shown in **FIG. 3***a,* a sealant area **117** is formed on an array substrate **119**. The sealant area **117** is located at a position opposite to the outside of the black matrix area **115** and separated from the black matrix area **115** by a predetermined space. Secondly, at least one drop of a liquid crystal **118** is dripped down on the array substrate **119**. Next, the color filter substrate **111** and the array substrate **119** are superposed face-to-face as shown in **FIG. 3***a* under a vacuum condition. Further, the sealant area **117** is cured by applying ultraviolet light from a side of the color filter substrate **111**, and then an ODF LCD panel as shown in **FIG. 3***b* is obtained.

[0035] According to **FIG. 3***b,* because the sealant area **117** and the black matrix area **115** are separated by the space, the sealant area **117** is completely hardened while applying ultraviolet light from the side of the color filter substrate **111** without the light shielding problems resulting from the black matrix area **115**.

[0036] Furthermore, the above liquid crystal **118**, for example, is a mixture, and the mixture is preferably composed of liquid crystal materials and spacers.

[0037] Third Embodiment

[0038] Refer to **FIGS. 4***a* and **4***b*. A color pixel area **123** and a black matrix area **125** are preformed on a color filter substrate **121**. First, as shown in **FIG. 4***a,* a photo spacer area **126** is formed on a outside edge of the black matrix area **125**, wherein the photo spacer area **126** overlaps the outside edge of the black matrix area **125**. Secondly, a sealant area **127** is formed on a peripheral region **124** of the color filter substrate **121**, and the sealant area **127** is located at the outside of the photo spacer area **126**. Next, at least one drop

of a liquid crystal **128** is dripped down on an array substrate **129**. Moreover, the color filter substrate **121** and the array substrate **129** are superposed face-to-face as shown in **FIG. 4***a* under a vacuum condition. Further, the sealant area **127** is cured by applying ultraviolet light from a side of the color filter substrate **121**, and then an ODF LCD panel as shown in **FIG. 4***b* is obtained.

[**0039**] According to **FIG. 4***b*, because the sealant area **127** and the black matrix area **125** are separated by the photo spacer area **126**, the sealant area **127** is completely hardened while applying ultraviolet light from the side of the color filter substrate **121** without the light shielding problems resulting from the black matrix area **125**. Moreover, this also completely hardens the sealant area **127**, thereby preventing pollution of the liquid crystal **128**. This further improves the efficiency of the liquid crystal **128**.

[**0040**] Furthermore, the above liquid crystal **128**, for example, is a mixture, and the mixture is preferably composed of liquid crystal materials and spacers.

[**0041**] Fourth Embodiment

[**0042**] Refer to **FIGS. 5***a* and **5***b*. A color pixel area **133** and a black matrix area **135** are preformed on a color filter substrate **131**. First, as shown in **FIG. 5***a*, a photo spacer area **136** is formed on an outside edge of the black matrix area **135**, wherein the photo spacer area **136** overlaps the outside edge of the black matrix area **135**. Secondly, a sealant area **137** is formed on an array substrate **139**, wherein the sealant area **137** is located at a position opposite to the outside of the photo spacer area **136**. Next, at least one drop of a liquid crystal **138** is dripped down on the array substrate **139**. Moreover, the color filter substrate **131** and the array substrate **139** are superposed face-to-face as shown in **FIG. 5***a* under a vacuum condition. Further, the sealant area **137** is cured by applying ultraviolet light from a side of the color filter substrate **131**, and then an ODF LCD panel as shown in **FIG. 5***b* is obtained.

[**0043**] According to **FIG. 5***b*, because the sealant area **137** and the black matrix area **135** are separated by the photo spacer area **136**, the sealant area **137** is completely hardened while applying ultraviolet light from the side of the color filter substrate **131** without the light shielding problems resulting from the black matrix area **135**. Moreover, this also completely hardens the sealant area **137**, thereby preventing pollution of the liquid crystal **138**. This further improves the efficiency of the liquid crystal **138**.

[**0044**] Furthermore, the above liquid crystal **138**, for example, is a mixture, and the mixture is preferably composed of liquid crystal materials and spacers.

[**0045**] Fifth Embodiment

[**0046**] Refer to **FIGS. 6***a* and **6***b*. A color pixel area **143** and a black matrix area **145** are preformed on a color filter substrate **141**. First, as shown in **FIG. 6***a*, a photo spacer area **146** is formed on an array substrate **149**, wherein the photo spacer area **146** is located at a first position opposite to the outside edge of the black matrix area **145**. Secondly, a sealant area **147** is formed on a peripheral region **144** of the color filter substrate **141**, wherein the sealant area **147** is located at a second position opposite to the outside of the photo spacer area **146**. Next, at least one drop of a liquid crystal **148** is dripped down on the array substrate **149**. Moreover, the color filter substrate **141** and the array substrate **149** are superposed face-to-face as shown in **FIG. 6***a* under a vacuum condition. Further, the sealant area **147** is cured by applying ultraviolet light from a side of the color filter substrate **141**, and then an ODF LCD panel as shown in **FIG. 6***b* is obtained.

[**0047**] According to **FIG. 6***b*, because the sealant area **147** and the black matrix area **145** are separated by the photo spacer area **146**, the sealant area **147** is completely hardened while applying ultraviolet light from the side of the color filter substrate **141** without the light shielding problems resulting from the black matrix area **145**. Moreover, this also completely hardens the sealant area **147**, thereby preventing pollution of the liquid crystal **148**. This further improves the efficiency of the liquid crystal **148**.

[**0048**] Furthermore, the above liquid crystal **148**, for example, is a mixture, and the mixture is preferably composed of liquid crystal materials and spacers.

[**0049**] Sixth Embodiment

[**0050**] Refer to **FIGS. 7***a* and **7***b*. A color pixel area **153** and a black matrix area **155** are preformed on a color filter substrate **151**. First, as shown in **FIG. 7***a*, a photo spacer area **156** is formed on an array substrate **159**, wherein the photo spacer area **156** is located at a position opposite to the outside edge of the black matrix area **155**. Secondly, a sealant area **157** is formed on the array substrate **159**, wherein the sealant area **157** is located at the outside of the photo spacer area **156**. Next, at least one drop of a liquid crystal **158** is dripped down on the array substrate **159**. Moreover, the color filter substrate **151** and the array substrate **159** are superposed face-to-face as shown in **FIG. 7***a* under a vacuum condition. Further, the sealant area **157** is cured by applying ultraviolet light from a side of the color filter substrate **151**, and then an ODF LCD panel as shown in **FIG. 7***b* is obtained.

[**0051**] According to **FIG. 7***b*, because the sealant area **157** and the black matrix area **155** are separated by the photo spacer area **156**, the sealant area **157** is completely hardened while applying ultraviolet light from the side of the color filter substrate **151** without the light shielding problems resulting from the black matrix area **155**. Moreover, this also completely hardens the sealant area **157**, thereby preventing pollution of the liquid crystal **158**. This further improves the efficiency of the liquid crystal **158**.

[**0052**] Furthermore, the above liquid crystal **158**, for example, is a mixture, and the mixture is preferably composed of liquid crystal materials and spacers.

[**0053**] Seventh Embodiment

[**0054**] Refer to **FIGS. 8***a* and **8***b*. A color pixel area **163** and a black matrix area **165** are preformed on a color filter substrate **161**. First, as shown in **FIG. 8***a*, a photo spacer area **166** is formed on a peripheral region **164** of the color filter substrate **161**. The photo spacer area **166** is located at the outside of the black matrix area **165** and is separated from the black matrix area **165** by a predetermined space. Secondly, a sealant area **167** is formed on the peripheral region **164**, and the sealant area **167** is located at the outside of the photo spacer area **166**. Next, at least one drop of a liquid crystal **168** is dripped down on an array substrate **169**. Moreover, the color filter substrate **161** and the array sub-

strate **169** are superposed face-to-face as shown in **FIG. 8***a* under a vacuum condition. Further, the sealant area **167** is cured by applying ultraviolet light from a side of the color filter substrate **161**, and then an ODF LCD panel as shown in **FIG. 8***b* is obtained.

[**0055**] According to **FIG. 8***b*, because the sealant area **167** and the black matrix area **165** are separated by the photo spacer area **166**, the sealant area **167** is completely hardened while applying ultraviolet light from the side of the color filter substrate **161** without the light shielding problems resulting from the black matrix area **165**. Moreover, this also completely hardens the sealant area **167**, thereby preventing pollution of the liquid crystal **168**. This further improves the efficiency of the liquid crystal **168**.

[**0056**] Furthermore, the above liquid crystal **168**, for example, is a mixture, and the mixture is preferably composed of liquid crystal materials and spacers.

[**0057**] Eighth Embodiment

[**0058**] Refer to **FIGS. 9***a* and **9***b*. A color pixel area **173** and a black matrix area **175** are preformed on a color filter substrate **171**. First, as shown in **FIG. 9***a*, a photo spacer area **176** is formed on a peripheral region **174** of the color filter substrate **171**. The photo spacer area **176** is located at the outside of the black matrix area **175** and is separated from the black matrix area **175** by a predetermined space. Secondly, a sealant area **177** is formed on an array substrate **179**, wherein the sealant area **177** is located at a position opposite to the outside of the photo spacer area **176**. Next, at least one drop of a liquid crystal **178** is dripped down on the array substrate **179**. Moreover, the color filter substrate **171** and the array substrate **179** are superposed face-to-face as shown in **FIG. 9***a* under a vacuum condition. Further, the sealant area **177** is cured by applying ultraviolet light from a side of the color filter substrate **171**, and then an ODF LCD panel as shown in **FIG. 9***b* is obtained.

[**0059**] According to **FIG. 9***b*, because the sealant area **177** and the black matrix area **175** are separated by the photo spacer area **176**, the sealant area **177** is completely hardened while applying ultraviolet light from the side of the color filter substrate **171** without the light shielding problems resulting from the black matrix area **175**. Moreover, this also completely hardens the sealant area **177**, thereby preventing pollution of the liquid crystal **178**. This further improves the efficiency of the liquid crystal **178**.

[**0060**] Furthermore, the above liquid crystal **178**, for example, is a mixture, and the mixture is preferably composed of liquid crystal materials and spacers.

[**0061**] Ninth Embodiment

[**0062**] Refer to **FIGS. 10***a* and **10***b*. A color pixel area **183** and a black matrix area **185** are preformed on a color filter substrate **181**. First, as shown in **FIG. 10***a*, a photo spacer area **186** is formed on an array substrate **189**. The photo spacer area **186** is located at a position opposite to the outside of the black matrix area **185** and is separated from the black matrix area **185** by a predetermined space. Secondly, a sealant area **187** is formed on a peripheral region **184** of the color filter substrate **181**, and the sealant area **187** is located at a position opposite to the outside of the photo spacer area **186**. Next, at least one drop of a liquid crystal **188** is dripped down on the array substrate **189**. Moreover, the color filter substrate **181** and the array substrate **189** are superposed face-to-face as shown in **FIG. 10***a* under a vacuum condition. Further, the sealant area **187** is cured by applying ultraviolet light from a side of the color filter substrate **181**, and then an ODF LCD panel as shown in **FIG. 10***b* is obtained.

[**0063**] According to **FIG. 10***b*, because the sealant area **187** and the black matrix area **185** are separated by the photo spacer area **186**, the sealant area **187** is completely hardened while applying ultraviolet light from the side of the color filter substrate **181** without the light shielding problems resulting from the black matrix area **185**. Moreover, this also completely hardens the sealant area **187**, thereby preventing pollution of the liquid crystal **188**. This further improves the efficiency of the liquid crystal **188**.

[**0064**] Furthermore, the above liquid crystal **188**, for example, is a mixture, and the mixture is preferably composed of liquid crystal materials and spacers.

[**0065**] Tenth Embodiment

[**0066**] Refer to **FIGS. 11***a* and **11***b*. A color pixel area **193** and a black matrix area **195** are preformed on a color filter substrate **191**. First, as shown in **FIG. 11***a*, a photo spacer area **196** is formed on an array substrate **199**. The photo spacer area **196** is located at a position opposite to the outside of the black matrix area **195** and is separated from the black matrix area **195** by a predetermined space. Secondly, a sealant area **197** is formed on the array substrate **199**, and the sealant area **197** is located at the outside of the photo spacer area **196**. Next, at least one drop of a liquid crystal **198** is dripped down on the array substrate **199**. Moreover, the color filter substrate **191** and the array substrate **199** are superposed face-to-face as shown in **FIG. 11***a* under a vacuum condition. Further, the sealant area **197** is cured by applying ultraviolet light from a side of the color filter substrate **191**, and then an ODF LCD panel as shown in **FIG. 11***b* is obtained.

[**0067**] According to **FIG. 11***b*, because the sealant area **197** and the black matrix area **195** is separated by the photo spacer area **196**, the sealant area **197** is completely hardened while applying ultraviolet light from the side of the color filter substrate **191** without the light shielding problems resulting from the black matrix area **195**. Moreover, this also completely hardens the sealant area **197**, thereby preventing pollution of the liquid crystal **198**. This further improves the efficiency of the liquid crystal **198**.

[**0068**] Furthermore, the above liquid crystal **198**, for example, is a mixture, and the mixture is preferably composed of liquid crystal materials and spacers.

[**0069**] Finally, while the invention has been described by way of example and in terms of the preferred embodiment, it is to be understood that the invention is not limited to the disclosed embodiments. On the contrary, it is intended to cover various modifications and similar arrangements as would be apparent to those skilled in the art. Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

What is claimed is:

1. A method of manufacturing a one drop fill liquid crystal display panel, comprising the steps of:

providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively;

forming a sealant area on the first peripheral region, wherein the sealant area is located at the outside of the black matrix area and separated from the black matrix area by a predetermined space;

dispersing at least one drop of a liquid crystal on the second central region;

superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and

curing the sealant area by applying ultraviolet light from a side of the first substrate.

2. The method of manufacturing a one drop fill liquid crystal display panel as claimed in claim 1, wherein the liquid crystal is a mixture composed of liquid crystal materials and spacers.

3. A method of manufacturing a one drop fill liquid crystal display panel, comprising the steps of:

providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively;

forming a sealant area on the second peripheral region, wherein the sealant area is located opposite to the outside of the black matrix area and separated from the black matrix area by a predetermined space;

dispersing at least one drop of a liquid crystal on the second central region;

superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and

curing the sealant area by applying ultraviolet light from a side of the first substrate.

4. The method of manufacturing a one drop fill liquid crystal display panel as claimed in claim 3, wherein the liquid crystal is a mixture composed of liquid crystal materials and spacers.

5. A method of manufacturing a one drop fill liquid crystal display panel, comprising the steps of:

providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively;

forming a photo spacer area on the first peripheral region, wherein the photo spacer area overlaps the outside edge of the black matrix area;

forming a sealant area on the first peripheral region, wherein the sealant area is located at the outside of the photo spacer area;

dispersing at least one drop of a liquid crystal on the second central region;

superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and

curing the sealant area by applying ultraviolet light from a side of the first substrate.

6. The method of manufacturing a one drop fill liquid crystal display panel as claimed in claim 5, wherein the liquid crystal is a mixture composed of liquid crystal materials and spacers.

7. A method of manufacturing a one drop fill liquid crystal display panel, comprising the steps of:

providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively;

forming a photo spacer area on the first peripheral region, wherein the photo spacer area overlaps the outside edge of the black matrix area;

forming a sealant area on the second peripheral region, wherein the sealant area is located opposite to the outside of the photo spacer area;

dispersing at least one drop of a liquid crystal on the second central region;

superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and

curing the sealant area by applying ultraviolet light from a side of the first substrate.

8. The method of manufacturing a one drop fill liquid crystal display panel as claimed in claim 7, wherein the liquid crystal is a mixture composed of liquid crystal materials and spacers.

9. A method of manufacturing a one drop fill liquid crystal display panel, comprising the steps of:

providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively;

forming a photo spacer area on the second peripheral region, wherein the photo spacer area is located at a first position opposite to the outside edge of the black matrix area;

forming a sealant area on the first peripheral region, wherein the sealant area is located at a second position opposite to the outside of the photo spacer area;

dispersing at least one drop of a liquid crystal on the second central region;

superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and

curing the sealant area by applying ultraviolet light from a side of the first substrate.

10. The method of manufacturing a one drop fill liquid crystal display panel as claimed in claim 9, wherein the liquid crystal is a mixture composed of liquid crystal materials and spacers.

11. A method of manufacturing a one drop fill liquid crystal display panel, comprising the steps of:

providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively;

forming a photo spacer area on the second peripheral region, wherein the photo spacer area is located opposite to the outside edge of the black matrix area;

forming a sealant area on the second peripheral region, wherein the sealant area is located at the outside of the photo spacer area;

dispersing at least one drop of a liquid crystal on the second central region;

superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and

curing the sealant area by applying ultraviolet light from a side of the first substrate.

12. The method of manufacturing a one drop fill liquid crystal display panel as claimed in claim 11, wherein the liquid crystal is a mixture composed of liquid crystal materials and spacers.

13. A method of manufacturing a one drop fill liquid crystal display panel, comprising the steps of:

providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively;

forming a photo spacer area on the first peripheral region, wherein the photo spacer area is located at the outside of the black matrix area and separated from the black matrix area by a predetermined space;

forming a sealant area on the first peripheral region, wherein the sealant area is located at the outside of the photo spacer area;

dispersing at least one drop of a liquid crystal on the second central region;

superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and

curing the sealant area by applying ultraviolet light from a side of the first substrate.

14. The method of manufacturing a one drop fill liquid crystal display panel as claimed in claim 13, wherein the liquid crystal is a mixture composed of liquid crystal materials and spacers.

15. A method of manufacturing a one drop fill liquid crystal display panel, comprising the steps of:

providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively;

forming a photo spacer area on the first peripheral region, wherein the photo spacer area is located at the outside of the black matrix area and separated from the black matrix area by a predetermined space;

forming a sealant area on the second peripheral region, wherein the sealant area is located opposite to the outside of the photo spacer area;

dispersing at least one drop of a liquid crystal on the second central region;

superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and

curing the sealant area by applying ultraviolet light from a side of the first substrate.

16. The method of manufacturing a one drop fill liquid crystal display panel as claimed in claim 15, wherein the liquid crystal is a mixture composed of liquid crystal materials and spacers.

17. A method of manufacturing a one drop fill liquid crystal display panel, comprising the steps of:

providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively;

forming a photo spacer area on the second peripheral region, wherein the photo spacer area is located opposite to the outside of the black matrix area and separated from the black matrix area by a predetermined space;

forming a sealant area on the first peripheral region, wherein the sealant area is located opposite to the outside of the photo spacer area;

dispersing at least one drop of a liquid crystal on the second central region;

superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and

curing the sealant area by applying ultraviolet light from a side of the first substrate.

18. The method of manufacturing a one drop fill liquid crystal display panel as claimed in claim 17, wherein the liquid crystal is a mixture composed of liquid crystal materials and spacers.

19. A method of manufacturing a one drop fill liquid crystal display panel, comprising the steps of:

providing a first substrate and a second substrate, the first substrate having a first central region and a first peripheral region, and the second substrate having a second central region and a second peripheral region, wherein a color pixel area and a black matrix area are positioned on the surface of the first central region, and the first central region and the first peripheral region are positioned opposite to the second central region and the second peripheral region respectively;

forming a photo spacer area on the second peripheral region, wherein the photo spacer area is located opposite to the outside of the black matrix area and separated from the black matrix area by a predetermined space;

forming a sealant area on the second peripheral region, wherein the sealant area is located at the outside of the photo spacer area;

dispersing at least one drop of a liquid crystal on the second central region;

superposing the first substrate and the second substrate under a condition of reduced ambient air pressure; and

curing the sealant area by applying ultraviolet light from a side of the first substrate.

20. The method of manufacturing a one drop fill liquid crystal display panel as claimed in claim 19, wherein the liquid crystal is a mixture composed of liquid crystal materials and spacers.

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专利名称(译)	制造一滴液晶显示面板的方法		
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[标]申请(专利权)人(译)	远流LOUIS 田中栄 张清CHAO		
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摘要(译)

公开了一种制造单滴填充液晶显示器（ODF LCD）面板的方法。通过使用空间或光隔离物分离密封剂和黑色矩阵，可以通过从滤色器基板的侧面施加紫外光来硬化密封剂而没有光屏蔽问题。而且，这也使密封剂完全硬化，从而防止液晶材料的污染。这进一步提高了液晶材料的效率。