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Date: June 5, 2024

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- CN1538212A

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[19] State Intellectual Property Office of the People's Republic of China

[51] Int. Cl[7]
G02F 1/1333

[12] **Invention Patent Application Specification**

[21] Application No.: 200310102858.0

[43] Date of Publication: October 20, 2004

[11] Publication No: CN 1538212A

[22] **Application Date:** 10/22/2003

[21] **Application No.:** 200310102858.0

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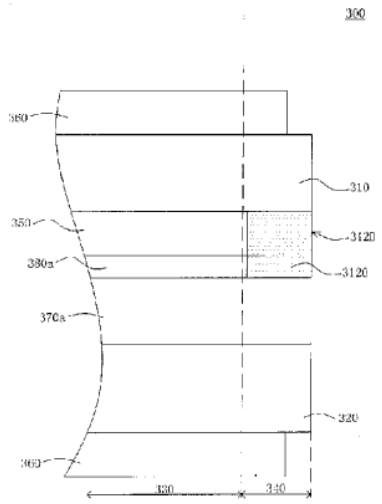
Claims 2 pages Specification 8 pages Drawings 13 pages

[54] **Title of Invention:** Display panel frame adhesive structure

[57] **Abstract**

A display panel frame adhesive structure includes an upper substrate, a lower substrate, and frame adhesive applied between the upper substrate and the lower substrate. The lower substrate has a first covering layer, with a second covering layer over the first covering layer. The second covering layer has a groove or opening that exposes a portion of the first covering layer. The frame adhesive contacts the first covering layer through the groove or opening, thereby bonding the lower substrate to the upper substrate. The first covering layer and the second covering layer, from bottom to top, include a first metal layer, a dielectric layer, a second metal layer, and a protective layer. This invention can withstand significant impact or vibration forces caused by mishandling, preventing the formation of cracks between the upper and lower substrates, thereby maintaining the display quality of the panel.



ISSN1008-4274

Published by Intellectual Property Publishing House

1. A display panel frame adhesive structure, comprising:

An upper substrate;

A lower substrate positioned relative to the upper substrate. The lower substrate comprising:

A first covering layer located on the lower substrate; and

A second covering layer located on the first covering layer, with the second covering layer having a groove or opening that exposes a portion of the first covering layer; and

A frame adhesive applied between the upper substrate and the lower substrate, where the frame adhesive contacts the first covering layer through the groove or opening, thereby bonding the lower substrate to the upper substrate.

2. The display panel frame adhesive structure as claimed in claim 1, wherein the first covering layer comprises a first metal layer, a dielectric layer, and a second metal layer, with the dielectric layer covering the first metal layer, and the second metal layer covering the dielectric layer; the second covering layer is a protective layer.

3. The display panel frame adhesive structure as claimed in claim 1, wherein the first covering layer comprises a first metal layer and a dielectric layer, with the dielectric layer covering the first metal layer; the second covering layer comprises a second metal layer and a protective layer, with the protective layer covering the second metal layer.

4. The display panel frame adhesive structure as claimed in claim 1, wherein the first covering layer is a first metal layer; the second covering layer comprises a protective layer, a second metal layer, and a dielectric layer, with the second metal layer covering the dielectric layer, and the protective layer covering the second metal layer.

5. The display panel frame adhesive structure as claimed in claim 1, wherein the groove or opening is elongated.

6. The display panel frame adhesive structure as claimed in any one of claims 2 to 4, wherein the first metal layer is a scan line metal layer; the second metal layer is a data line metal layer; and the material forming the protective layer can be silicon dioxide (SiO_2) or silicon nitride (Si_3N_4).

7. The display panel frame adhesive structure as claimed in claim 1, wherein the groove or opening is X-shaped.

8. The display panel frame adhesive structure as claimed in claim 1, wherein the groove or opening is in a matrix shape.

9. The display panel frame adhesive structure as claimed in claim 1, wherein the groove or opening has a V-shaped distribution in the cross-section of the second covering layer.

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10. The display panel frame adhesive structure as claimed in claim 1, wherein the groove or opening has a stepped distribution in the cross-section of the second covering layer.

11. The display panel frame adhesive structure as claimed in claim 1, wherein the display panel is a thin-film transistor liquid crystal display (TFT-LCD) panel, the upper substrate is a color filter substrate, and the lower substrate is a thin-film transistor substrate.

12. A display panel frame adhesive structure, comprising:

An upper substrate;

A lower substrate, having a covering layer, with the covering layer having a groove or opening that exposes a portion of the lower substrate; and

A frame adhesive applied between the upper substrate and the lower substrate, where the frame adhesive contacts the lower substrate through the groove or opening, thereby bonding the lower substrate to the upper substrate;

Wherein the covering layer includes a protective layer, a second metal layer, a dielectric layer, and a first metal layer, with the dielectric layer covering the first metal layer, the second metal layer covering the dielectric layer, and the protective layer covering the second metal layer.

13. The display panel frame adhesive structure as claimed in claim 12, wherein the first metal layer is a scan line metal layer; the second metal layer is a data line metal layer; and the material forming the protective layer can be silicon dioxide or silicon nitride.

14. The display panel frame adhesive structure as claimed in claim 12, wherein the groove or opening is elongated.

15. The display panel frame adhesive structure as claimed in claim 12, wherein the groove or opening is X-shaped.

16. The display panel frame adhesive structure as claimed in claim 12, wherein the groove or opening is in a matrix shape.

17. The display panel frame adhesive structure as claimed in claim 12, wherein the groove or opening has a V-shaped distribution in the cross-section of the covering layer.

18. The display panel frame adhesive structure as claimed in claim 12, wherein the groove or opening has a stepped distribution in the cross-section of the covering layer.

19. The display panel frame adhesive structure as claimed in claim 12, wherein the display panel is a thin-film transistor liquid crystal display (TFT-LCD) panel, its upper substrate is a color filter substrate, while its lower substrate is a thin-film transistor substrate.

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Display Frame Adhesive Structure

(1) Technical Field

The present invention relates to a display panel frame adhesive structure, and particularly to a display panel frame adhesive structure with superior bonding strength.

(2) Background Art

For a general liquid crystal display (LCD) panel, it can be divided into a display area and a frame adhesive area located around the display area. In the frame adhesive area of a thin-film transistor liquid crystal display (TFT-LCD) panel, the thin-film transistor (TFT) substrate usually has multiple covering layers. From bottom to top, these layers typically include a scan line metal layer, a dielectric layer composed of a material such as silicon nitride (SiN_x), a data line metal layer, and a protective layer used to protect the transistor components. In addition, for reflective and semi-transmissive/semi-reflective TFT-LCD panels, apart from the aforementioned covering layers, there may sometimes be an additional layer of photoresist layer (PL) above the protective layer.

Please refer to Figure 1A, which is a schematic diagram of a conventional LCD panel. The liquid crystal display panel 100 comprises a color filter (CF) substrate 110 and a thin-film transistor (TFT) substrate 120 located beneath the CF substrate 110. The display panel 100, composed of the CF substrate 110 and the TFT substrate 120, has a display area 130, a frame adhesive area 140 surrounding the display area 130, and a liquid crystal injection area 150.

Figure 1B is a cross-sectional view of the liquid crystal display panel in Figure 1A. Referring to Figure 1B, on the outer sides of the CF substrate 110 and the TFT substrate 120, there are polarizing plates 160, used to polarize light into polarized light. In the display area 130, on the TFT substrate 120, there is a covering layer comprising a first metal layer 121, a dielectric layer 122, a second metal layer 123, and a protective layer 124. The dielectric layer 122, for example, is a layer of silicon nitride (SiN_x), and the protective layer 124 is composed of silicon nitride (Si_3N_4) or silicon dioxide (SiO_2). The first metal layer 121, for example, is a scan line metal layer, while the second metal layer 123, for example, is a data line metal layer.

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The dielectric layer 122 covers the first metal layer 121, and the second metal layer 123 covers the dielectric layer 122, while the protective layer 124 covers the second metal layer 123. In the display area 130, between the CF substrate 110 and the protective layer 124, there is a liquid crystal injection area 150, which is reserved for injecting liquid crystal. In addition, in the frame adhesive area 140, on the TFT substrate 120, there are the first metal layer 121, the dielectric layer 122, the second metal layer 123, and the protective layer 124, extending from the display area 130 to the frame adhesive area 140. For the liquid crystal injection area 150 distributed in the display area 130, in the frame adhesive area 140, it contacts the frame adhesive 112, which is applied between the CF substrate 110 and the TFT substrate 120.

During the assembly process of the TFT substrate 120 and the CF substrate 110, the frame adhesive 112 in the frame adhesive area 140 is in contact with the protective layer 124 above the TFT substrate 120. Then, using a pressing tool, the CF substrate 110 and the TFT substrate 120 are pressed together and baked in an oven, causing the frame adhesive 112 to harden, thereby bonding the TFT substrate 120 to the CF substrate 110.

Refer to Figure 2A, which is a side view of a conventional reflective liquid crystal display panel. The reflective liquid crystal display panel 200A includes a CF substrate 210 and a TFT substrate 220 located beneath the CF substrate 210. On the outer sides of the CF substrate 210 and the TFT substrate 220, there is the polarizing plate 260 used to polarize the light into polarized light. The display panel 200A, composed of the CF substrate 210 and the TFT substrate 220, has a display area 230 and a frame adhesive area 240 surrounding the display area 230.

In the display area 230, on the TFT substrate 220, there is a covering layer comprising a first metal layer 221, a dielectric layer 222, a second metal layer 223, a protective layer 224, and a photoresist layer 225A. The dielectric layer 222, for example, is a silicon nitride (SiN_x) layer, the protective layer 224 can be composed of silicon nitride (Si_3N_4) or silicon dioxide (SiO_2), and the photoresist layer 225A can be composed of an organic material.

The dielectric layer 222 covers the first metal layer 221, the second metal layer 223 covers the dielectric layer 222, the protective layer 224 covers the second metal layer 223, and the photoresist layer 225A covers the protective layer 224. In the display area 230, between the CF substrate 210 and the photoresist layer 225, there is a liquid crystal injection area 250, which is reserved for injecting liquid crystal. In addition, in the frame adhesive area 240, the TFT substrate 220 has a first metal layer 221, a dielectric layer 222, a second metal layer 223, a protective layer 224, and a photoresist layer 225A, all of which extend from the display area 230 to the frame adhesive area 240. The liquid crystal injection area 250, which is distributed in the display area 230, contacts the frame adhesive 212A in the frame adhesive area 240. The frame adhesive 212A is applied between the CF substrate 210 and the TFT substrate 220. The difference between the reflective liquid crystal display panel 200A and the general liquid crystal display panel 100 is that the reflective liquid crystal display panel 200A has an additional photoresist layer 225A on the TFT substrate 220, which covers the protective layer 224.

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Figure 2B is a side view of another conventional reflective liquid crystal display panel. Referring to Figure 2B, similar to the reflective liquid crystal display panel 200A in Figure 2A, the reflective liquid crystal display panel 200B includes a CF substrate 210 and a TFT substrate 220 located beneath the CF substrate 210. On the outer sides of the CF substrate 210 and the TFT substrate 220, there is the polarizing plate 260 used to polarize the light into polarized light. The display panel 200B, composed of the CF substrate 210 and the TFT substrate 220, has a display area 230 and a frame adhesive area 240 surrounding the display area 230.

In the display area 230, on the TFT substrate 220, there is a covering layer that includes a first metal layer 221 such as a scan line metal layer, a dielectric layer 222, a second metal layer 223 such as a data line metal layer, a protective layer 224, and a photoresist layer 225. The dielectric layer 222, for example, is a silicon nitride (SiN_x) layer, the protective layer 224 can be composed of silicon nitride (Si_3N_4) or silicon dioxide (SiO_2), and the photoresist layer 225 can be composed of an organic material.

The dielectric layer 222 covers the first metal layer 221, the second metal layer 223 covers the dielectric layer 222, the protective layer 224 covers the second metal layer 223, and the photoresist layer 225 covers the protective layer 224. In the display area 230, between the CF substrate 210 and the photoresist layer 225, there is a liquid crystal injection area 250, which is reserved for injecting liquid crystal.

Here, different from the display panel 200A in Figure 2A, in the frame adhesive area 240 of the display panel 200B, the TFT substrate 220 has a first metal layer 221, a dielectric layer 222, a second metal layer 223, a protective layer 224, and a photoresist layer 225B, all extending from the display area 230 to the frame adhesive area 240. The photoresist layer 225B has an opening 2120 that exposes a portion of the protective layer 224. Therefore, in the frame adhesive area 240, the liquid crystal injection area 250, which is distributed in the display area 230, contacts the frame adhesive 212B. The frame adhesive 212B contacts the protective layer 224 through the opening 2120.

During the bonding process of the TFT substrate 220 and the CF substrate 210, the frame adhesive 212B in the frame adhesive area 240 contacts the liquid crystal injection area 250 and the photoresist layer 225B in the display area 230. Simultaneously, the frame adhesive 212B penetrates the opening 2120 and contacts the protective layer 224 on the TFT substrate 220. Then, using a pressing tool, the CF substrate 210 and the TFT substrate 220 are pressed together and baked in an oven, causing the frame adhesive 212B to harden, thereby bonding and assembling the TFT substrate 220 with the CF substrate 210.

However, the bonding strength of the assembled liquid crystal display panels 100, 200A, and 200B is insufficient. During reliability tests or drop tests, the panels are prone to developing cracks at the contact interface between the TFT substrate and the CF substrate due to impact or vibrational forces. This results in damage to the display panel, significantly affecting the quality of the display panel.

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(3) Summary of the Invention

In view of this, the purpose of the present invention is to provide a display panel frame adhesive structure with greater bonding strength. By increasing the contact area of the frame adhesive, more frame adhesive can penetrate into grooves or openings, thereby increasing the bonding strength between the TFT substrate and the CF substrate. This allows the structure to withstand greater external impact or vibration forces, avoiding the generation of damaging cracks between the CF substrate and the TFT substrate, thus affecting the display quality of the panel.

To achieve the purpose of the present invention, according to one aspect of the present invention, a display panel frame adhesive structure comprises an upper substrate, a lower substrate, and adhesive applied between the upper substrate and the lower substrate. The lower substrate is positioned relative to the upper substrate, and the lower substrate has a first covering layer and a second covering layer on it. The second covering layer has a groove or opening exposing a portion of the first covering layer, allowing the frame adhesive to contact the first covering layer through the groove or opening, thereby bonding the lower substrate to the upper substrate.

To achieve the purpose of the present invention, according to another aspect of the present invention, a display panel frame adhesive structure comprises an upper substrate, a lower substrate, and adhesive applied between the upper substrate and the lower substrate. The lower substrate has a covering layer, and this covering layer has a groove or opening exposing a portion of the lower substrate, through which the adhesive contacts the lower substrate, thereby bonding the lower substrate to the upper substrate. The covering layer from top to bottom includes a protective layer, a second metal layer, a dielectric layer, and a first metal layer. The dielectric layer covers the first metal layer, the second metal layer covers the dielectric layer, and the protective layer covers the second metal layer.

To further illustrate the above purposes, structural features, and effects of the present invention, detailed descriptions of the present invention will be provided below in conjunction with the accompanying drawings.

(4) Description of Drawings

Figure 1A is a schematic diagram of a conventional liquid crystal display panel.

Figure 1B is a cross-sectional view of the liquid crystal display panel in Figure 1A.

Figure 2A is a side view of a conventional reflective liquid crystal display panel.

Figure 2B is a side view of another conventional reflective liquid crystal display panel.

Figure 3A is a schematic diagram of a liquid crystal display panel according to the first embodiment of the present invention.

Figure 3B is a cross-sectional view of the liquid crystal display panel in Figure 3A.

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Figure 3C is a schematic diagram of a second display panel of the first embodiment.

Figure 3D is a schematic diagram of a third display panel of the first embodiment.

Figure 3E is a schematic diagram of a fourth display panel of the first embodiment.

Figure 4 is a side view of a liquid crystal display panel according to the second embodiment of the present invention.

Figure 5A is a schematic diagram of a groove or opening shape.

Figure 5B is a schematic diagram of another groove or opening shape.

Figure 6A is a schematic diagram of adhesive distribution.

Figure 6B is a schematic diagram of another adhesive distribution.

(5) Embodiments

First Embodiment

The main purpose of this embodiment is to increase the contact area of the frame adhesive, allowing more adhesive to penetrate into the grooves/openings, thereby enhancing the bonding strength between the TFT substrate and the CF substrate. Referring to both Figure 3A and Figure 3B, where Figure 3A is a schematic diagram of a liquid crystal display panel according to a first embodiment of the present invention, and Figure 3B is a sectional view of the liquid crystal display panel in Figure 3A. The liquid crystal display panel 300 comprises an upper substrate 310 and a lower substrate 320. The liquid crystal display panel 300, for example, is a thin-film transistor liquid crystal display (TFT LCD) panel, where the upper substrate 310 is a CF substrate, and the lower substrate 320 is a TFT substrate. On the outer sides of the CF substrate 310 and the TFT substrate 320, there is the polarizing plate 360 used to polarize the light into polarized light. The liquid crystal display panel 300 formed from the CF substrate 310 and the TFT substrate 320 has a display area 330 and a frame adhesive area 340 surrounding the display area 330.

In the display area 330, the TFT substrate 320 mainly consists of two covering layers: the first covering layer 370a and the second covering layer 380a, with the second covering layer 380a positioned above the first covering layer 370a. Between the second covering layer 380a and the CF substrate 310 lies a liquid crystal injection area 350. In the frame adhesive area 340, the TFT substrate 320 also includes the two covering layers 370a and 380a extending from the display area 330. Here, the second covering layer 380a has a groove or opening 3120 exposing a portion of the first covering layer 370a, and the groove or opening 3120 is elongated.

The frame adhesive 312B is applied between the CF substrate 310 and the TFT substrate 320 and is located in the frame adhesive area 340. Therefore, in the frame adhesive area 340, the liquid crystal injection area 350, which is distributed in the display area 330, contacts the frame adhesive 312B. The frame adhesive 312 contacts the first covering layer 370a through the groove or opening 3120.

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During the assembly process of the TFT substrate 320 and the CF substrate 310, the frame adhesive 312B in the frame adhesive area 340 makes lateral contact with the liquid crystal injection area 350 in the display area 330 and the second covering layer 380a. Simultaneously, the frame adhesive 312B penetrates into the groove or opening 3120 and makes contact with the surface of the first covering layer 370a on the TFT substrate 320. Then, using a pressing tool, the CF substrate 310 and the TFT substrate 320 are pressed together and baked in an oven, causing the frame adhesive 312B to harden, thereby bonding and assembling the TFT substrate 320 with the CF substrate 310.

In Figure 3B, both the first covering layer 370a and the second covering layer 380a on the TFT substrate 320 are single-layer structures. However, typically, the first covering layer 370a and the second covering layer 380a consist of four layers in total: a first metal layer (metal 1, M1), a dielectric layer, a second metal layer (metal 2, M2), and a protective layer. As shown in Figure 3C, it is a schematic diagram of the second display panel of the first embodiment. The first covering layer 370a consists of three layers: a first metal layer 321, a dielectric layer 322, and a second metal layer 323, while the second covering layer 380a is a protective layer 324. The dielectric layer 322 is covered on top of the first metal layer 321, the second metal layer 323 is covered on top of the dielectric layer 322, and the protective layer 324 is covered on top of the second metal layer 323. The first metal layer 321, for example, is a scanning line metal layer, and the second metal layer 323, for example, is a data line metal layer. The dielectric layer 322, for example, is a layer of silicon nitride (SiN_x), and the protective layer 324 is composed of silicon dioxide (SiO_2) or silicon nitride (Si_3N_4). As described in Figure 3B, the second covering layer 380a has a groove or opening 3120 exposing a portion of the first covering layer 370a. In this case, the second covering layer 380a refers to the protective layer 324, and the groove or opening 3120 exposes portion of the second metal layer 323. The frame adhesive 312C makes lateral contact with the liquid crystal injection area 350 in the display area 330 and the protective layer 324, while simultaneously penetrating into the opening 3120 and making contact with the surface of the second metal layer 323.

The main approach of the present invention is to increase the contact area of the frame adhesive, allowing more adhesive to penetrate into the groove or opening, thereby enhancing the bonding strength between the TFT substrate and the CF substrate. As the first covering layer 370a and the second covering layer 380a consist of four layers in total, enlarging the openings successively to lower layers achieves the goal of increasing the contact area of the frame adhesive, enabling more adhesive to penetrate into the openings and thus enhancing the bonding strength between the TFT substrate and the CF substrate. For example, please refer to Figure 3D, which is a schematic diagram of the third display panel of the first embodiment. The protective layer 324 and the second metal layer 323D have a common groove or opening 3120D, with the opening 3120D exposing a portion of the dielectric layer 322.

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The frame adhesive 312D makes lateral contact with the liquid crystal injection area 350, the protective layer 324, and the second metal layer 323D in the display area 330, while simultaneously penetrating into the groove or opening 3120D and making contact with the surface of the dielectric layer 322. Thus, as described in the first embodiment, the second covering layer has the opening 3120 exposing a portion of the first covering layer. In this case, the second covering layer 380b includes the second metal layer 323D and the protective layer 324, while the first covering layer 370b includes the first metal layer 321 and the dielectric layer 322.

Furthermore, the opening can be enlarged to the next layer, for example, as shown in Figure 3E, which is a schematic diagram of the fourth display panel according to the first embodiment. The protective layer 324, the second metal layer 323D, and the dielectric layer 322E have a common groove or opening 3120E, and the groove or opening 3120E exposes a portion of the first metal layer 321. The frame adhesive 312E makes lateral contact with the liquid crystal injection area 350, the protective layer 324, the second metal layer 323D, and the dielectric layer 322E in the display area 330, while simultaneously penetrating into the groove or opening 3120E and making contact with the surface of the first metal layer 321. Thus, as described in the first embodiment, the second covering layer has the opening 3120 exposing a portion of the first covering layer. In this case, the second covering layer 380c includes the protective layer 324, the second metal layer 323D, and the dielectric layer 322E, while the first covering layer 370c refers to the first metal layer 321.

Example 2

Figure 4 is a side view of a liquid crystal display panel according to the second embodiment of the present invention. The liquid crystal display panel 400 comprises an upper substrate 410 and a lower substrate 420. The liquid crystal display panel 400, for example, is a thin-film transistor liquid crystal display (TFT LCD) panel, where the upper substrate 410, for example, is a CF substrate, and the lower substrate 420, for example, is a TFT substrate. On the outer sides of the CF substrate 410 and the TFT substrate 420, there is the polarizing plate 460 used to polarize the light into polarized light. The liquid crystal display panel 400 formed from the CF substrate 410 and the TFT substrate 420 has a display area 430 and a frame adhesive area 440 surrounding the display area 430.

In the display area 430, the TFT substrate 420 has a covering layer extending from the display area 430 to the frame adhesive area 440. This covering layer includes a first metal layer 421, such as a scanning line metal layer, a dielectric layer 422, a second metal layer 423, such as a data line metal layer, and a protective layer 424.

The dielectric layer 422 is covered on top of the first metal layer 421, and the second metal layer 423 is covered on top of the dielectric layer 422, while the protective layer 424 is covered on top of the second metal layer 423. Between the protective layer 424 and the CF substrate 410 lies a liquid crystal injection area 450. The dielectric layer 422, for example, is a layer of silicon nitride (SiN_x), while the protective layer 424 can be composed of silicon nitride (Si_3N_4) or silicon dioxide (SiO_2).

In the frame adhesive area 440, the first metal layer 421, the dielectric layer 422, the second metal layer 423, and the protective layer 424 on the TFT substrate 420 have a common groove or opening 4120 exposing a portion of the TFT substrate 420.

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Through the groove or opening 4120, the frame adhesive 412 makes lateral contact with the liquid crystal injection area 450, the protective layer 424, the second metal layer 423, the dielectric layer 422, and the first metal layer 421 in the display area 430, while the frame adhesive 312 penetrates into the opening 4120, making it contact with the surface of the TFT substrate 420.

During the assembly process of the TFT substrate 420 and the CF substrate 410, the frame adhesive 412 in the frame adhesive area 440 penetrates into the groove or opening 4120, making lateral contact with the liquid crystal injection area 450, the protective layer 424, the second metal layer 423, the dielectric layer 422, and the first metal layer 421, while the frame adhesive 312 contacts with the surface of the TFT substrate 420. Then, using a pressing tool, the CF substrate 410 and the TFT substrate 420 are pressed together and baked in an oven, causing the frame adhesive 412 to harden, thereby bonding the TFT substrate 420 to the CF substrate 410.

From the above two embodiments, it is evident that the display panel completed by bonding after assembly is achieved by increasing the space occupied by the frame adhesive through the groove or opening, allowing more adhesive to penetrate into the groove or opening successively, effectively enhancing the bonding strength between the TFT substrate and the CF substrate. In addition, the shape of the groove or opening in the display panel of the present invention is not limited to a specific type. Apart from the elongated shape of the groove or opening 3120 in the first embodiment, the shape of the groove or opening can also be X-shaped (as shown in Figure 5A) or matrix-shaped (as shown in Figure 5B). Figure 5A illustrates the shape of the groove or opening, while Figure 5B illustrates another shape of the groove or opening.

Moreover, the distribution of the frame adhesive is not limited to being coated on the same plane. For example, please refer to Figure 6A, which is a schematic diagram illustrating the distribution of the frame adhesive. The covering layer on the TFT substrate 620, from bottom to top, includes: a first metal layer 621, a dielectric layer 622, a second metal layer 623, and a protective layer 624. The groove or opening 6120 in the profile of the covering layer on the TFT substrate 620 is distributed in a V-shaped manner. Alternatively, the groove or opening 6120 in the profile of the first metal layer 621, the dielectric layer 622, the second metal layer 623, and the protective layer 624 is distributed in a stepped manner, as shown in Figure 6B, which illustrates another distribution of the frame adhesive.

Therefore, when subjected to external impact or vibration forces, the increased space occupied by the frame adhesive between the TFT substrate and the CF substrate enhances the bonding strength between them. This can prevent the occurrence of cracks at the interface between the TFT substrate and the CF substrate, thereby effectively improving the quality of the panel.

While the present invention has been described with reference to specific embodiments, those skilled in the art should understand that the above embodiments are merely illustrative of the present invention and that various changes and modifications may be made therein without departing from the scope of the present invention. Therefore, they are not intended to limit the present invention. Any variations or modifications to the embodiments described above that fall within the essential spirit of the present invention will be within the scope of the claims of the present invention.

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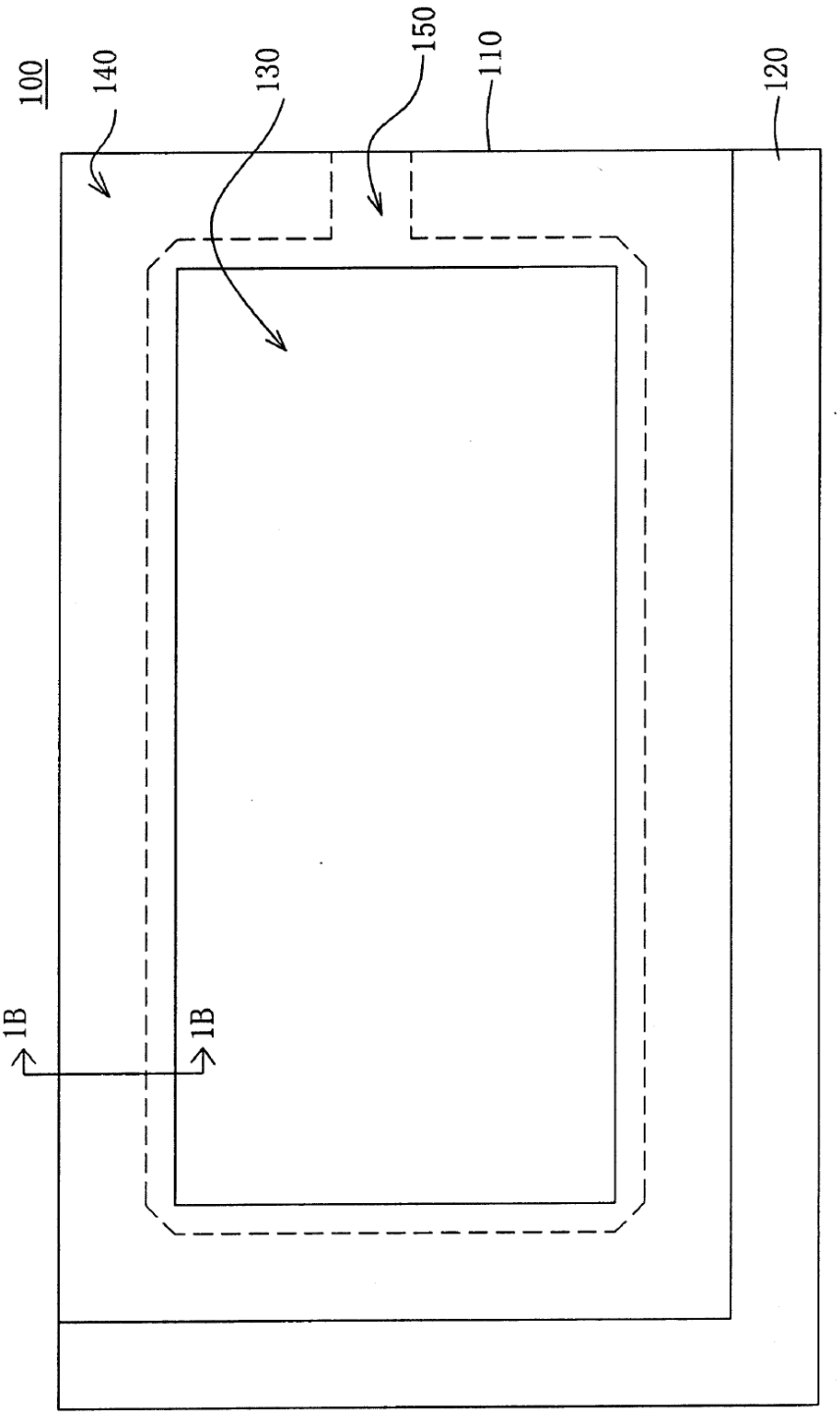

Fig. 1A

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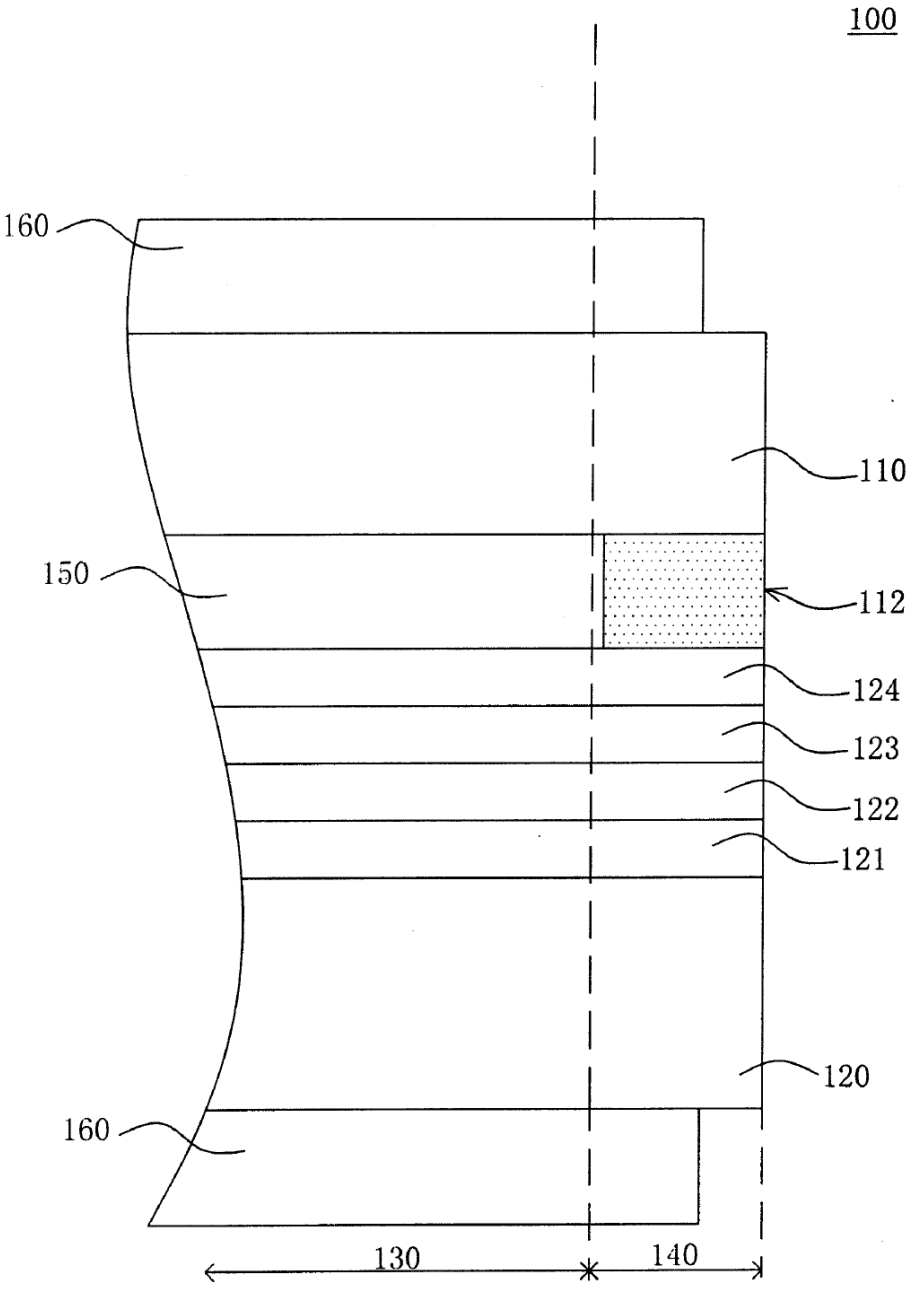

Fig. 1B

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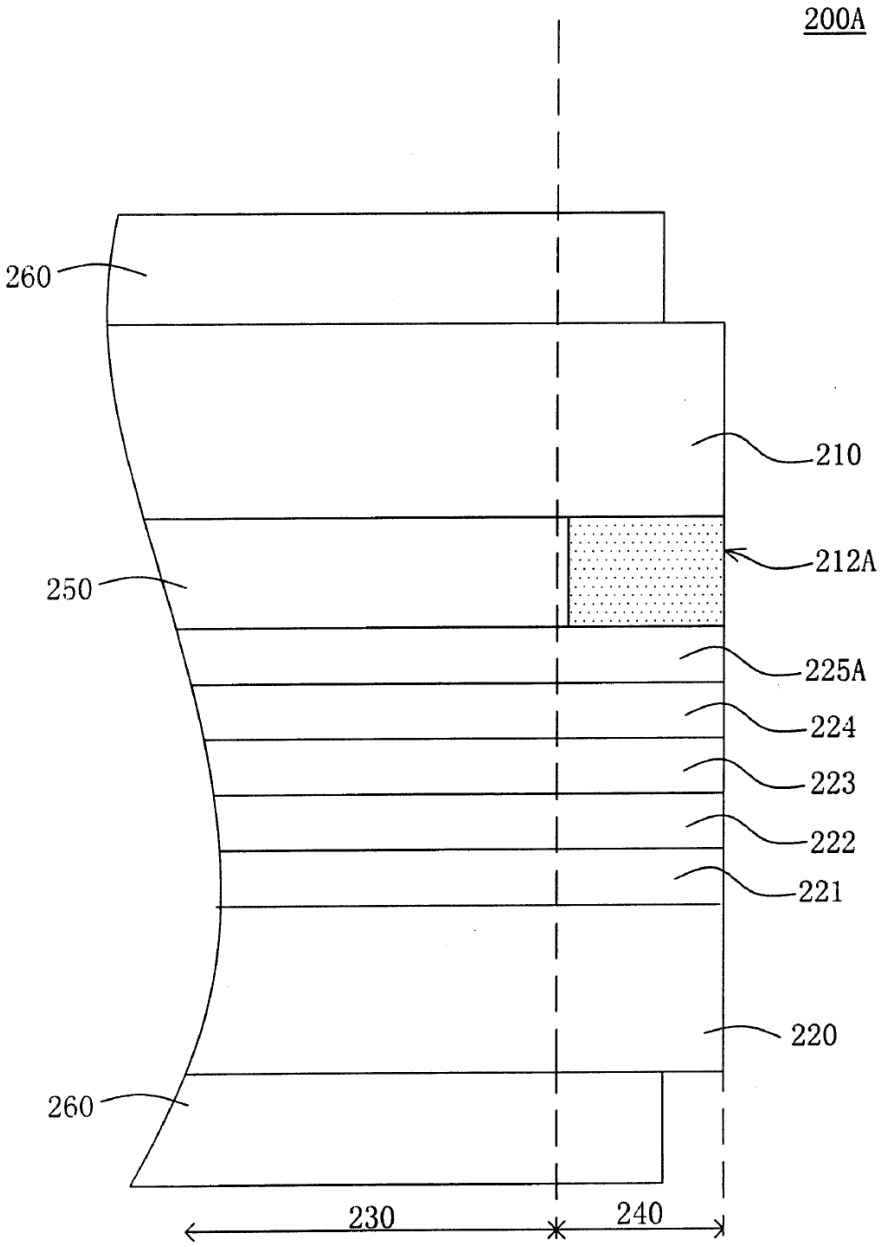

Fig. 2A

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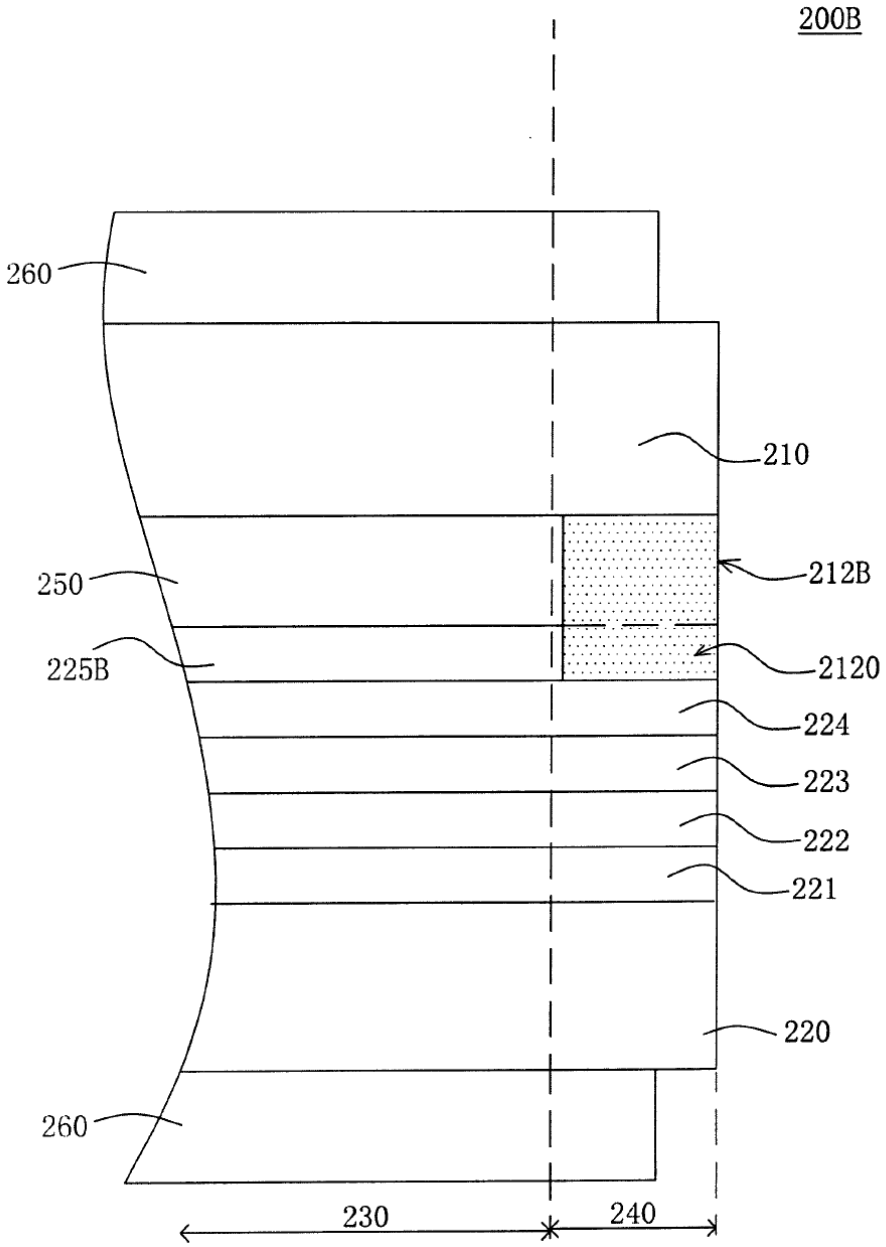

Fig. 2B

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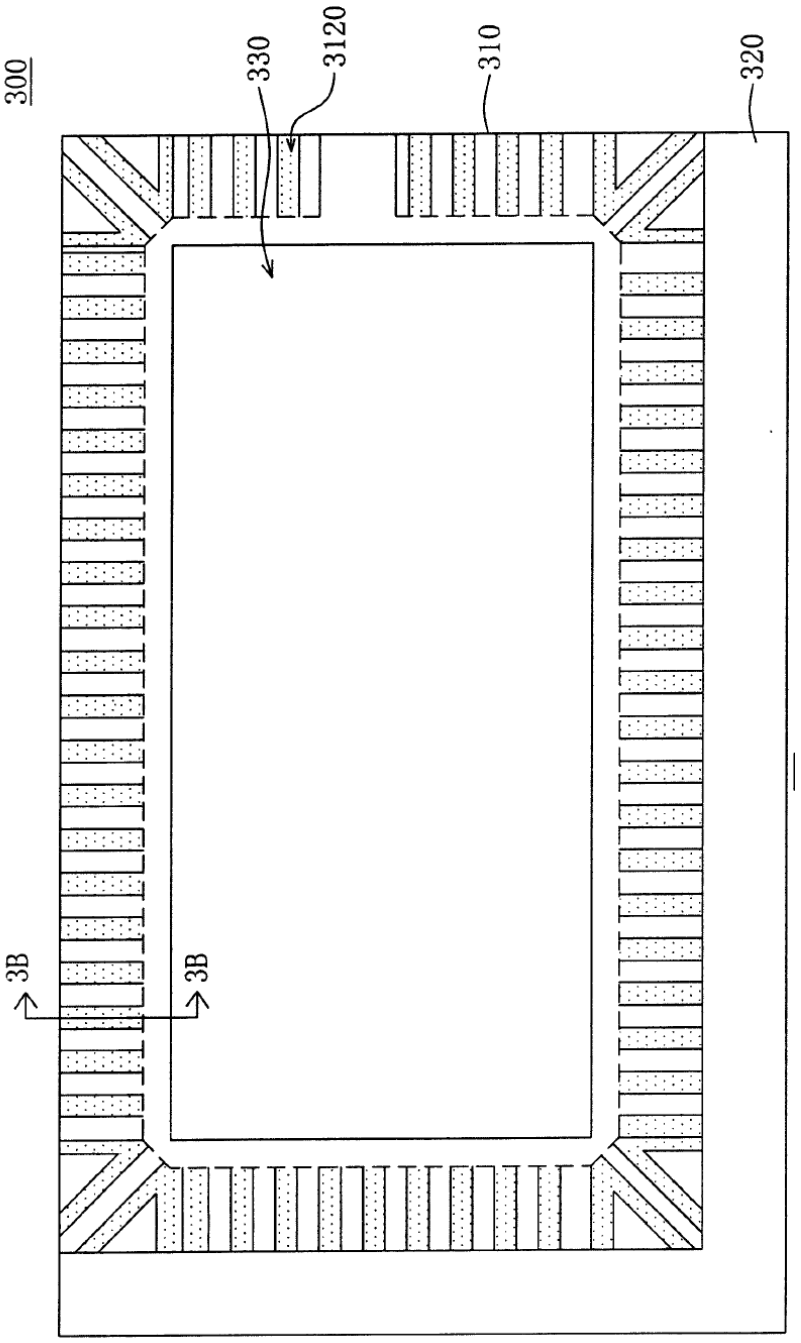

Fig. 3A

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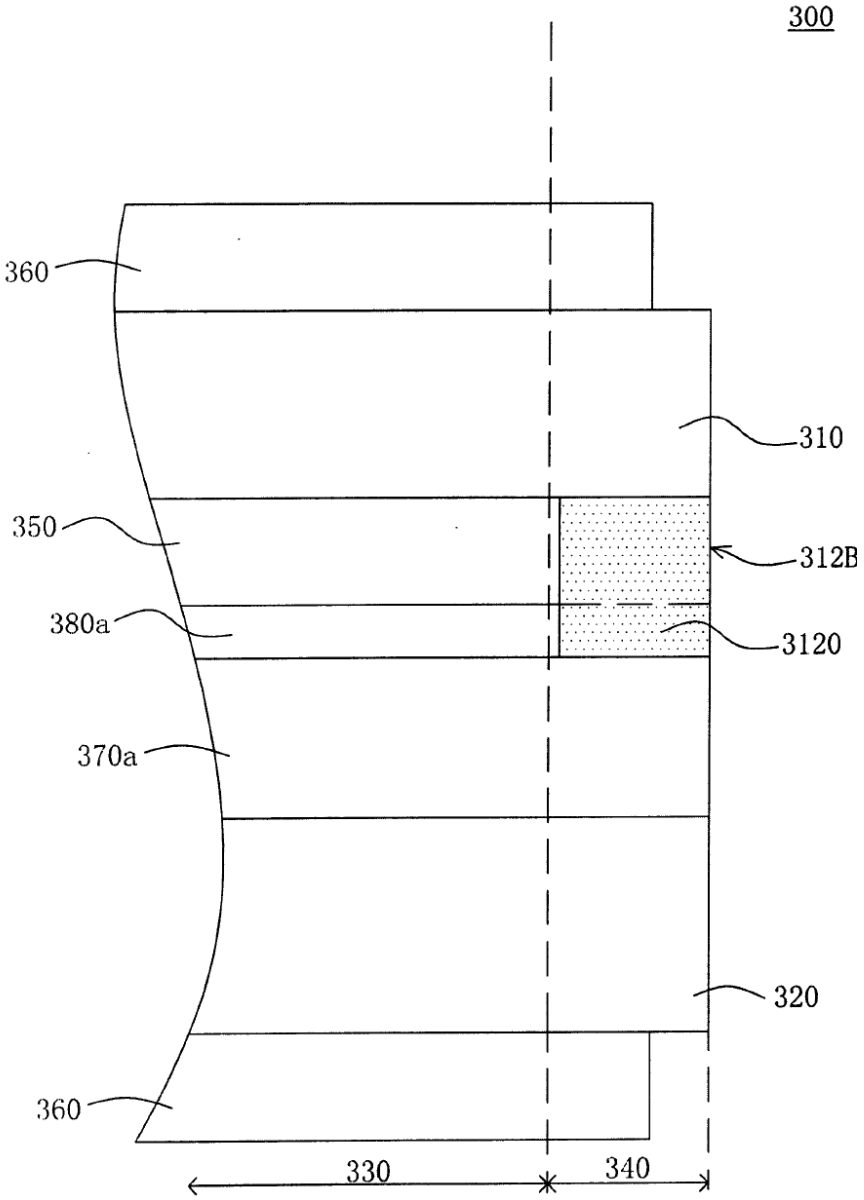

Fig. 3B

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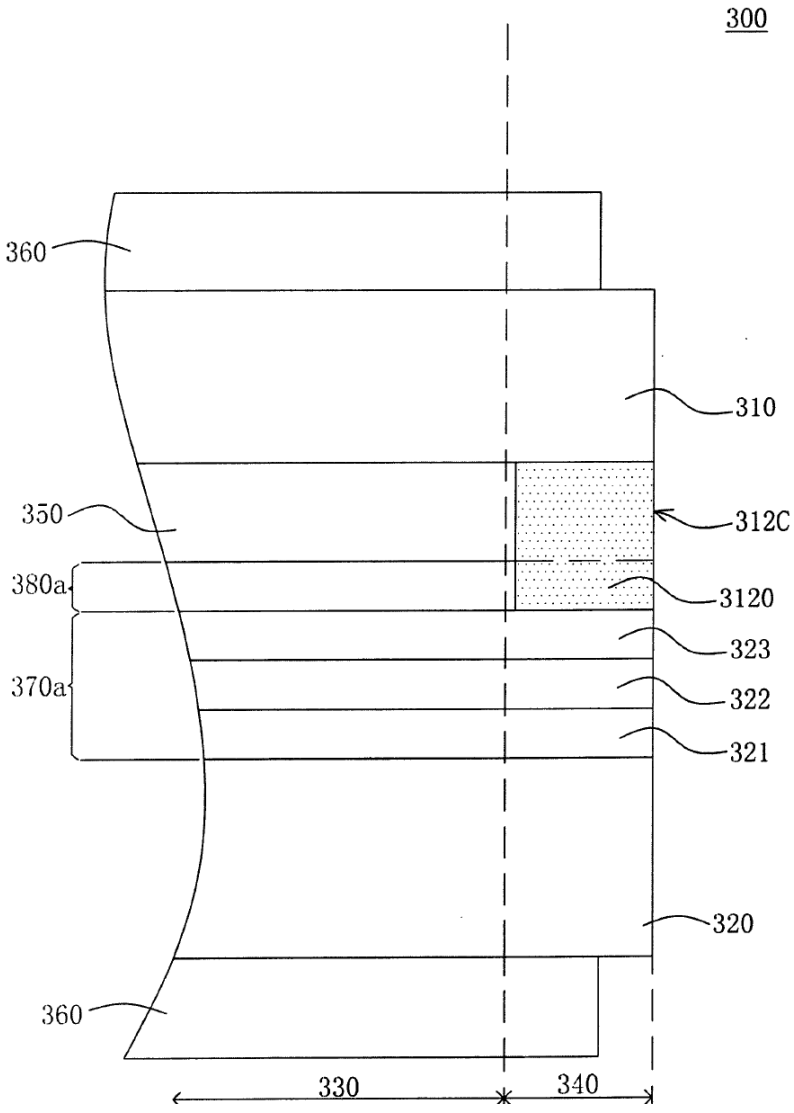

Fig. 3C

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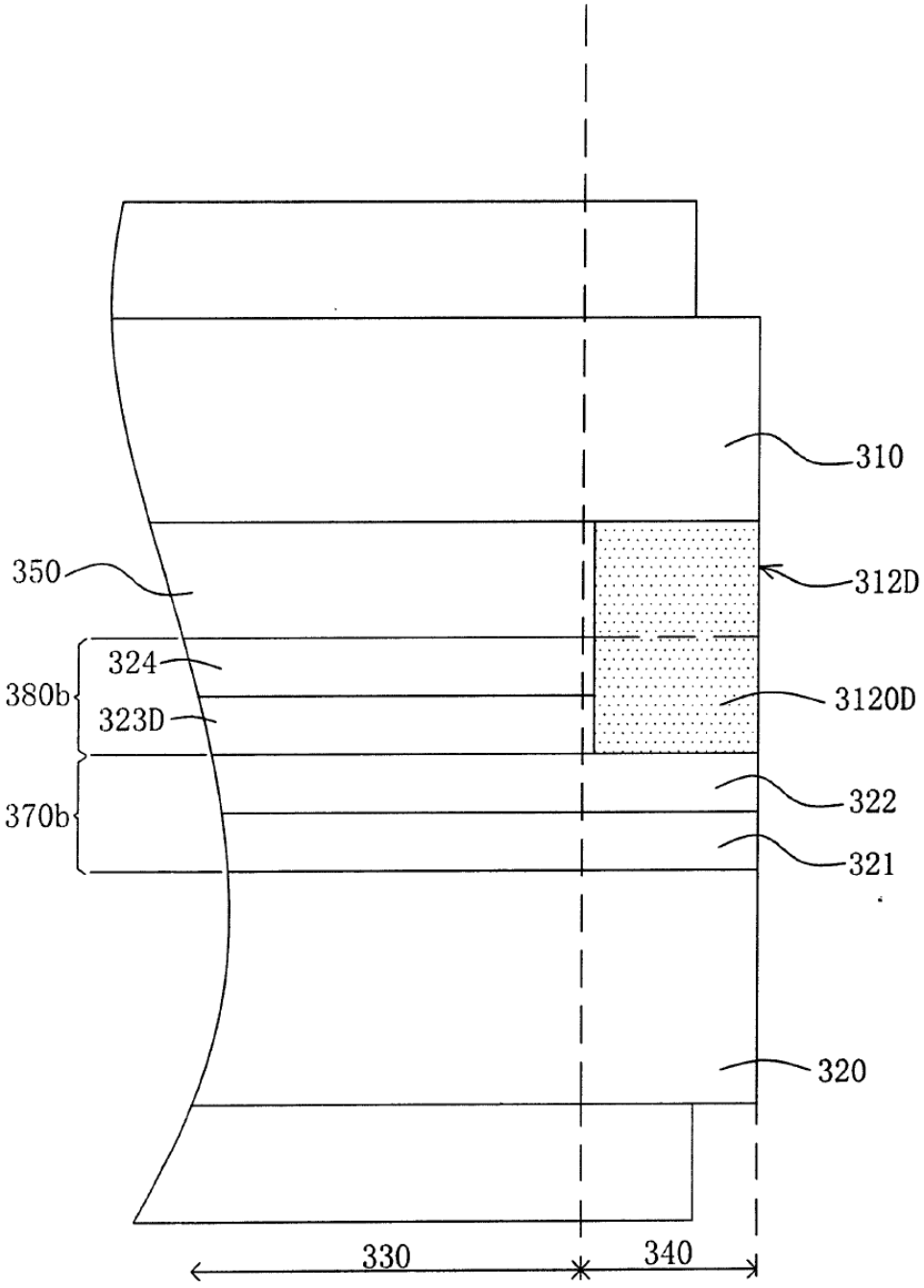

Fig. 3D

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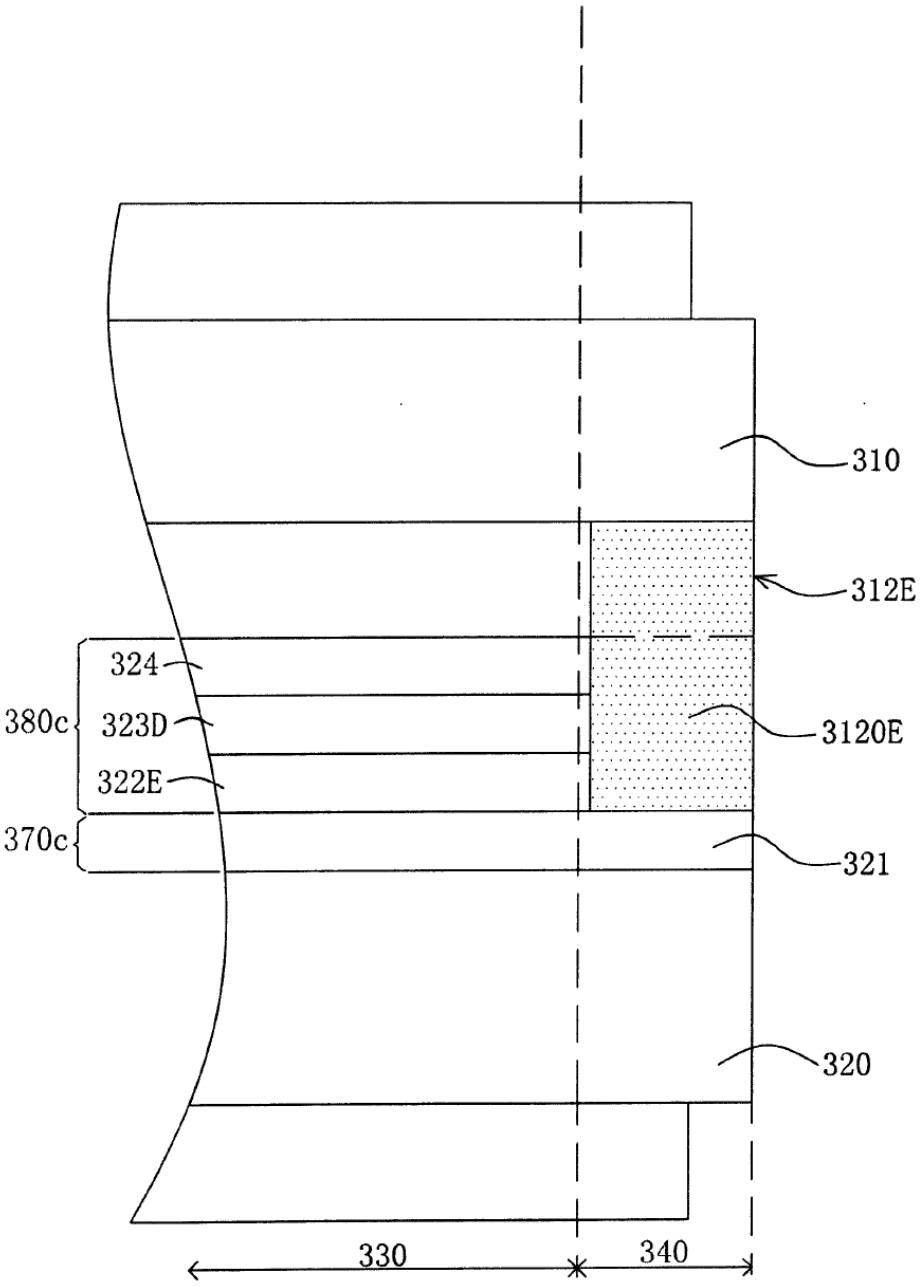

Fig. 3E

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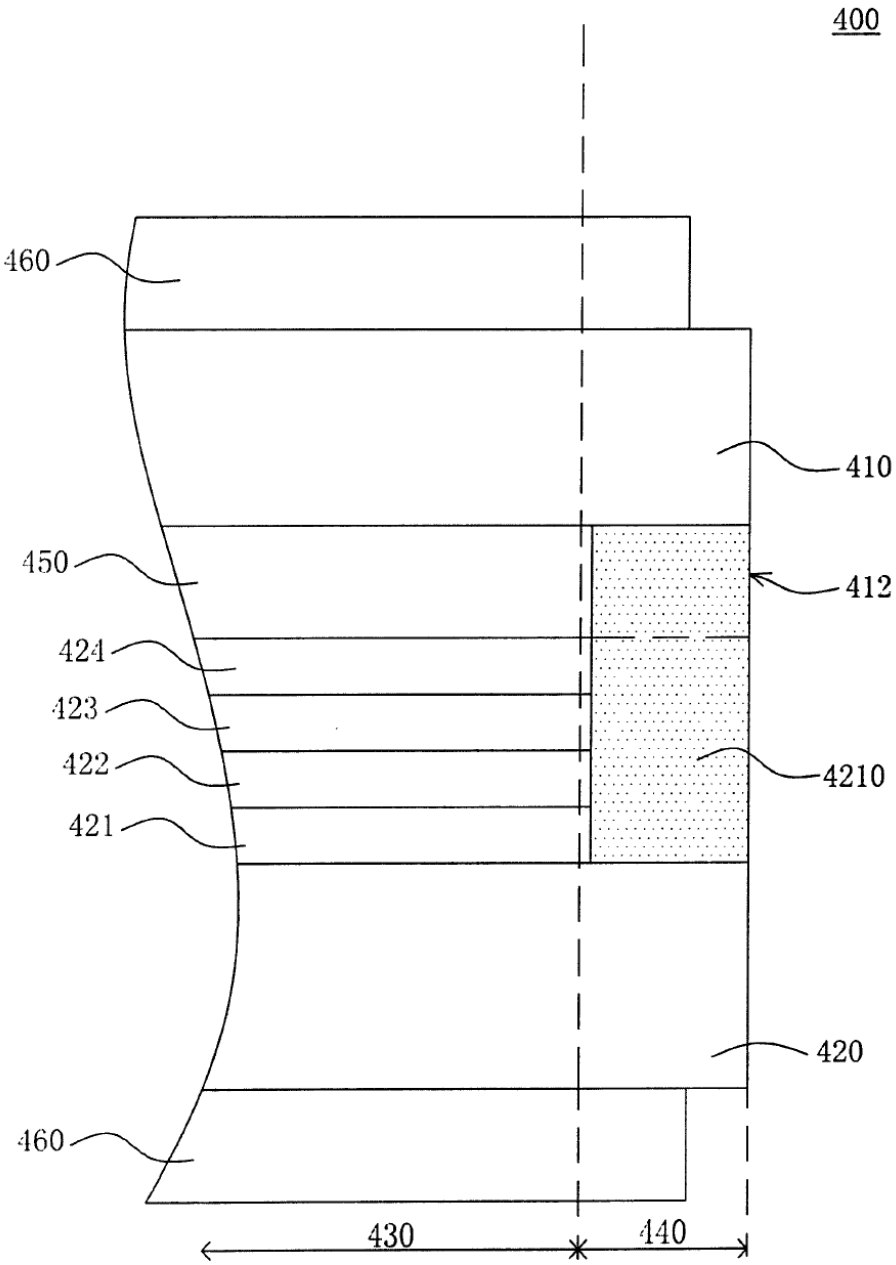

Fig. 4

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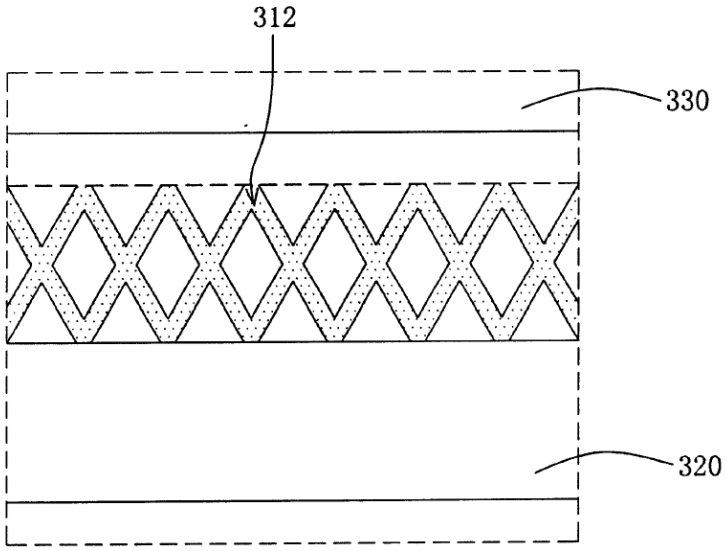

Fig. 5A

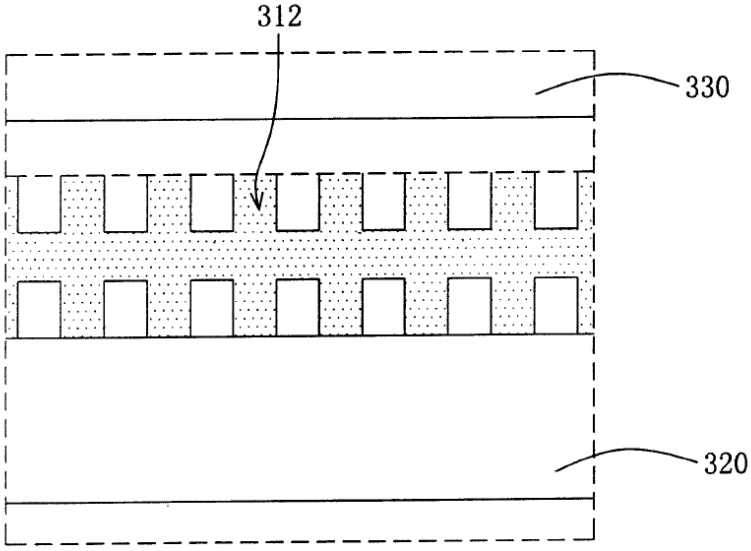

Fig. 5B

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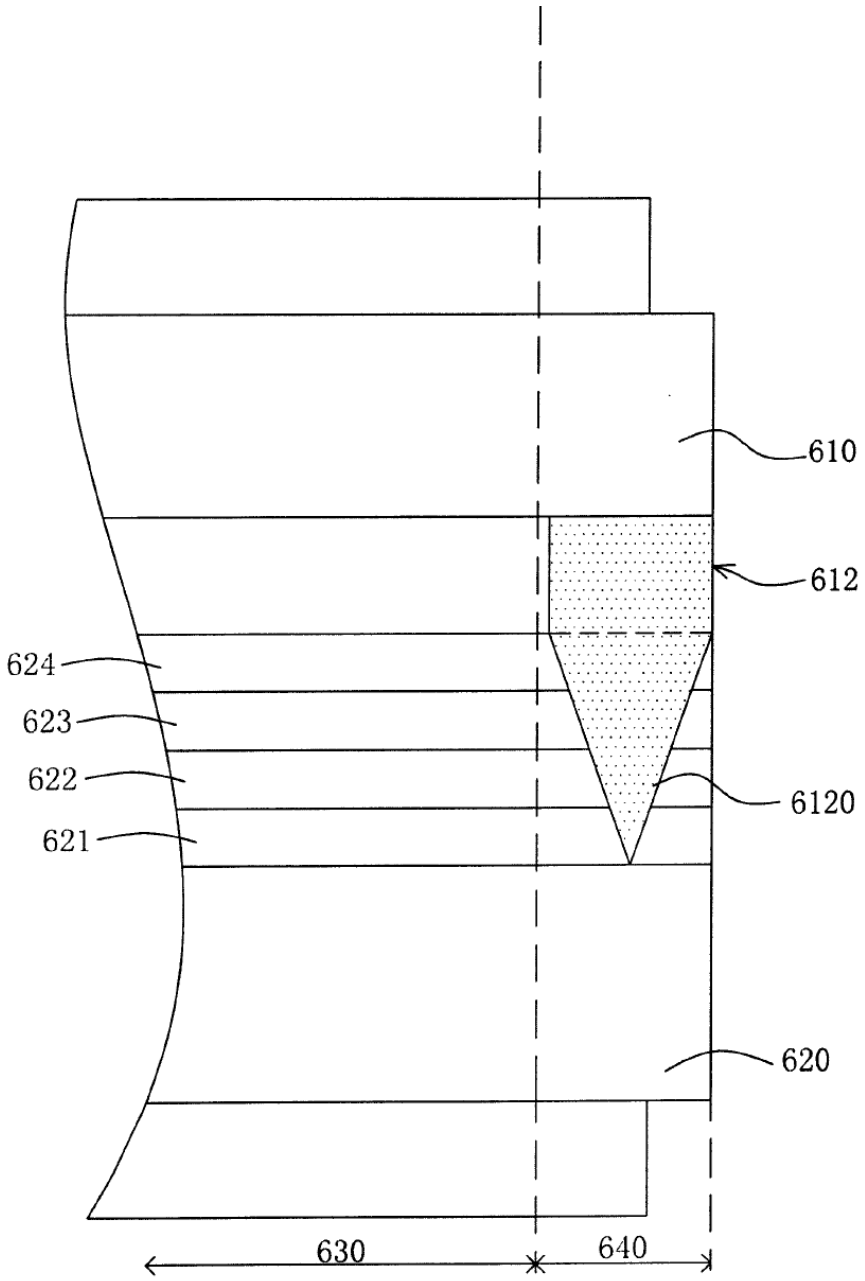

Fig. 6A

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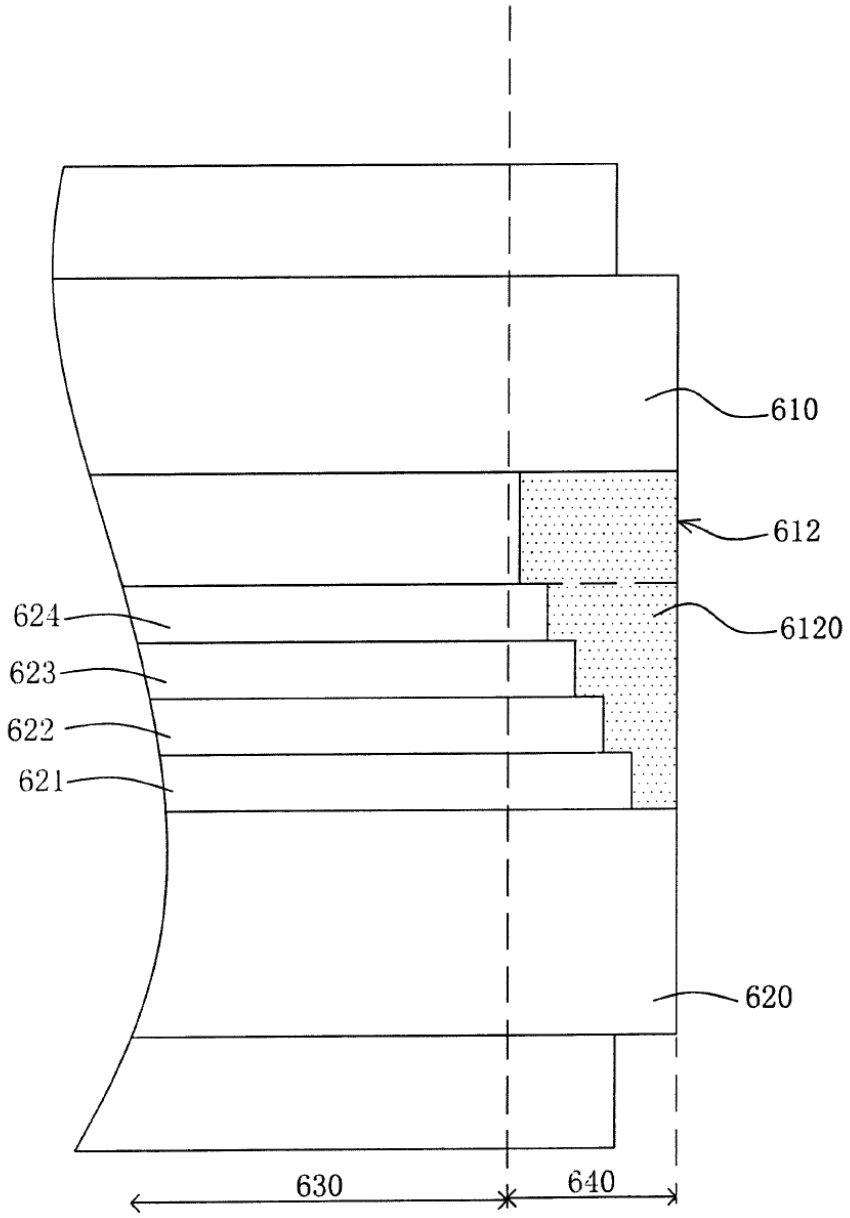

Fig. 6B

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[19] 中华人民共和国国家知识产权局

[51] Int. Cl[7]
G02F 1/1333

[12] 发明专利申请公开说明书

[21] 申请号 200310102858.0

[43] 公开日 2004 年 10 月 20 日

[11] 公开号 CN 1538212A

[22] 申请日 2003.10.22
[21] 申请号 200310102858.0
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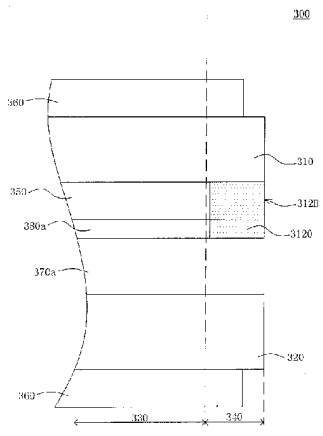
权利要求书 3 页 说明书 9 页 附图 13 页

[54] 发明名称 显示器面板框胶结构

[57] 摘要

一种显示器面板框胶结构，包括有上基板、下基板及涂布于上基板与下基板之间的框胶。下基板具有第一覆盖层，第一覆盖层上方覆有第二覆盖层，且第二覆盖层具有一可暴露出部分的第一覆盖层的凹槽/开口。其中，框胶通过凹槽/开口与第一覆盖层接触，藉此使下基板与上基板黏合。在此，第一覆盖层与第二覆盖层由下至上共包括：第一金属层、介电层、第二金属层与保护层。本发明可以承受较大的因使用疏忽所造成的冲击外力或振动外力，避免在上基板与下基板之间产生破坏裂痕，进而影响面板的显示品质。



ISSN1008-4274

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1. 一种显示器面板框胶结构，包括：

一上基板；

一下基板，相对于该上基板配置，该下基板包括：

一第一覆盖层，位于该下基板上；以及

一第二覆盖层，位于该第一覆盖层上，且该第二覆盖层具有一可暴露出部分的该第一覆盖层的凹槽/开口；以及

一框胶，是涂布于该上基板与该下基板之间，该框胶是通过该凹槽/开口与该第一覆盖层接触，藉此使该下基板与该上基板黏合。

2. 如权利要求 1 所述的显示器面板框胶结构，其特征在于该第一覆盖层包括一第一金属层、一介电层与一第二金属层，该介电层是覆盖于该第一金属层上，而该第二金属层是覆盖于该介电层上；该第二覆盖层是一保护层。

3. 如权利要求 1 所述的显示器面板框胶结构，其特征在于该第一覆盖层包括一第一金属层与一介电层，该介电层是覆盖于该第一金属层上；该第二覆盖层包括一第二金属层与一保护层，该保护层是覆盖于该第二金属层上。

4. 如权利要求 1 所述的显示器面板框胶结构，其特征在于该第一覆盖层是一第一金属层；该第二覆盖层包括一保护层、一第二金属层与一介电层，该第二金属层是覆盖于该介电层上，该保护层是覆盖于该第二金属层上。

5. 如权利要求 1 所述的显示器面板框胶结构，其特征在于该凹槽/开口为长条形。

6. 如权利要求 2 至 4 之任一项所述的显示器面板框胶结构，其特征在于该第一金属层，是扫瞄线金属层；该第二金属层，是数据线金属层；而构成该保护层的材料可为二氧化硅(SiO_2)或氮化硅(Si_3N_4)。

7. 如权利要求 1 所述的显示器面板框胶结构，其特征在于该凹槽/开口为 X 字形。

8. 如权利要求 1 所述的显示器面板框胶结构，其特征在于该凹槽/开口为矩阵形。

9. 如权利要求 1 所述的显示器面板框胶结构，其特征在于该凹槽/开口于

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该第二覆盖层的剖面中呈 V 字形分布。

10. 如权利要求 1 所述的显示器面板框胶结构，其特征在于该凹槽/开口于该第二覆盖层的剖面中呈阶梯状分布。

11. 如权利要求 1 所述的显示器面板框胶结构，其特征在于该显示器面板是一薄膜晶体管液晶显示器面板，该上基板是一彩色滤光片基板，而该下基板是一薄膜晶体管基板。

12. 一种显示器面板框胶结构，包括：

一上基板；

一下基板，具有一覆盖层，该覆盖层具有一可暴露出部分的该下基板的凹槽/开口；以及

一框胶，是涂布于该上基板与该下基板之间，且该框胶通过该凹槽/开口与该下基板接触，藉此使该下基板与该上基板黏合；

其中，该覆盖层包括一保护层、一第二金属层、一介电层与一第一金属层，该介电层是覆盖于该第一金属层上，该第二金属层是覆盖于该介电层上，该保护层是覆盖于该第二金属层上。

13. 如权利要求 12 所述的显示器面板框胶结构，其特征在于该第一金属层是扫瞄线金属层；该第二金属层是数据线金属层；而构成该保护层的材料可为二氧化硅或氮化硅。

14. 如权利要求 12 所述的显示器面板框胶结构，其特征在于该凹槽/开口为长条形。

15. 如权利要求 12 所述的显示器面板框胶结构，其特征在于该凹槽/开口为 X 字形。

16. 如权利要求 12 所述的显示器面板框胶结构，其特征在于该凹槽/开口为矩阵形。

17. 如权利要求 12 所述的显示器面板框胶结构，其特征在于该凹槽/开口于该覆盖层的剖面中呈 V 字形分布。

18. 如权利要求 12 所述的显示器面板框胶结构，其特征在于该凹槽/开口于该覆盖层的剖面中呈阶梯状分布。

19. 如权利要求 12 所述的显示器面板框胶结构，其特征在于该显示器面

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板是一薄膜晶体管液晶显示器面板，该上基板是一彩色滤光片基板，而该下基板是一薄膜晶体管基板。

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显示器面板框胶结构

(1)技术领域

本发明有关一种显示器面板框胶结构，且特别是有关一种具有较佳接合强度的显示器面板框胶结构。

(2)背景技术

对于一般液晶显示器面板，可分成显示区与位于显示区外围的框胶区。而在薄膜晶体管液晶显示器面板框胶区中，薄膜晶体管(Thin Film Transistor, TFT)基板上通常会具有多层覆盖层，由下至上依次覆盖包括如一扫瞄线金属层、一材质例如是氮化硅类(SiN_x)所构成的介电层层、一数据线金属层以及一用以保护晶体管组件的保护层，而对于反射式与半穿透半反射式薄膜晶体管液晶显示器面板而言，除了上述的覆盖层外，于保护层上方有时则会多覆盖一层光阻层(Photoresist Layer, PL)。

请参照图 1A，其是习知的液晶显示器面板的示意图。液晶显示器面板 100 包括有一彩色滤光片(Color Filter substrate, CF)基板 110 以及一位于 CF 基板 110 下方的薄膜晶体管(TFT)基板 120。由 CF 基板 110 与 TFT 基板 120 所组成的显示器面板 100，具有一显示区 130、一环绕显示区 130 的框胶区 140 以及一液晶注入区 150。

图 1B 是图 1A 中液晶显示器面板的剖面图。请参照图 1B，于 CF 基板 110 与 TFT 基板 120 的外侧各设有一偏光板 160，用以将光线偏极化而成偏极光。在显示区 130 中，于 TFT 基板 120 上，具有一覆盖层，包括一第一金属层 121、一介电层 122、一第二金属层 123 以及一保护层 124，介电层 122 例如是一氮化硅类(SiN_x)层，而保护层 124 是由氮化硅(silicon nitride, Si_3N_4)或是由二氧化硅(silicon dioxide, SiO_2)所构成。第一金属层 121 例如是一扫瞄线金属层而第二金属层 123 例如是一数据线金属层。

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介电层 122 覆盖于第一金属层 121 上，第二金属层 123 覆盖于介电层 122 上，而保护层 124 覆盖于第二金属层 123 上。于显示区 130 中，介于 CF 基板 110 与保护层 124 之间为一液晶注入区 150，则是预留作为液晶注入之用。另外，在框胶区 140 中，TFT 基板 120 上则具有由显示区 130 延展至框胶区 140 的第一金属层 121、介电层 122、第二金属层 123 以及保护层 124。而对于分布于显示区 130 的液晶注入区 150，于框胶区 140 则与框胶 112 接触，框胶 112 是涂布于 CF 基板 110 与 TFT 基板 120 之间。

当进行 TFT 基板 120 与 CF 基板 110 的对组制程时，框胶区 140 中的框胶 112 是与 TFT 基板 120 上方的保护层 124 接触。然后，以工装用具加压的方式压合 CF 基板 110 与 TFT 基板 120，并入炉烘烤，使框胶 112 硬化，藉此使 TFT 基板 120 与 CF 基板 110 黏合。

请参照图 2A，其是习知的反射式液晶显示器面板的侧视图。反射式液晶显示器面板 200A 包括有一 CF 基板 210 以及一位于 CF 基板 210 下方的 TFT 基板 220。于 CF 基板 210 与 TFT 基板 220 的外侧各设有一偏光板 260，用以将光线偏极化，而成偏极光。由 CF 基板 210 与 TFT 基板 220 所组成的显示器面板 200A，具有一显示区 230 以及一环绕显示区 230 的框胶区 240。

在显示区 230 中，于 TFT 基板 220 上，具有一覆盖层，包括一第一金属层 221、一介电层 222、一第二金属层 223、一保护层 224 以及一光阻层 225A。介电层 222 例如是一氮化硅类(SiN_x)层、保护层 224 可以由氮化硅(Si_3N_4)或是二氧化硅(SiO_2)所构成，而光阻层 225A 则可以由有机材料构成。

介电层 222 覆盖于第一金属层 221 上，第二金属层 223 覆盖于介电层 222 上，而保护层 224 覆盖于第二金属层 223 上，光阻层 225A 覆盖于保护层 224 上。于显示区 230 中，介于 CF 基板 210 与光阻层 225 之间为一液晶注入区 250，则是预留作为液晶注入之用。另外，在框胶区 240 中，TFT 基板 220 上则具有由显示区 230 延展至框胶区 240 的第一金属层 221、介电层 222、第二金属层 223、保护层 224 以及光阻层 225A。而分布于显示区 230 的液晶注入区 250，于框胶区 240 中则与框胶 212A 接触，框胶 212A 是涂布于 CF 基板 210 与 TFT 基板 220 之间。在此，反射式液晶显示器面板 200A 与一般液晶显示器面板 100 的差别在于反射式液晶显示器面板 200A 的 TFT 基板 220 上多了一光阻层 225A 覆盖于保护层 224 上。

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图 2B 是传统的另一反射式液晶显示器面板的侧视图。请参照图 2B，与图 2A 的反射式液晶显示器面板 200A 相同，反射式液晶显示器面板 200B 包括有一 CF 基板 210 以及一位于 CF 基板 210 下方的 TFT 基板 220。于 CF 基板 210 与 TFT 基板 220 的外侧各设有一偏光板 260，用以将光线偏极化而成偏极光。由 CF 基板 210 与 TFT 基板 220 所组成的显示器面板 200B 具有一显示区 230 以及一环绕显示区 230 的框胶区 240。

在显示区 230 中，于 TFT 基板 220 上具有一覆盖层，包括一例如是扫瞄线金属层的第一金属层 221、一介电层 222、一例如是数据线金属层的第二金属层 223、一保护层 224 以及一光阻层 225。介电层 222 例如是一氮化硅类(SiN_x)层、保护层 224 可以由氮化硅(Si_3N_4)或是二氧化硅(SiO_2)所构成，而光阻层 225 则可以由有机材料构成。

介电层 222 覆盖于第一金属层 221 上，第二金属层 223 覆盖于介电层 222 上，而保护层 224 覆盖于第二金属层 223 上，光阻层 225 覆盖于保护层 224 上。于显示区 230 中，介于 CF 基板 210 与光阻层 225 之间为一液晶注入区 250，则是预留作为液晶注入之用。

在此，与图 2A 的显示器面板 200A 所不同的是，在显示器面板 200B 的框胶区 240 中，TFT 基板 220 上具有由显示区 230 延展至框胶区 240 的第一金属层 221、介电层 222、第二金属层 223、保护层 224 以及光阻层 225B，且光阻层 225B 具有一可暴露出部分的保护层 224 的开口 2120。因此，对于分布于显示区 230 的液晶注入区 250，于框胶区 240 中，液晶注入区 250 则与框胶 212B 接触，且框胶 212B 通过开口 2120 与保护层 224 接触。

当进行 TFT 基板 220 与 CF 基板 210 的黏合制程时，框胶区 240 中的框胶 212B 是与显示区 230 中的液晶注入区 250 以及光阻层 225B 接触，并同时框胶 212B 渗入开口 2120 而与 TFT 基板 220 上方的保护层 224 接触。然后，以工装用具加压的方式压合 CF 基板 210 与 TFT 基板 220，并入炉烘烤，使框胶 212B 硬化，藉此使 TFT 基板 220 与 CF 基板 210 黏合并对组。

然而，经对组完成的液晶显示器面板 100、200A 以及 200B 的液晶显示器面板的接合强度不足，往往在对面板进行可靠性测试(reliability test)或落下测试时，极容易因冲击外力或振动外力，而于 TFT 基板与 CF 基板的接触界面处产生

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裂痕，造成显示器面板的毁损，影响显示器面板的品质甚巨。

(3)发明内容

有鉴于此，本发明的目的就是提供一种具有较大的接合强度的显示器面板框胶结构，通过增加框胶的接触面积，使较多的框胶渗入凹槽或开口中，以使得 TFT 基板与 CF 基板之间的接合强度变大，而能够承受较大的冲击外力或振动外力，避免在 CF 基板与 TFT 基板之间产生破坏裂痕，进而影响面板的显示品质。

为达到本发明的目的，根据本发明一方面的一种显示器面板框胶结构，包括有上基板、下基板及涂布于上基板与下基板之间的框胶。下基板相对于该上基板配置，且下基板上具有第一覆盖层与其上的第二覆盖层。第二覆盖层具有一可暴露出部分的第一覆盖层的凹槽/开口，使得框胶可通过凹槽/开口与第一覆盖层接触，藉此使下基板与上基板黏合。

为达到本发明的目的，根据本发明另一方面的一种显示器面板框胶结构，包括有上基板、下基板及涂布于上基板与下基板之间的框胶。下基板具有一覆盖层，且此覆盖层具有一可暴露出部分的下基板的凹槽/开口，框胶通过此凹槽/开口与下基板接触，藉此使下基板与上基板黏合。覆盖层由上至下包括保护层、第二金属层、介电层与第一金属层。介电层覆盖于第一金属层上，第二金属层覆盖于介电层上，而保护层覆盖于第二金属层上。

为进一步说明本发明的上述目的、结构特点和效果，以下将结合附图对本发明进行详细的描述。

(4)附图说明

图 1A 是习知的液晶显示器面板的示意图。

图 1B 是图 1A 中液晶显示器面板的剖面图。

图 2A 是习知的反射式液晶显示器面板的侧视图。

图 2B 是习知的另一反射式液晶显示器面板的侧视图。

图 3A 是依据本发明第一实施例的液晶显示器面板的示意图。

图 3B 是图 3A 中液晶显示器面板的剖面图。

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图 3C 是第一实施例的第二显示器面板的示意图。

图 3D 是第一实施例的第三显示器面板的示意图。

图 3E 是第一实施例的第四显示器面板的示意图。

图 4 是依据本发明第二实施例的液晶显示器面板的侧视图。

图 5A 是凹槽/开口形状的示意图。

图 5B 是另一凹槽/开口形状的示意图。

图 6A 是框胶分布的示意图。

图 6B 是另一框胶分布的示意图。

(5)具体实施方式

第一实施例

本实施例的主要目的在于增加框胶的接触面积，使较多的框胶渗入凹槽/开口中，藉以提高 TFT 基板与 CF 基板之间的接合强度。请同时参照图 3A 与图 3B。图 3A 是依据本发明第一实施例的液晶显示器面板的示意图，而图 3B 是图 3A 中液晶显示器面板的剖面图。液晶显示器面板 300 包括有一上基板 310 以及一下基板 320。液晶显示器面板 300 例如是一薄膜晶体管液晶显示器面板、上基板 310 是一 CF 基板，而下基板 320 是一 TFT 基板。于 CF 基板 310 与 TFT 基板 320 的外侧各设有一偏光板 360，用以将光线偏极化而成偏极光。由 CF 基板 310 与 TFT 基板 320 合成的液晶显示器面板 300，具有一显示区 330 及一环绕显示区 330 的框胶区 340。

在显示区 330 中，于 TFT 基板 320 上主要具有二覆盖层：第一覆盖层 370a 与第二覆盖层 380a，且第二覆盖层 380a 是位于第一覆盖层 370a 之上。介于第二覆盖层 380a 与 CF 基板 310 之间为一液晶注入区 350。在框胶区 340 中，TFT 基板 320 上还具有由显示区 330 所延伸的二覆盖层 370a 及 380a。在此，第二覆盖层 380a 具有一可暴露出部分的覆盖层 370a 的凹槽/开口 3120，凹槽/开口 3120 为长条形。

框胶 312B 涂布于 CF 基板 310 与 TFT 基板 320 之间，并位于框胶区 340 中。因此，对于分布于显示区 330 的液晶注入区 350，于框胶区 340 中，液晶注入区 350 则与框胶 312B 接触，且框胶 312 通过凹槽/开口 3120 与第一覆盖

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层 370a 接触。

当进行 TFT 基板 320 与 CF 基板 310 的对组制程时，框胶区 340 中的框胶 312B 是与显示区 330 中的液晶注入区 350 以及第二覆盖层 380a 作侧面接触，并同时框胶 312B 渗入凹槽/开口 3120 而与 TFT 基板 320 上方的第一覆盖层 370a 表面接触。然后，以工装用具加压的方式压合 CF 基板 310 与 TFT 基板 320，并入炉烘烤，使框胶 312B 硬化，藉此使 TFT 基板 320 与 CF 基板 310 黏合并对组。

于图 3B 中，TFT 基板 320 上的第一覆盖层 370a 与第二覆盖层 380a 都是单层的结构。然而，一般而言，第一覆盖层 370a 与第二覆盖层 380a 共包括四层：一第一金属层(metal 1，M1)、一介电层、一第二金属层(metal 2，M2)以及一保护层。请参照图 3C，其是第一实施例的第二显示器面板的示意图。第一覆盖层 370a 共包括三层：第一金属层 321、介电层 322、第二金属层 323，而第二覆盖层 380a 则为一保护层 324。介电层 322 是覆盖于第一金属层 321 上，第二金属层 323 是覆盖于介电层 322 上，而保护层 324 则覆盖于第二金属层 323 上。第一金属层 321 例如是一扫瞄线金属层，而第二金属层 323 例如是一数据线金属层。介电层 322 例如是一氮化硅类(SiN_x)层，而保护层 324 则由二氧化硅(silicon dioxide,SiO_2)或是氮化硅(silicon nitride, Si_3N_4)所构成。于图 3B 中所述，第二覆盖层 380a 具有一可暴露出部分的第一覆盖层 370a 的开口 3120，在此，第二覆盖层 380a 即是指保护层 324，而开口 3120 可暴露出部分的第二金属层 323。框胶 312C 是与显示区 330 中的液晶注入区 350 以及保护层 324 作侧面接触，并同时框胶 312C 渗入开口 3120 而与第二金属层 323 的表面接触。

本发明的主要作法在于增加框胶的接触面积，使较多的框胶渗入凹槽/开口中，藉以提高 TFT 基板与 CF 基板之间的接合强度。由于第一覆盖层 370a 与第二覆盖层 380a 共包括四层，若将开口逐次往下层扩大，便可达到增加框胶接触面积，使较多的框胶渗入开口中，藉以提高 TFT 基板与 CF 基板间接合强度的目的。例如，请参照图 3D，图 3D 是第一实施例的第三显示器面板的示意图。保护层 324 与第二金属层 323D 具有一共同凹槽/开口 3120D，而开口 3120D 暴露出部分的介电层 322。框胶 312D 是与显示区 330 中的液晶注入区 350、

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保护层 324 以及第二金属层 323D 作侧面接触，并同时框胶 312D 渗入凹槽/开口 3120D 而与介电层 322 的表面接触。这样，根据第一实施例中所述，第二覆盖层具有一可暴露出部分的第一覆盖层的开口 3120，此时的第二覆盖层 380b 所指包括：第二金属层 323D 及保护层 324，而第一覆盖层 370b 指的是第一金属层 321 与介电层 322。

另外，将开口再往下一层扩大，例如，请参照图 3E，是依据第一实施例的第四显示器面板的示意图。保护层 324、第二金属层 323D 与介电层 322E 具有一共同凹槽/开口 3120E，而凹槽/开口 3120E 是暴露出部分的第一金属层 321。框胶 312E 是与显示区 330 中的液晶注入区 350、保护层 324、第二金属层 323D 以及介电层 322E 作侧面接触，并同时框胶 312E 渗入凹槽/开口 3120E 而与第一金属层 321 的表面接触。这样，根据第一实施例中所述，第二覆盖层具有一可暴露出部分的第一覆盖层的开口 3120，此时的第二覆盖层 380c 所指包括：保护层 324、第二金属层 323D 与介电层 322E，而第一覆盖层 370c 指的是第一金属层 321。

第二实施例

图 4 是依据本发明第二实施例的液晶显示器面板的侧视图。液晶显示器面板 400 包括有一上基板 410 以及一下基板 420。液晶显示器面板 400 例如是一薄膜晶体管液晶显示器面板、上基板 410 例如是一 CF 基板，而下基板 420 例如是一 TFT 基板。于 CF 基板 410 与 TFT 基板 420 的外侧各设有一偏光板 460，用以将光线偏极化而成偏极光。由 CF 基板 410 与 TFT 基板 420 合成的液晶显示器面板 400，具有一显示区 430 及一环绕显示区 430 的框胶区 440。

在显示区 430 中，于 TFT 基板 420 上具有由显示区 430 延展至框胶区 440 的一覆盖层，包括一例如是如扫瞄线金属层的第一金属层 421、一介电层 422、一例如是数据线金属层的第二金属层 423 以及一保护层 424。

介电层 422 覆盖于第一金属层 421 上，第二金属层 423 覆盖于介电层 422 上，而保护层 424 是覆盖于第二金属层 423 上。于保护层 424 与 CF 基板 410 之间为一液晶注入区 450。介电层 422 例如是一氮化硅类(SiN_x)层，而保护层 424 可以由氮化硅(Si_3N_4)或是二氧化硅(SiO_2)所构成。

在框胶区 440 中，TFT 基板 420 上的第一金属层 421、介电层 422、第二

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金属层 423 以及保护层 424 具有一可暴露出部分的 TFT 基板 420 的共同凹槽/开口 4120。藉由凹槽/开口 4120，框胶 412 是与显示区 430 中的液晶注入区 450、保护层 424、第二金属层 423、介电层 422 以及第一金属层 421 作侧面接触，并同时框胶 312 渗入开口 4120 而与 TFT 基板 420 的表面接触。

当进行 TFT 基板 420 与 CF 基板 410 的对组制程时，框胶区 440 中的框胶 412 渗入凹槽/开口 4120 中，与液晶注入区 450、保护层 424、第二金属层 423、介电层 422 以及第一金属层 421 作侧面接触，并同时框胶 312 与 TFT 基板 420 的表面接触。然后，以工装用具加压的方式压合 CF 基板 410 与 TFT 基板 420，并入炉烘烤，使框胶 412 硬化，藉此使 TFT 基板 420 与 CF 基板 410 黏合。

由以上二个实施例可知，本发明的经对组并黏合完成的面板，是通过一凹槽/开口，使框胶所占空间增加，逐次使得较多的框胶得以渗入凹槽/开口中，以有效提高 TFT 基板与 CF 基板之间的接合强度。另外，本发明的显示器面板，其凹槽/开口的形状并不限定于特定的一种，除了第一实施例的凹槽/开口 3120 为长条形的外，凹槽/开口的形状可为 X 字形(如图 5A 所示)或矩阵形(如图 5B 所示)。图 5A 是凹槽/开口形状的示意图，而图 5B 是另一凹槽/开口形状的示意图。

同时，框胶的分布也非限定于涂布于同一平面上，例如，请参照图 6A，其是框胶分布的示意图。TFT 基板 620 上的覆盖层，由下至上依次包括：第一金属层 621、介电层 622、第二金属层 623 以及保护层 624。凹槽/开口 6120 于 TFT 基板 620 上的覆盖层的剖面中呈 V 字形分布。或者，凹槽/开口 6120 于第一金属层 621、介电层 622、第二金属层 623 以及保护层 624 的剖面中呈阶梯状分布，如图 6B 所示，图 6B 是另一框胶分布的示意图。

因此，当对本发明的面板输入冲击外力或振动外力时，TFT 基板与 CF 基板之间，因框胶的所占空间增加，增加了 TFT 基板与 CF 基板之间的接合强度，可避免于 TFT 基板与 CF 基板之间的接触界面处产生裂痕，进而可有效提升面板的品质。

虽然本发明已参照当前的具体实施例来描述，但是本技术领域中的普通技术人员应当认识到，以上的实施例仅是用来说明本发明，应理解其中可作各种变化和修改而在广义上没有脱离本发明，所以并非作为对本发明的限定，

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只要在本发明的实质精神范围内，对以上所述实施例的变化、变形都将落在本发明权利要求书的范围内。

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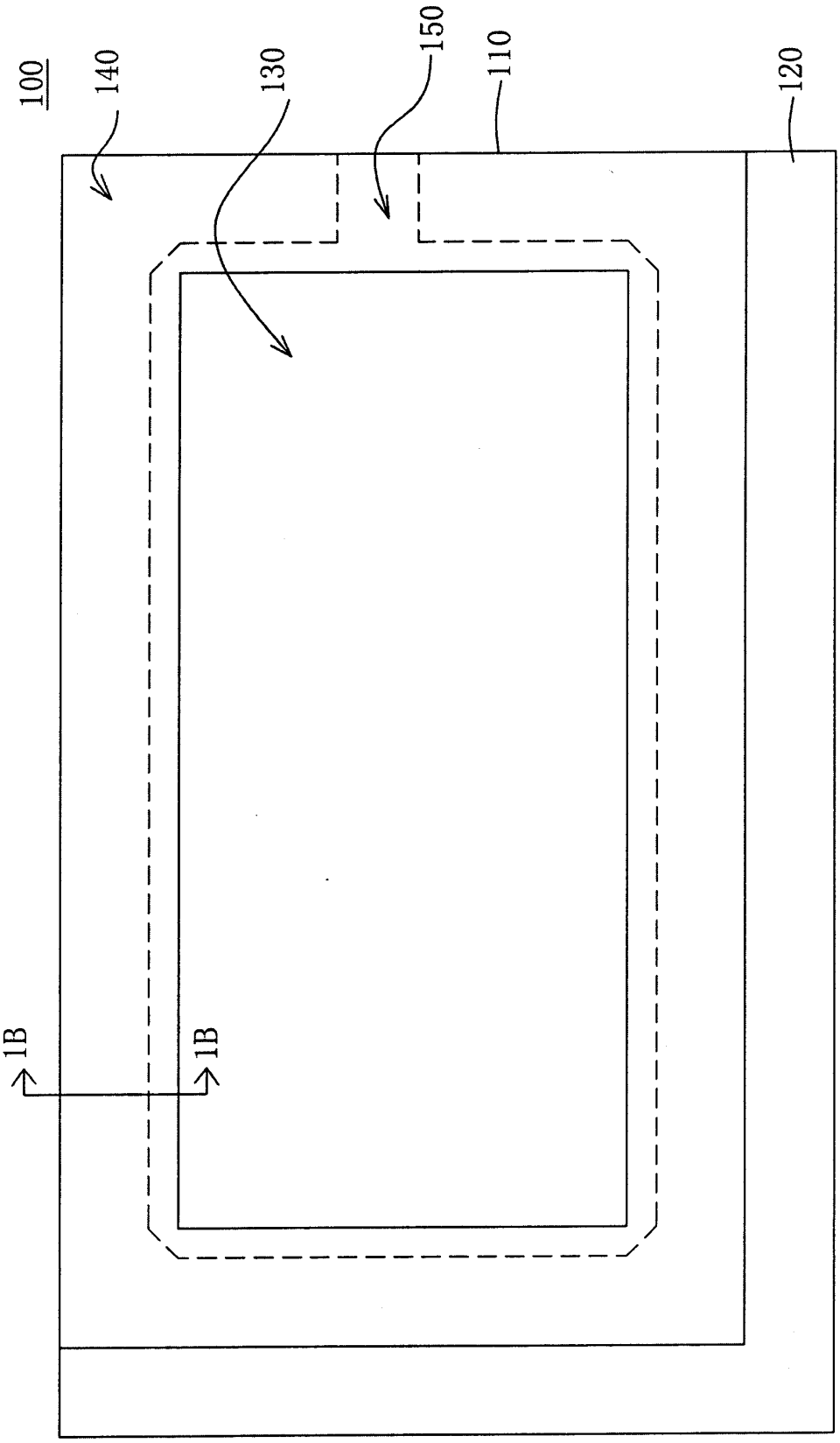

图 1A

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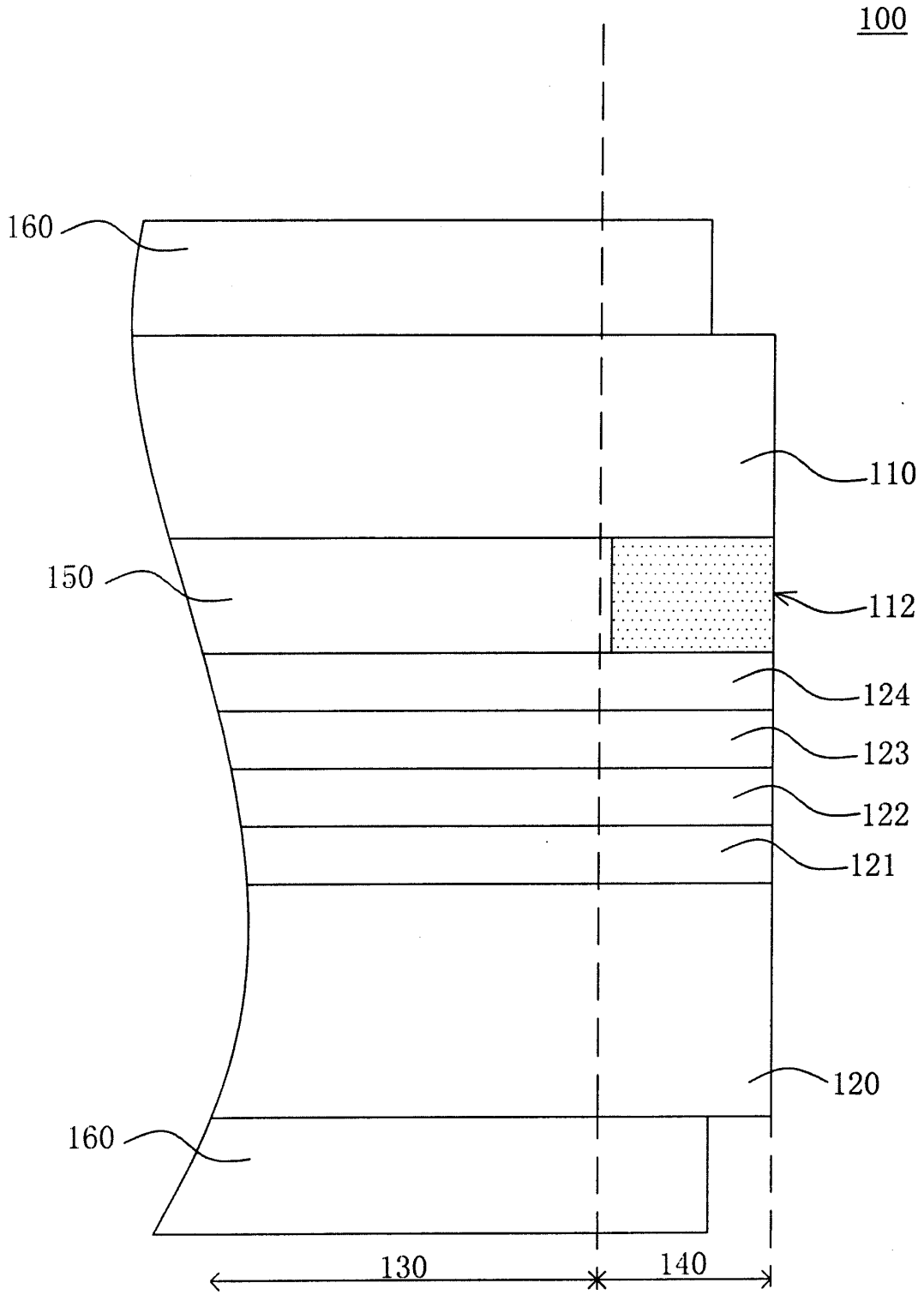

图 1B

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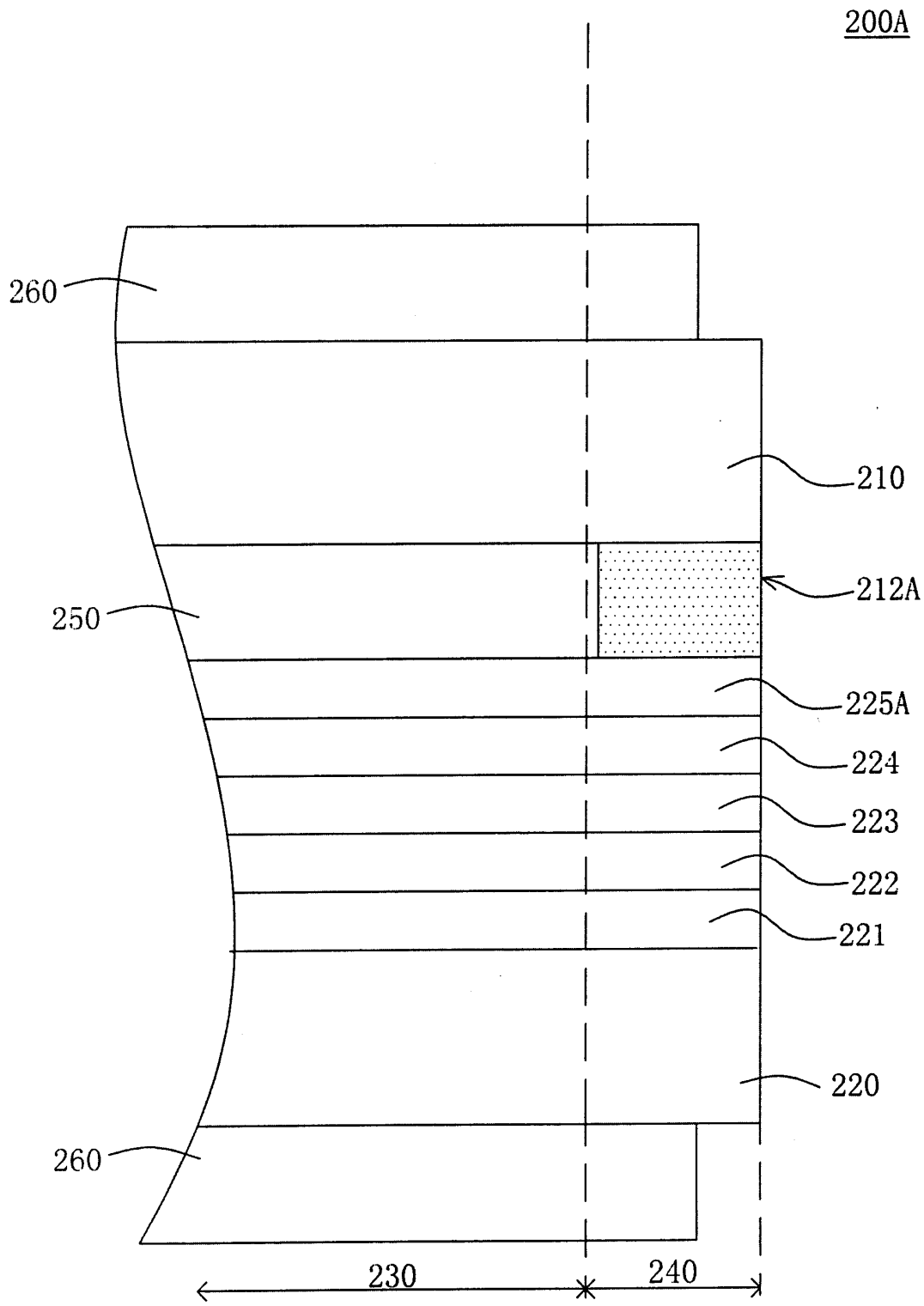

图 2A

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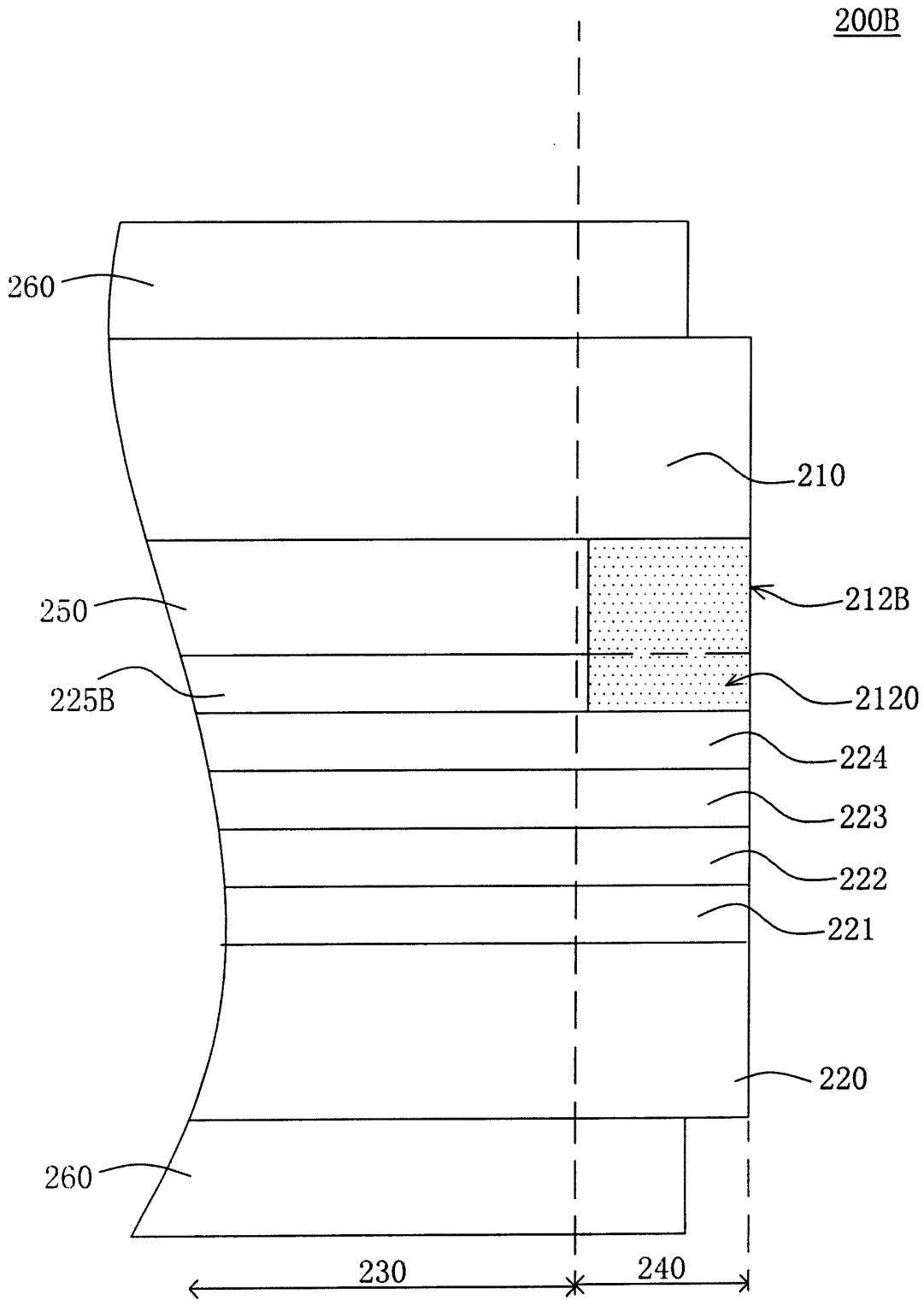

图 2B

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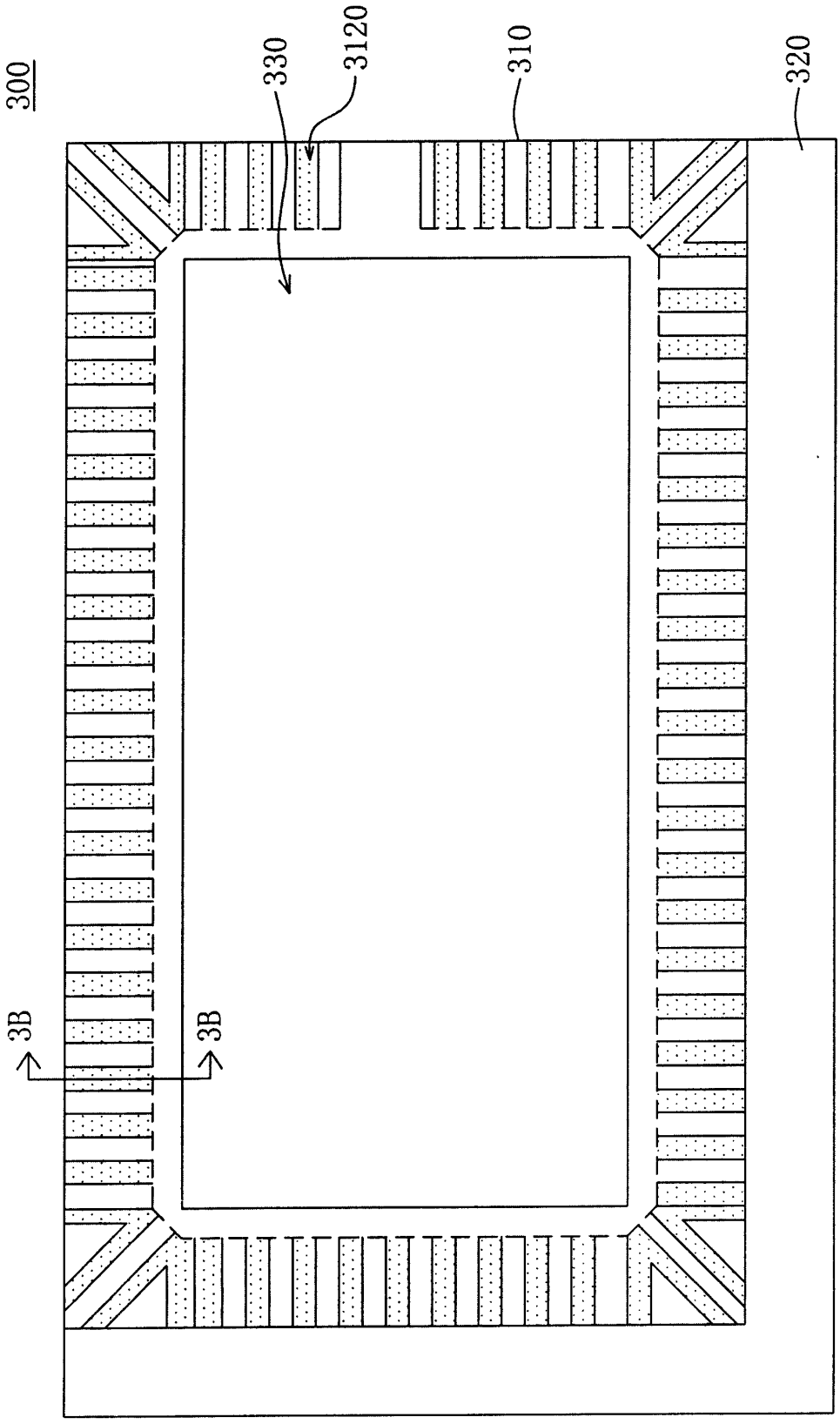

图 3A

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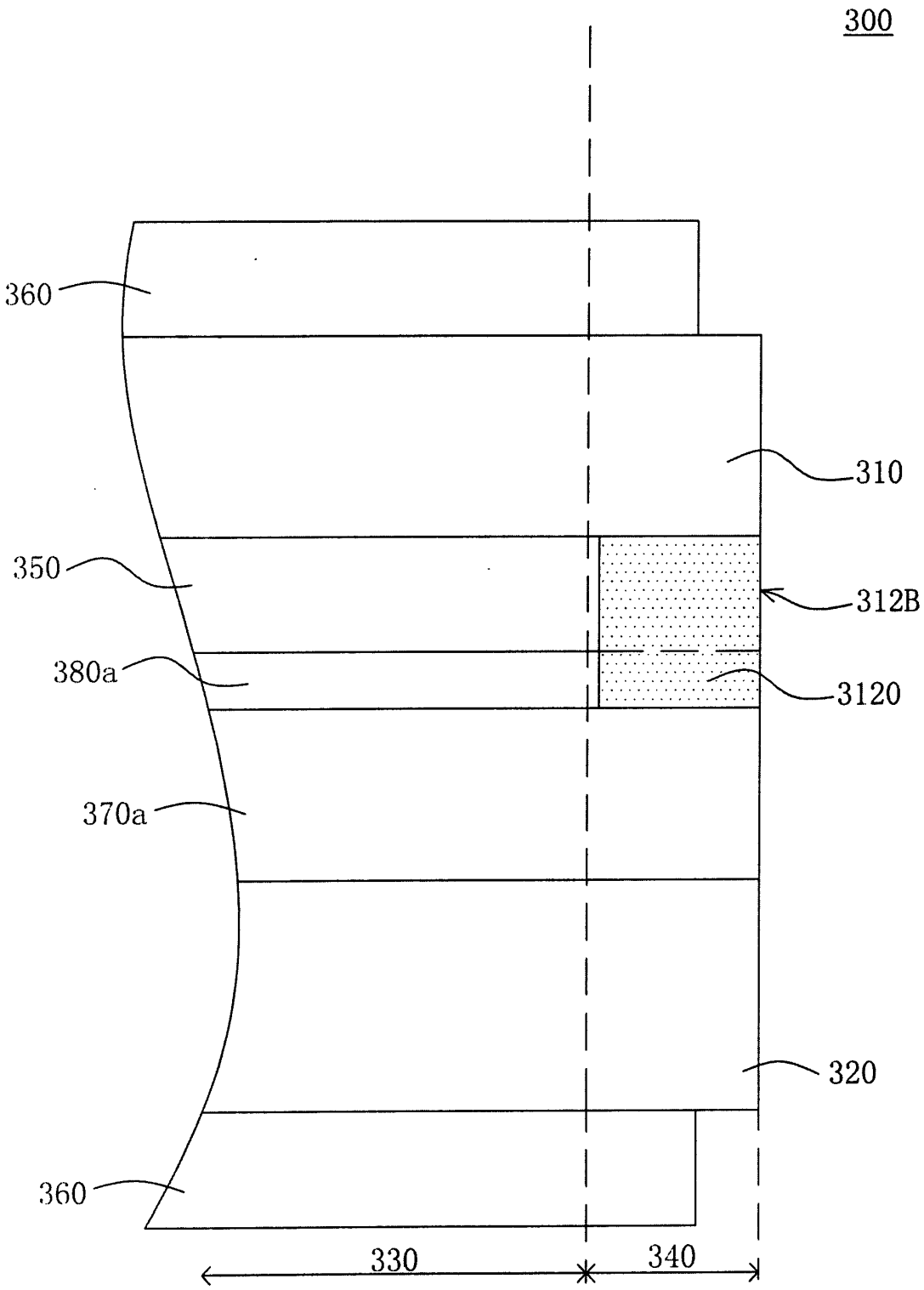

图 3B

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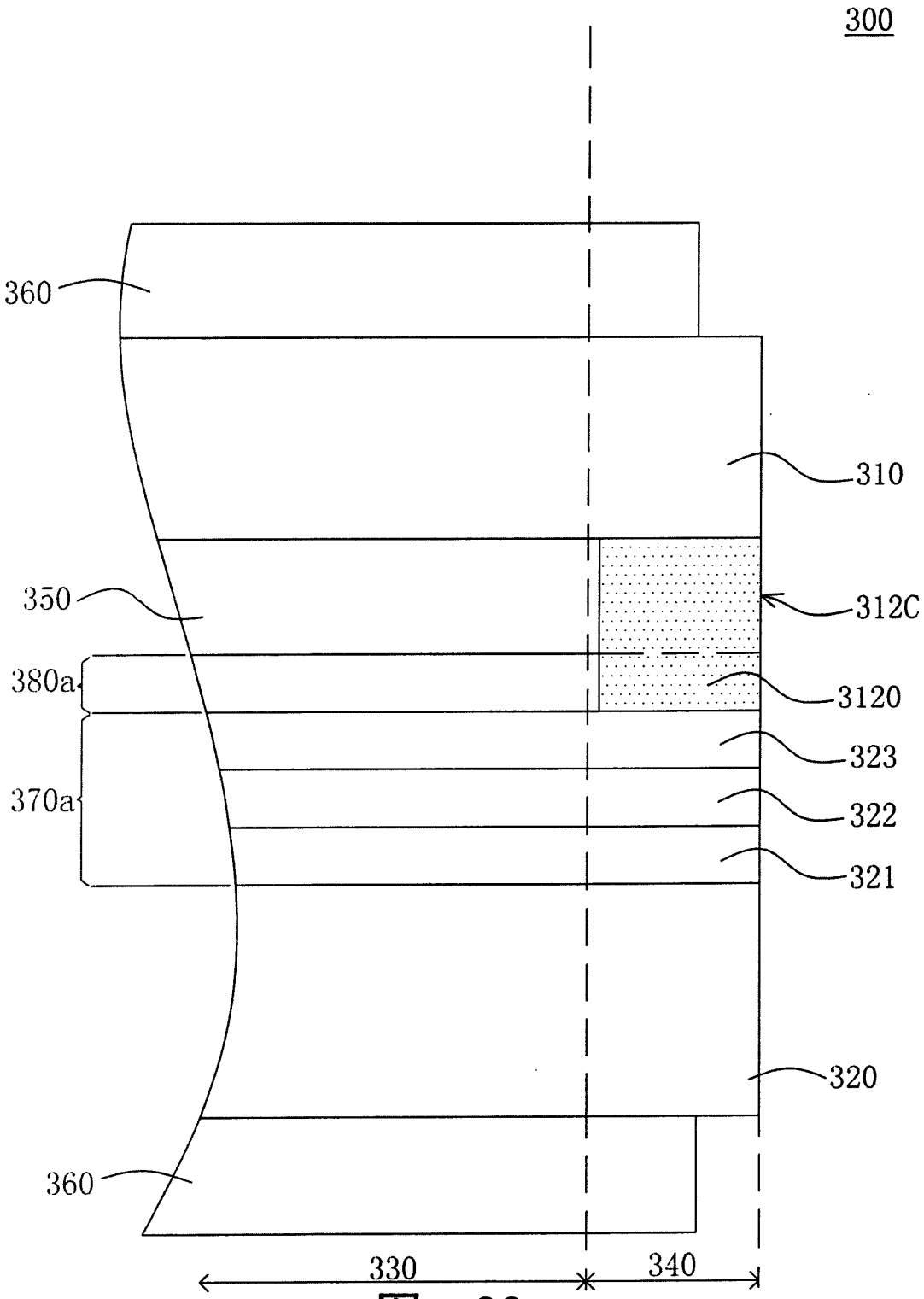

图 3C

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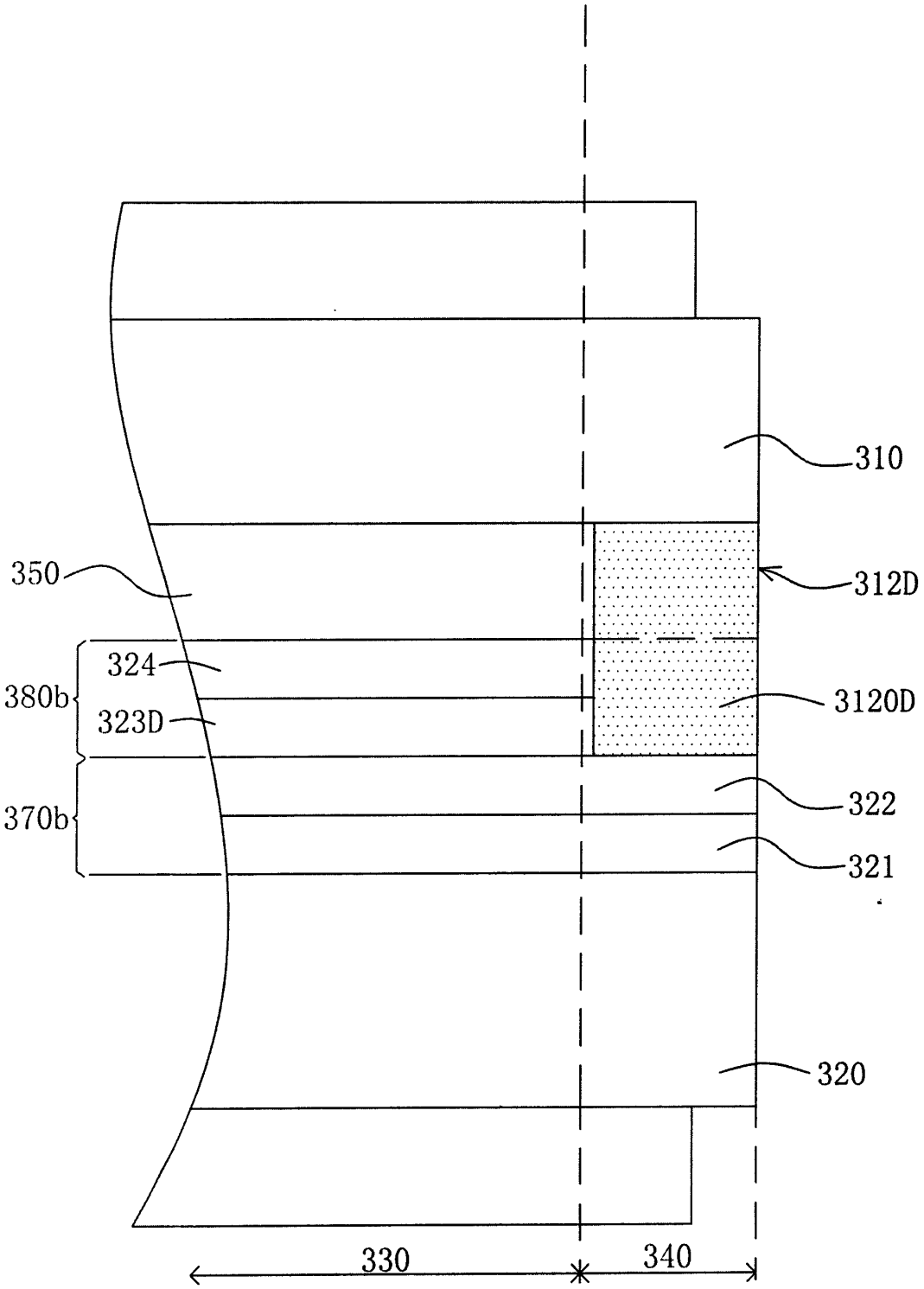

图 3D

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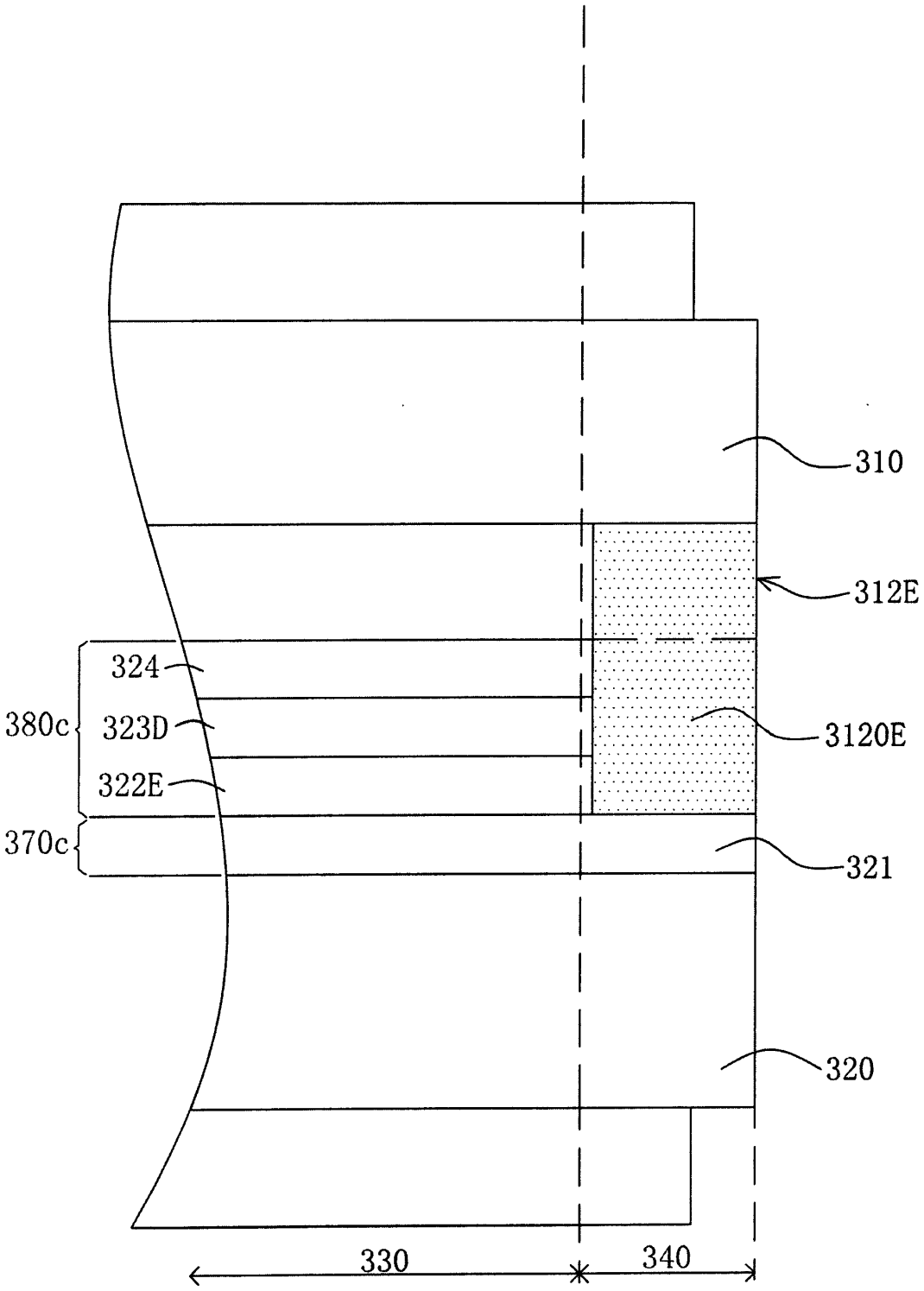

图 3E

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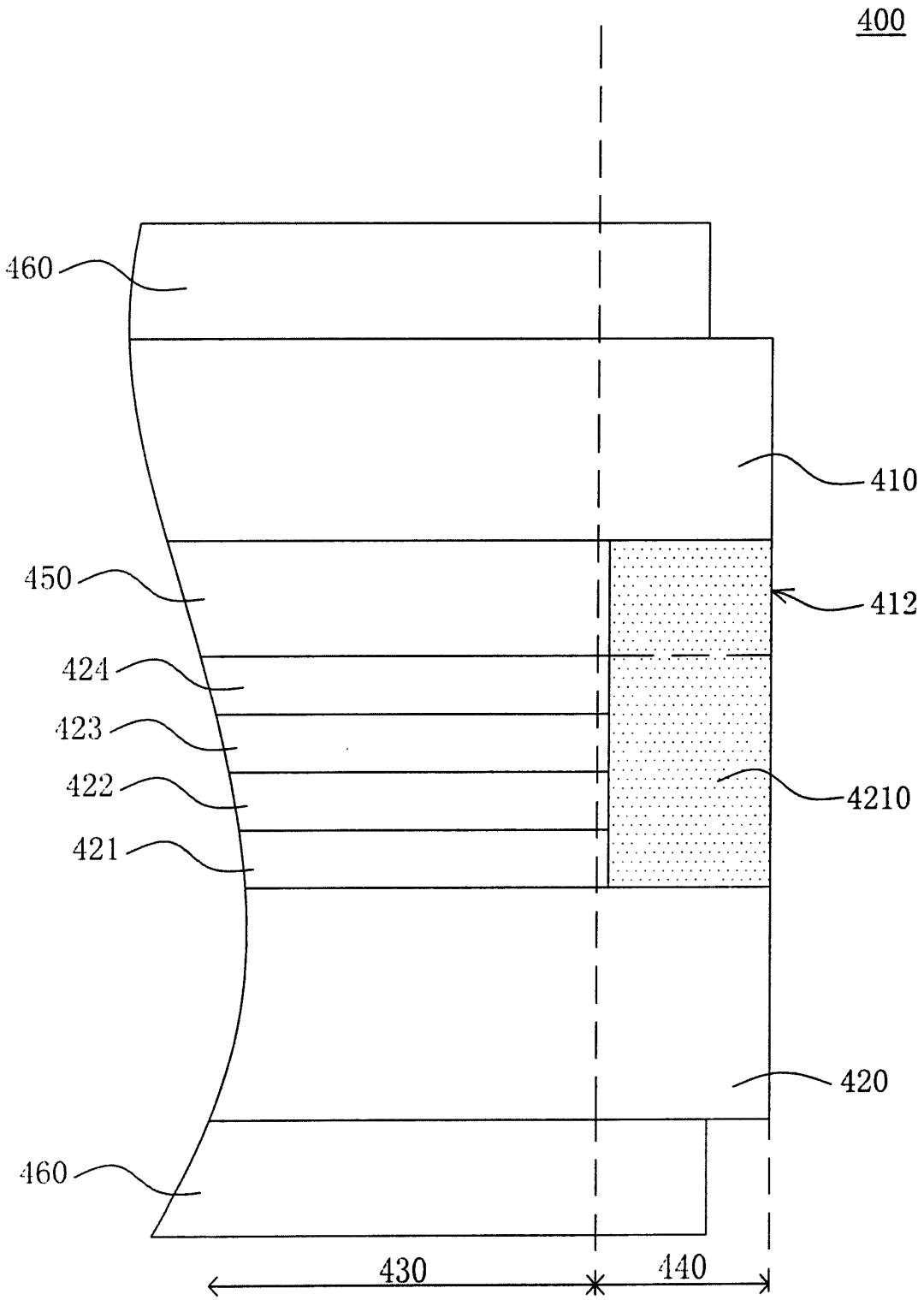

图 4

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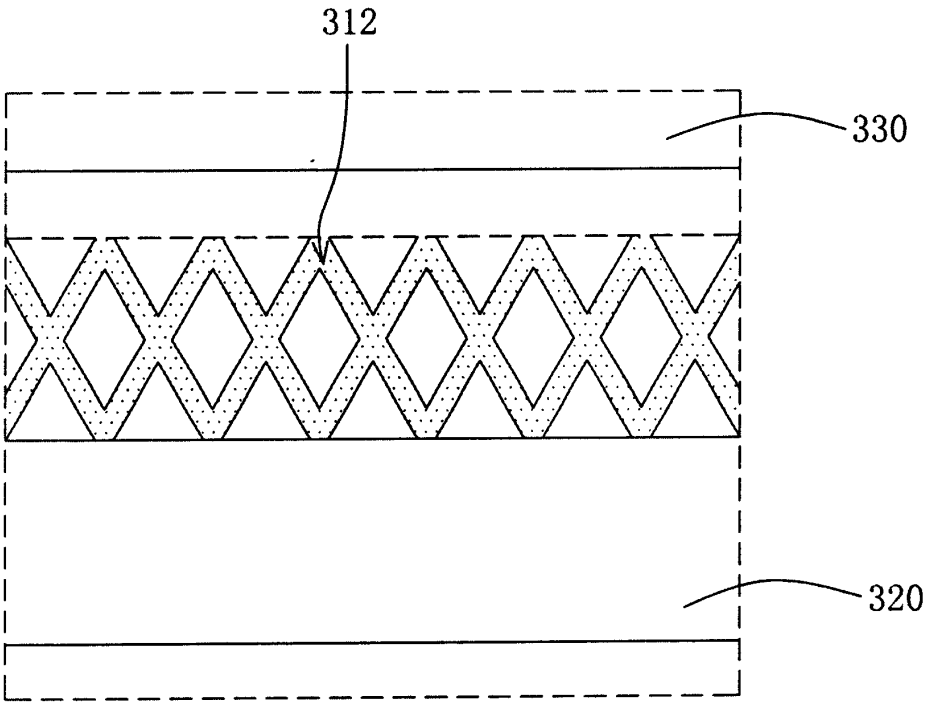

图 5A

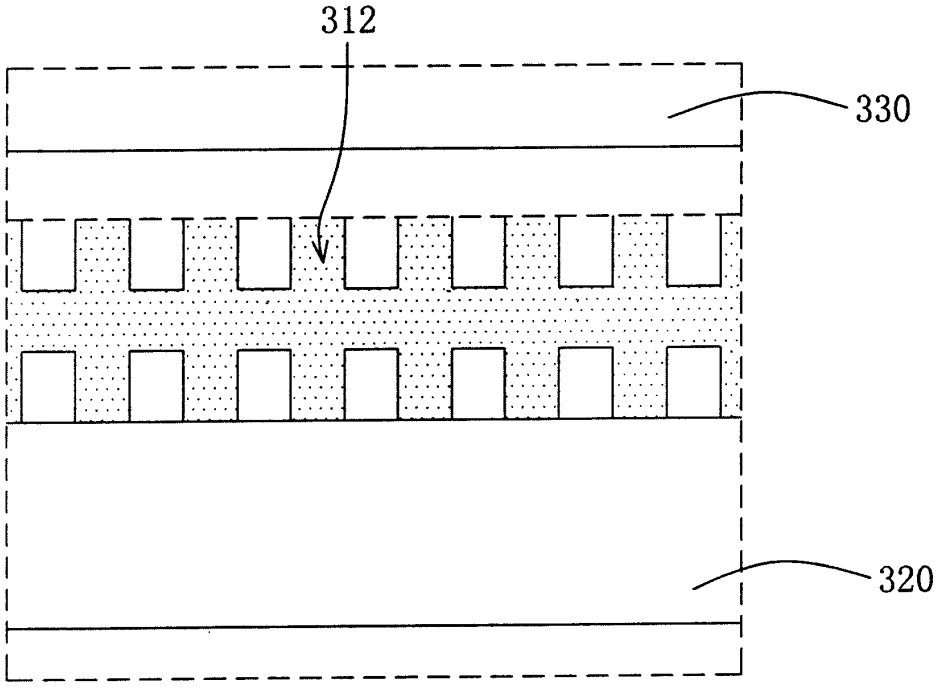

图 5B

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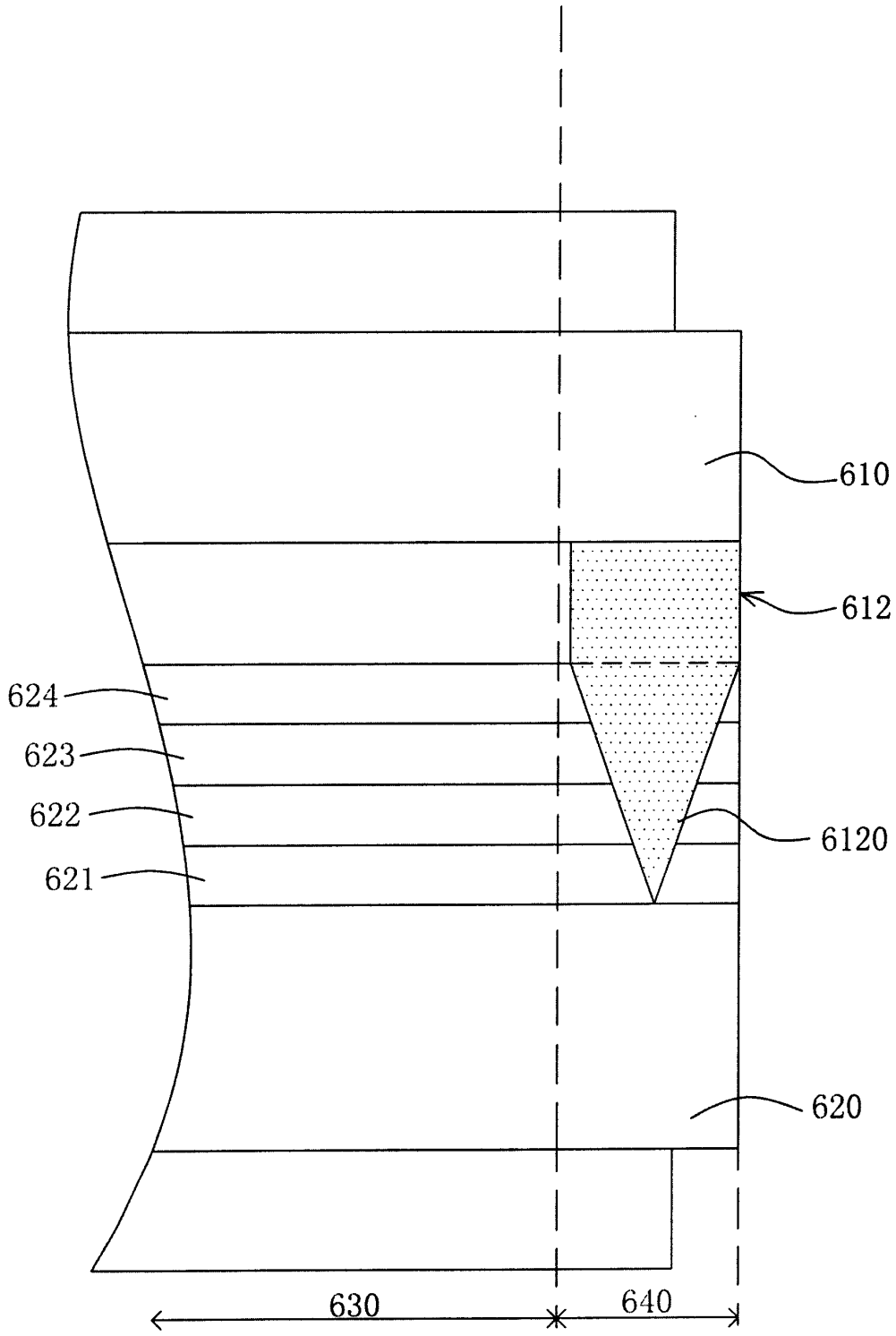

图 6A

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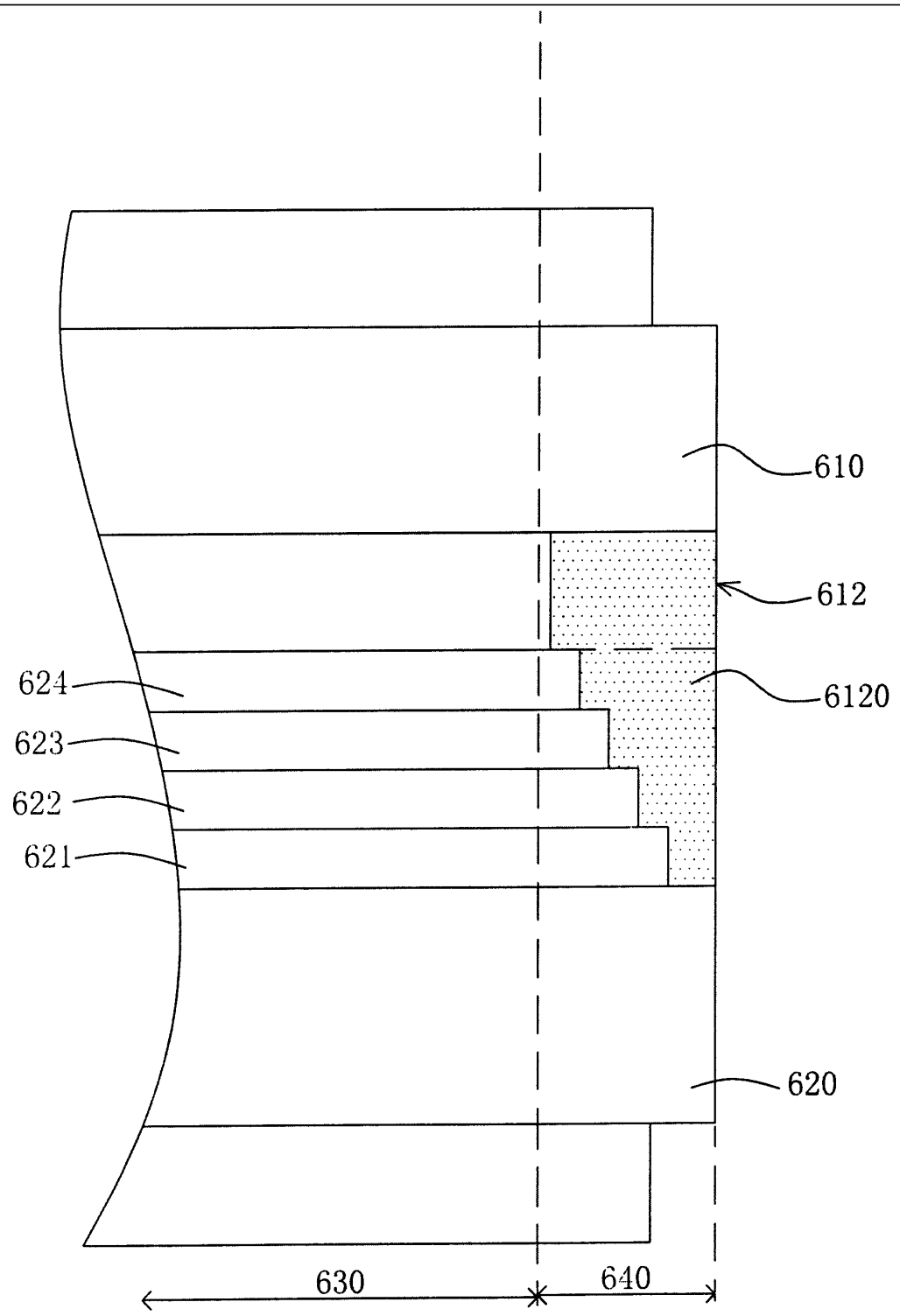

图 6B

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