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(54) 3D PANEL AND PREPARATION METHOD THEREFOR, AND 3D DISPLAY DEVICE PROVIDED WITH 3D PANEL

3D-TAFEL UND HERSTELLUNGSVERFAHREN DAFÜR SOWIE 3D-ANZEIGEVORRICHTUNG MIT DER 3D-TAFEL

PANNEAU 3D ET SON PROCÉDÉ DE PRÉPARATION, ET DISPOSITIF D'AFFICHAGE 3D MUNI D'UN PANNEAU 3D

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EP 3 203 312 B1

Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of Chinese Patent Application No.201410520459.4 filed on September 30, 2014 entitled "3D Panel, Method for Producing the Same, And 3D Display Apparatus Having the Same" with the State Intellectual Property Office of China.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present disclosure relates to a technical field of 3D display, in particular, to an active grating 3D panel, a method for producing the same, and a 3D display apparatus having the 3D panel.

Description of the Related Art

[0003] Stereoscopic display (i.e., 3D display) has become a trend of display field. A basic principle of the stereoscopic display is to generate stereoscopic effect by parallax. In other words, a left eye of one person can only see a left eye picture and a right eye thereof only can see a right eye picture, wherein the left eye picture and the right eye picture constitute a pair of stereopicture images having parallax from each other.

[0004] One method for achieving the 3D display is to employ a serial display. Specifically, at a first time point, a display device displays the left eye picture, and at this time only the left eye of a viewer can see the displayed picture. At a second time point, the display device displays the right eye picture and only the right eye of the viewer can see the displayed picture. The viewer will feel the left and right eyes see the left and right eye pictures at the same time, due to persistence of images onto their eye retinas, thereby producing a stereoscopic vision.

[0005] Another method for achieving the 3D display is to employ a parallel display. Specifically, at the same time point, a part of pixels on the display device display contents of the left eye picture, and the other part of pixels display contents of the right eye picture. Gratings, polaroid glasses or the like are used to enable the right eye to see the display content of a part of the pixels and the left eye to see the display content of the other part of the pixels, thereby producing a stereoscopic vision.

[0006] As for the 3D display mode in which 3D spectacles are needed, it gradually cannot meet users' requirements to the 3D display, because the 3D spectacles are easy to be lost and damaged, and are not convenient to be used when too many viewers are present, and the stereoscopic images cannot be presented only through the 3D display devices. For a naked eye 3D display mode, for example, grating type of naked eye 3D display apparatus, because the grating is directly provided into the display panel without needing 3D spectacles, it is more convenient for viewing and thus it gets more and more concerns.

[0007] US 2013/088653 A1 discloses a stereoscopic image panel including: a liquid crystal layer, a first parallax barrier layer including a first electrode unit adjacent to one side of the liquid crystal layer and a second electrode unit opposite the other side of the liquid crystal layer, and a second parallax barrier layer including a third electrode unit opposite one side of the liquid crystal layer, between the liquid crystal layer and the first electrode unit, wherein the second electrode unit is positioned between the liquid crystal layer and the fourth electrode unit.

SUMMARY OF THE INVENTION

[0008] An embodiment of the present invention provides a 3D panel for the naked eye 3D display as described above. Specifically, embodiments of the present invention provide a 3D panel, a method for producing the same and a 3D display apparatus comprising the 3D panel. It makes full use of space at two sides of the 3D display panel, and gratings having two periods are manufactured on an upper substrate and a lower substrate of the 3D panel. The switching of physical viewpoint number of 3D display in the same panel can be achieved by switching signals, and at the same time it can also achieve compatibility of the same 3D panel with two different resolutions, that is, the purpose that two 3D displays can share the same 3D panel can be achieved, and finally the economic benefits of reducing development costs can be obtained.

[0009] In accordance with one aspect of the present invention, it provides a 3D panel, comprising:

a first substrate;
a second substrate; and
liquid crystals, configured to be filled between the first substrate and the second substrate,
wherein both the first substrate and the second substrate are provided thereon with a common electrode and a signal electrode,
the first substrate comprises, in sequence from top to bottom, a first base substrate, a first common electrode, a first common electrode lead, a first insulation layer, a first signal electrode lead, a second insulation layer and a first signal electrode; and
the second substrate comprises, in sequence from bottom to top, a second base substrate, a second common electrode, a second common electrode lead, a third insulation layer, a second signal electrode lead, a fourth insulation layer and a second signal electrode,
wherein the first signal electrode is arranged to face the second signal electrode, and
both the first signal electrode and the second signal electrode are a plurality of stripped electrodes, and an arrangement direction of the stripped electrodes in the first signal electrode is interlaced with that of

the stripped electrodes in the second signal electrode,

wherein the plurality of stripped electrodes constituting the first signal electrode are evenly arranged and have a first period;

the plurality of stripped electrodes constituting the second signal electrode are evenly arranged and have a second period which is different from the first period.

[0010] In one example, spacing between the plurality of stripped electrodes in the first signal electrode is larger than or equals to 10 micrometers; and

spacing between the plurality of stripped electrodes in the second signal electrode is larger than or equals to 10 micrometers.

[0011] In one example, the first common electrode lead and the first signal electrode lead are in the form of frame, and a signal access part is provided at one side of the first base substrate; and

the second common electrode lead and the second signal electrode lead are in the form of frame, and a signal access part is provided at one side of the second base substrate.

[0012] In one example, all of the first common electrode, the first signal electrode, the second common electrode and the second signal electrode are made of transparent conductive materials.

[0013] In one example, the first and second common electrodes are planar electrodes.

[0014] In one example, the 3D panel further comprises a signal control module, configured to enable the signal electrode lead of the corresponding substrate when the first or second substrate is used as a working electrode.

[0015] In one example, in a case that the first substrate is served as the working electrode, the first common electrode lead is opened, the first signal electrode lead is accessed with a signal, the second common electrode lead and the second signal electrode lead are accessed with a common electrode signal, and the first substrate functions as a grating;

in a case that the second substrate is served as the working electrode, the second common electrode lead is opened, the second signal electrode lead is accessed with a signal, the first common electrode lead and the first signal electrode lead are accessed with a common electrode signal, and the second substrate functions as a grating.

[0016] In accordance with another aspect of the present invention, it also provides a 3D display apparatus, comprising the 3D panel as described above.

[0017] In accordance with a further aspect of the present invention, it also provides a method for producing a 3D panel, comprising the steps of:

forming a first common electrode layer on a first base substrate, which is used as a first common electrode of pixels;

forming a first conductive layer on the first common electrode, and patterning the first conductive layer to form a first common electrode lead;

forming a first insulation layer on the first common electrode lead;

forming a second conductive layer on the first insulation layer and patterning the second conductive layer to form a first signal electrode lead;

forming a second insulation layer on the first signal electrode lead, and forming vias onto the second insulation layer, which expose a partial region of the first signal electrode lead;

forming a first signal electrode layer on the second insulation layer and patterning the first signal electrode layer to form a first signal electrode, which is electrically connected with the first signal electrode lead by means of the vias, so as to obtain a first substrate;

obtaining a second substrate by repeating the same steps as those for producing the first substrate;

attaching edges of the first and second substrates together, so that the first signal electrode of the first substrate faces the second signal electrode of the second substrate, and liquid crystals are filled between the first substrate and the second substrate, thereby forming the 3D panel, both the first signal electrode and the second signal electrode are composed of a plurality of stripped electrodes, and the first signal electrode and the second signal electrode are disposed so that an arrangement direction of the stripped electrodes in the first signal electrode is interlaced with that of the stripped electrodes in the second signal electrode,

wherein the plurality of striped electrodes in the first signal electrode are evenly arranged and have a first period;

the plurality of stripped electrodes in the second signal electrode are evenly arranged and have a second period which is different from the first period.

[0018] By producing single electrodes onto substrates at two sides of the 3D panel, the present invention achieves the switching of viewpoint number in terms of physical level, so that the viewpoint number can be adjusted. In addition, the electrodes on substrates at two sides of the 3D panel in the present invention can be controlled independently. The switching of a grating electrode function between the upper and lower substrates can be achieved by switching the signals to the two substrates, thereby improving the application range of the 3D panel and the compatibility and versatility of the 3D panel.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

Fig.1 is a schematic sectional view showing a struc-

ture of 3D panel in accordance with an embodiment of the present invention;

Fig.2 is a schematic sectional view showing a structure of 3D panel in accordance with an embodiment of the present invention;

Figs. 3A-3F' are flow charts showing a producing process of the 3D panel in accordance with an embodiment of the present invention; and

Fig. 4 is a sectional view of the produced 3D panel in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

[0020] In order that objects, solutions and advantages of the present disclosure will become more apparent and explicit, the embodiments will be described hereinafter in detail with reference to the accompanied drawings.

[0021] In accordance with one aspect of the present invention, it provides a 3D panel, for example, for a naked eye 3D display. As shown in Fig. 1, the 3D panel includes a first substrate, a second substrate, and liquid crystals filled between the first substrate and the second substrate. Both the first substrate and the second substrate are provided with a common electrode and a signal electrode.

[0022] In an embodiment of the present invention, the first substrate includes, in sequence from top to bottom, a first base substrate 1, a first common electrode 2, a first common electrode lead 3, a first insulation layer 4, a first signal electrode lead 5, a second insulation layer 6 and a first signal electrode 7. The first base substrate 1 can be made from glasses, silicon wafer, quartz, plastics or the similar materials.

[0023] The first common electrode 2 and the first signal electrode 7 are made from a transparent conductive material, which may be a transparent metal film, a transparent metallic oxide film, a non-metallic oxide film, ferroelectric materials dispersed with conductive particles or the like. The film may be in the form of a single layer, two layers, a plurality of layers or multiple layers, non-doping type, doping type, or multi-elements type. Preferably, the transparent conducive material is a metallic oxide film, for example an ITO film.

[0024] The first common electrode lead 3 and the first signal electrode lead 5 are made of a conductive material. Preferably, such conductive material is metal material.

[0025] The first insulation layer 4 is used to insulate the first common electrode lead 3 from the first signal electrode lead 5.

[0026] A plurality of vias are formed on the second insulation layer 6, so as to partially insulate the first signal electrode lead 5 from the first signal electrode 7. The vias can expose a partial region of the first signal electrode lead 5. The first signal electrode 7 is electrically connected with the first signal electrode lead 5 by means of the vias.

[0027] The first insulation layer 4 and the second insulation layer 6 are made of a transparent insulation material.

[0028] In an example of the present invention, the first common electrode lead 3 and the first signal electrode lead 5 are in the form of frame. A signal access part is provided at one side of the first base substrate 1. It should be understood by those skilled in the art that the signal access part of the first common electrode lead 3 and the signal access part of the first signal electrode lead 5 are positioned close to each other (as shown in Fig. 3D), in order to facilitate accessing of signal. This cannot be interpreted as limiting to the present invention.

[0029] Further, the first common electrode lead 3 is located at an outer periphery of the first base substrate 1 (as shown in Fig. 3B), and the first signal electrode lead 5 is located at an inner side of the first common electrode lead 3 (as shown in Fig. 3D).

[0030] Of course, the first common electrode lead 3 and the first signal electrode lead 5 may be in other forms, as long as they can be electrically connected with the first common electrode 2 and the first signal electrode 7, respectively.

[0031] In one example of the present invention, the first common electrode 2 can be a planar electrode, and the first signal electrode 7 can be composed of a plurality of stripped electrodes.

[0032] In one example of the present invention, the first signal electrode 7 is composed of a plurality of stripped electrodes, each of which is electrically connected with the first signal electrode lead 5 by the respective vias. Further, the plurality of stripped electrodes are placed to be inclined. In one preferable example, the plurality of stripped electrodes of the first signal electrode 7 are evenly arranged and have a first period.

[0033] In an embodiment of the present invention, the second substrate includes, in sequence from bottom to top, a second base substrate 1', a second common electrode 2', a second common electrode lead 3', a third insulation layer 4', a second signal electrode lead 5', a fourth insulation layer 6' and a second signal electrode 7'. The second base substrate 1' can be made from glasses, silicon wafer, quartz, plastics or the similar materials.

[0034] The second common electrode 2' and the second signal electrode 7' are made from a transparent conductive material, which may be a transparent metal film, a transparent metallic oxide film, non-metallic oxide film, or ferroelectric materials dispersed with conductive particles. The film may be in the form of a single layer, two layers, a plurality of layers or multiple layers, non-doping type, doping type, or multi-elements type. Preferably, the transparent conducive material is a metallic oxide film, for example ITO film.

[0035] The second common electrode lead 3' and the second signal electrode lead 5' are made of a conductive material. Preferably, such conductive material is metal material.

[0036] The third insulation layer 4' is used to insulate

the second common electrode lead 3' from the second signal electrode lead 5'.

[0037] A plurality of vias are formed on the fourth insulation layer 6', so as to partially insulate the second signal electrode lead 5' from the second signal electrode 7'. The vias can expose a partial region of the second signal electrode lead 5'. The second signal electrode 7' is electrically connected with the second signal electrode lead 5' by means of the vias.

[0038] The third insulation layer 4' and the fourth insulation layer 6' are made of a transparent insulation material.

[0039] In an example of the present invention, the second common electrode lead 3' and the second signal electrode lead 5' are in the form of frame. A signal access part is provided at one side of the second base substrate 1'. It should be understood by those skilled in the art that the signal access part of the second common electrode lead 3' and the signal access part of the second signal electrode lead 5' are positioned close to each other (as shown in Fig. 3D'), in order to facilitate accessing of signal. This cannot be interpreted as limiting to the present invention.

[0040] Further, the second common electrode lead 3' is located at an outer periphery of the second base substrate 1' (as shown in Fig. 3B'), and the second signal electrode lead 5' is located at an inner side of the second common electrode lead 3' (as shown in Fig. 3D').

[0041] Of course, the second common electrode lead 3' and the second signal electrode lead 5' may be in other forms, as long as they can be electrically connected with the second common electrode 2' and the second signal electrode 7', respectively.

[0042] In one example of the present invention, the second common electrode 2' can be a planar electrode, and the second signal electrode 7' can be composed of a plurality of stripped electrodes.

[0043] In one example of the present invention, the second signal electrode 7' is composed of a plurality of stripped electrodes, each of which is electrically connected with the second signal electrode lead 5' by the respective vias. Further, the plurality of stripped electrodes are placed to be inclined. In one preferable example, the plurality of stripped electrodes of the second signal electrode 7' are evenly arranged and have a second period which is different from the first period.

[0044] The first signal electrode 7 is disposed to face the second signal electrode 7'.

[0045] In one example of the present invention, the stripped electrodes of the first signal electrode 7 and those of the second signal electrode 7' are arranged to interlace with each other. For example, as shown in Figs. 3F and 3F', the stripped electrodes of the first signal electrode 7 and those of the second signal electrode 7' are respectively arranged to be inclined, and they are inclined in different directions. That is, the stripped electrodes of the first signal electrode 7 are not parallel to those of the second signal electrode 7'.

[0046] Further, the first substrate and the second substrate have the same structure, and they are attached together in such way that the signal electrodes thereof face each other. In this way, the 3D panel is symmetrical with respect to an axis which is a center line between the first substrate and the second substrate. In the present example, because the first and second substrate are identical in terms of structure, when producing the first substrate and the second substrate, for example, producing the common electrode lead, the signal electrode lead and other identical pattern designs, the same mask can be used. Due to the above-mentioned shared designs of the mask, it is possible to reduce the producing cost of the 3D panel.

[0047] In the above examples, an enabling time of inputting signals to the first signal electrode 7 is different from that of inputting signals to the second signal electrode 7', for example, the time of inputting signals to the first signal electrode 7 and that of inputting signals to the second signal electrode 7' being stagger. In this way, switching the viewpoint number of the 3D panel in terms of physical level can be achieved by switching signals of the first and second substrates. Also, two kinds of liquid crystal panels having different resolutions can be incorporated into one and the same 3D panel, that is, to achieve the purpose of two kinds of 3D display devices sharing the same 3D panel, and finally to obtain the economic benefits of reducing the development costs.

[0048] In one example of the present invention, the 3D panel also includes a signal control module, configured to enable the signal electrode lead of the corresponding substrate when the viewpoints of the first or second substrate are switched on, i.e., the signal electrode lead of the corresponding substrate is accessed with the signal (the signal is inputted into the signal electrode lead of the corresponding substrate). Specifically, when the viewpoints of the first substrate are switched on, that is, the first substrate is served as a working electrode, the first common electrode lead 3 is opened, the first signal electrode lead 5 is accessed with the signal, the second common electrode lead 3' and the second signal electrode lead 5' are accessed with a common electrode signal. At this time, the first substrate functions as a grating. When the viewpoints of the second substrate are switched on, that is, the second substrate is served as a working electrode, the second common electrode lead 3' is opened, the second signal electrode lead 5' is accessed with the signal, the first common electrode lead 3 and the first signal electrode lead 5 are accessed with a common electrode signal. At this time, the second substrate functions as a grating. As such, the viewpoint number of the 3D panel can be adjusted as actually required. In addition, since the electrodes on the substrates at two sides of the 3D panel according to the present invention can be controlled independently, the switching of the grating electrode function between the first and second substrates (i.e., an upper substrate and a lower substrate) can be achieved by switching the signals to the two substrates,

thereby improving the application range of the 3D panel and the compatibility and versatility of the 3D panel.

[0049] In accordance with another aspect of the present invention, it also provides a 3D display panel, which includes the above 3D panel, an insulating glass 8 and a LCD panel 9, as shown in Fig. 2.

[0050] In accordance with a further aspect of the present invention, it also provides a 3D display apparatus, including the 3D panel as described above.

[0051] In accordance with a further aspect of the present invention, it also provides a producing method for the 3D panel, for example, as shown in Figs. 3A-3F', including the following steps.

[0052] A first common electrode layer is formed on a first base substrate 1, serving as a first common electrode 2 (Vcom) of pixels, wherein the first common electrode 2 is a planar electrode, as shown in Fig. 3A.

[0053] Preferably, the first base substrate 1 can be made from glasses, silicon wafer, quartz, plastics or the similar materials.

[0054] The first common electrode layer is made from a transparent conductive material, and thus is not shown in Fig. 3. The transparent conductive material may be a transparent metal film, a transparent metallic oxide film, a non-metallic oxide film, or ferroelectric materials dispersed with conductive particles. The film may be in the form of a single layer, two layers, a plurality of layers or multiple layers, non-doping type, doping type, or multi-elements type. Preferably, the transparent conducive material is a metallic oxide film, for example an ITO film.

[0055] A first conductive layer is formed on the first common electrode 2, and a first common electrode lead 3 is formed by a patterning process, as shown in Fig. 3B. The first conductive layer is made of a conductive material, and preferably the conductive material is metal material. Furthermore, the first conductive layer can be formed by a deposition process, and the first common electrode lead 3 can be formed by the patterning process such as exposing, etching or the like.

[0056] In one example of the present invention, the first common electrode lead 3 is in the form of frame. A signal access part is provided at one side of the first base substrate 1.

[0057] Of course, the first common electrode lead 3 can also be in other forms, as long as it can be electrically connected with the first common electrode 2.

[0058] A first insulation layer 4 is formed on the first common electrode lead 3, to insulate the first common electrode lead 3 from the first signal electrode lead 5, as shown in Fig. 3C. Because the first insulation layer 4 is made of a transparent insulation material, it is not shown in Fig. 3C. The first insulation layer 4 can be formed by a process, such as depositing.

[0059] A second conductive layer is formed on the first insulation layer 4, and a first signal electrode lead 5 is formed by a patterning process, as shown in Fig. 3D. The second conductive layer is made of a conductive material. Preferably, the conductive material is metal material. Furthermore, the second conductive layer can be formed by a deposition process, and the first signal electrode lead 5 can be formed by the patterning process such as exposing, etching or the like.

[0060] In an example of the present invention, the first signal electrode lead 5 is also in the form of frame. Also, a signal access part of the first signal electrode lead 5 is provided at the same side where the signal access part of the first common electrode lead 3 is located. It should be understood by those skilled in the art that the signal access part of the first common electrode lead 3 and the signal access part of the first signal electrode lead 5 are positioned close to each other, in order to facilitate accessing of signal. This cannot be interpreted as limiting to the present invention.

[0061] Similarly, the first signal electrode lead 5 may also be in other forms, as long as it can be electrically connected with the first signal electrode 7.

[0062] A second insulation layer 6 is formed on the first signal electrode lead 5, and a plurality of vias are formed on the second insulation layer 6, so as to partially insulate the first signal electrode lead 5 from the first signal electrode 7. The vias can expose a partial region of the first signal electrode lead 5, as shown in Fig. 3E. Because the second insulation layer 6 is made of a transparent insulation material, it is not shown in Fig. 3E. The second insulation layer 6 can be formed by a process, such as depositing; and the vias can be formed by a process such as etching.

[0063] A first signal electrode layer is formed on the second insulation layer 6, and a first signal electrode 7 can be formed by a patterning process. The first signal electrode 7 is electrically connected with the first signal electrode lead 5 through vias. In this way, the first substrate is obtained as shown in Fig. 3F.

[0064] Specifically, the first signal electrode 7 is made from a transparent conductive material, which may be a transparent metal film, a transparent metallic oxide film, a non-metallic oxide film, or ferroelectric materials dispersed with conductive particles. The film may be in the form of a single layer, two layers, a plurality of layers or multiple layers, non-doping type, doping type, or multi-elements type. Preferably, the transparent conducive material is a metallic oxide film, for example an ITO film.

[0065] In one example of the present invention, the first signal electrode 7 is composed of a plurality of stripped electrodes, each of which is electrically connected with the first signal electrode lead 5 by the respective vias. Further, the plurality of stripped electrodes are placed to be inclined. In one preferable example, the plurality of stripped electrodes of the first signal electrode 7 are evenly arranged and have a first period.

[0066] The second substrate can be obtained by repeating the above steps, as shown in Figs. 3A', 3B', 3C', 3D', 3E', and 3F'. The difference is that when producing the second signal electrode 7' of the second substrate, it should be ensured that the arrangement direction of the plurality of stripped electrodes within the second sig-

nal electrode 7' are interlaced with that of the plurality of stripped electrodes within the first signal electrode 7. For example, as shown in Figs. 3F and 3F', the inclination directions of the plurality of stripped electrodes within the first signal electrode 7 and the plurality of stripped electrode within the second signal electrode 7' are different from each other. In one preferable example, the plurality of stripped electrodes of the second signal electrode 7' are evenly arranged and have a second period which is different from the first period. In addition, the spacing between the plurality of stripped electrodes within the first signal electrode 7 is larger or equals to 10 micrometers, and the spacing between the plurality of stripped electrodes within the second signal electrode 7' is larger or equals to 10 micrometers.

[0067] The first substrate and the second substrate are attached together, and liquid crystals are filled between the first substrate and the second substrate, so as to form the 3D panel.

[0068] Further, the first substrate and the second substrate have the same structure, and they are attached together in such way that the signal electrodes thereof face each other. In this way, the 3D panel is symmetrical with respect to an axis which is a center line between the first substrate and the second substrate. In the present example, because the first and second substrate are identical in terms of structure, when the second common electrode lead 3' and the second signal electrode lead 5' as well as other identical pattern designs are formed on the second substrate, the same mask as used for producing the first substrate can be used. Due to the above shared designs of the mask, it is possible to reduce the producing cost of the 3D panel.

[0069] In one example of the present invention, the first substrate is attached to the second substrate by the necessary materials such as TN mode liquid crystals, sphere spacers, and polarizers. Fig.4 is a sectional view showing the 3D display panel obtained in accordance with one embodiment of the present invention. As shown in Fig. 4, the common electrode leads and signal electrode leads of the first and second substrates are respectively connected to a flexible printed circuit (FPC) board by anisotropic conductive adhesives; and the two dark regions between the first and second substrates are sealant.

[0070] Currently, an active type grating 3D display panel is conventionally designed with only one periodic grating, and thus it is compatible with only one viewpoint number display of a liquid crystal panel. In this way, it is not convenient for utilization by the user and production by the manufacturers. With the 3D panel produced by the above technical solutions in accordance with the present invention, an upper substrate and a lower substrate thereof (i.e., the first and second substrate) are formed with the common electrode and the signal electrode thereon, but the signal electrodes of the first and second substrates have enabling times which are staggered. The times when the signal electrodes of the first substrate and the second substrate are accessed with the signals are staggered. In this way, switching the viewpoint number of the 3D panel in terms of physical level can be achieved by switching signals between the first and second substrates. Also, two kinds of liquid crystal panels having different resolutions can be incorporated into one 3D panel, that is, to achieve the purpose of two kinds of 3D display devices sharing the same 3D panel, and finally to obtain the economic benefits of reducing the development costs.

[0071] With the 3D panel produced by the above technical solutions, the signal electrode lead of the corresponding substrate is enabled when the viewpoints of the first or second substrate are switched on, i.e., the signal electrode lead of the corresponding substrate is accessed with the signal. Specifically, when the viewpoints of the first substrate are switched on, that is, the first substrate is served as a working electrode, the first common electrode lead is opened, the first signal electrode lead is accessed with the signal, the second common electrode lead and the second signal electrode lead are accessed with a common electrode signal. At this time, the first substrate functions as a grating. When the viewpoints of the second substrate are switched on, that is, the second substrate is served as a working electrode, the second common electrode lead is opened, the second signal electrode lead is accessed with the signal, the first common electrode lead and the first signal electrode lead are accessed with a common electrode signal. At this time, the second substrate functions as a grating. As such, the viewpoint number of the 3D panel can be adjusted as actually required. In addition, since the electrodes on the substrates at two sides of the 3D panel according to the present invention can be controlled independently, the switching of the grating electrode function between the first and second substrates (i.e., the upper and lower substrates) can be achieved by switching the signals to the two substrates, thereby improving the application range of the 3D panel and the compatibility and versatility of the 3D panel.

[0072] The objects, solutions and advantageous effects of the present disclosure have been described in details with reference to the above specific embodiments. It should be understood that the above embodiments are given only by ways of examples instead of limiting the present invention.

Claims

1. A 3D panel, comprising:

a first substrate;
a second substrate; and
liquid crystals filled between the first substrate and the second substrate, wherein both the first substrate and the second substrate are provided with a common electrode and a signal electrode, the first substrate comprises, in sequence from

top to bottom, a first base substrate (1), a first common electrode (2), a first common electrode lead (3), a first insulation layer (4), a first signal electrode lead (5), a second insulation layer (6) and a first signal electrode (7); and
the second substrate comprises, in sequence from bottom to top, a second base substrate (1'), a second common electrode (2'), a second common electrode lead (3'), a third insulation layer (4'), a second signal electrode lead (5'), a fourth insulation layer (6') and a second signal electrode (7'),
wherein the first signal electrode (7) is arranged to face the second signal electrode (7'), and
both the first signal electrode (7) and the second signal electrode (7') are composed of a plurality of stripped electrodes, and an arrangement direction of the stripped electrodes in the first signal electrode (7) is interlaced with that of the stripped electrodes in the second signal electrode (7'),
the plurality of stripped electrodes in the first signal electrode (7) are evenly arranged and have a first period;
the plurality of stripped electrodes in the second signal electrode (7') are evenly arranged and have a second period which is different from the first period.

2. The 3D panel according to claim 1, wherein
spacing between the plurality of stripped electrodes in the first signal electrode (7) is larger than or equals to 10 micrometers; and
spacing between the plurality of stripped electrodes in the second signal electrode (7') is larger than or equals to 10 micrometers.

3. The 3D panel according to claim 1, wherein
the first common electrode lead (3) and the first signal electrode lead (5) are in the form of frame, and a signal access part is provided at one side of the first base substrate (1); and
the second common electrode lead (3') and the second signal electrode lead (5') are in the form of frame, and a signal access part is provided at one side of the second base substrate (1').

4. The 3D panel according to claim 1, wherein
all of the first common electrode (2), the first signal electrode (7), the second common electrode (2') and the second signal electrode (7') are made of transparent conductive materials.

5. The 3D panel according to claim 1, wherein
the first and second common electrodes (2, 2') are planar electrodes.

6. The 3D panel according to claim 1, further comprising a signal control module, configured to enable the signal electrode lead of the corresponding substrate when the first or second substrate is used as a working electrode.

7. The 3D panel according to claim 6, wherein
in a case that the first substrate is served as the working electrode, the first common electrode lead (3) is opened, the first signal electrode lead (5) is accessed with a signal, the second common electrode lead (3') and the second signal electrode lead (5') are accessed with a common electrode signal, and the first substrate functions as a grating;
in a case that the second substrate is served as the working electrode, the second common electrode lead (3') is opened, the second signal electrode lead (5') is accessed with a signal, the first common electrode lead (3) and the first signal electrode lead (5) are accessed with a common electrode signal, and the second substrate functions as a grating.

8. A 3D display apparatus, comprising the 3D panel according to any one of claims 1-7.

9. A method for producing a 3D panel, comprising the steps of:

forming a first common electrode layer on a first base substrate (1), which is used as a first common electrode (2) of pixels;
forming a first conductive layer on the first common electrode (2), and patterning the first conductive layer to form a first common electrode lead (3);
forming a first insulation layer (4) on the first common electrode lead (3);
forming a second conductive layer on the first insulation layer (4) and patterning the second conductive layer to form a first signal electrode lead (5);
forming a second insulation layer (6) on the first signal electrode lead (5), and forming vias onto the second insulation layer (6), the vias exposing a partial region of the first signal electrode lead (5);
forming a first signal electrode layer on the second insulation layer (6) and patterning the first signal electrode layer to form a first signal electrode (7), which is electrically connected with the first signal electrode lead (5) by means of vias, so as to obtain a first substrate;
obtaining a second substrate by repeating the same steps as above-mentioned for producing the first substrate;
attaching edges of the first and second substrates together, so that the first signal electrode (7) of the first substrate faces the second signal electrode (7') of the second substrate, and liquid

crystals are filled between the first substrate and the second substrate, thereby forming the 3D panel, and
both the first signal electrode (7) and the second signal electrode (7') are composed of a plurality of stripped electrodes, and the first signal electrode (7) and the second signal electrode (7') are disposed so that an arrangement direction of the stripped electrodes in the first signal electrode (7) is interlaced with that of the stripped electrodes in the second signal electrode (7'), and
the plurality of stripped electrodes in the first signal electrode (7) are evenly arranged and have a first period;
the plurality of stripped electrodes in the second signal electrode (7') are evenly arranged and have a second period which is different from the first period.

10. The method according to claim 9, wherein the signal electrode lead of the corresponding substrate is enabled when the first or second substrate is used as a working electrode.

Patentansprüche

1. 3D-Panel, Folgendes umfassend:

ein erstes Substrat;
ein zweites Substrat; und
Flüssigkristalle, die zwischen dem ersten Substrat und dem zweiten Substrat eingefüllt sind, wobei sowohl das erste Substrat als auch das zweite Substrat mit einer gemeinsamen Elektrode und einer Signalelektrode versehen sind, wobei das erste Substrat nacheinander von oben nach unten Folgendes umfasst: ein erstes Basissubstrat (1), eine erste gemeinsame Elektrode (2), eine erste gemeinsame Elektrodenleitung (3), eine erste Isolationsschicht (4), eine erste Signalelektrodenleitung (5), eine zweite Isolationsschicht (6) und eine erste Signalelektrode (7); und
wobei das zweite Substrat nacheinander von oben nach unten Folgendes umfasst: ein zweites Basissubstrat (1'), eine zweite gemeinsame Elektrode (2'), eine zweite gemeinsame Elektrodenleitung (3'), eine dritte Isolationsschicht (4'), eine zweite Signalelektrodenleitung (5'), eine vierte Isolationsschicht (6') und eine zweite Signalelektrode (7'), wobei die erste Signalelektrode (7) so angeordnet ist, dass sie der zweiten Signalelektrode (7') zugewandt ist, und sowohl die erste Signalelektrode (7) als auch die zweite Signalelektrode (7') aus einer Vielzahl von abisolierten Elektroden bestehen, und eine Anordnungsrichtung der abisolierten Elektroden in der ersten Signalelektrode (7) mit derjenigen der abisolierten Elektroden in der zweiten Signalelektrode (7') verschränkt ist, wobei die mehreren abisolierten Elektroden in der ersten Signalelektrode (7) gleichmäßig angeordnet sind und eine erste Periode aufweisen;
wobei die Vielzahl von abisolierten Elektroden in der zweiten Signalelektrode (7') gleichmäßig angeordnet sind und eine zweite Periode aufweisen, die sich von der ersten Periode unterscheidet.

2. 3D-Panel nach Anspruch 1, wobei Abstände zwischen der Vielzahl von abisolierten Elektroden in der ersten Signalelektrode (7) mindestens 10 Mikrometer betragen; und die Abstände zwischen der Vielzahl von abisolierten Elektroden in der zweiten Signalelektrode (7') mindestens 10 Mikrometer betragen.

3. 3D-Panel nach Anspruch 1, wobei die erste gemeinsame Elektrodenleitung (3) und die erste Signalelektrodenleitung (5) in der Form eines Rahmens vorliegen und ein Signalzugriffsteil an einer Seite des ersten Basissubstrats (1) bereitgestellt ist; und
die zweite gemeinsame Elektrodenleitung (3') und die zweite Signalelektrodenleitung (5') in der Form eines Rahmens vorliegen und ein Signalzugriffsteil an einer Seite des zweiten Basissubstrats (1') bereitgestellt ist.

4. 3D-Panel nach Anspruch 1, wobei die erste gemeinsame Elektrode (2), die erste Signalelektrode (7), die zweite gemeinsame Elektrode (2') und die zweite Signalelektrode (7') jeweils aus transparenten leitfähigen Materialien gefertigt sind.

5. 3D-Panel nach Anspruch 1, wobei die erste und die zweite gemeinsame Elektrode (2, 2') planare Elektroden sind.

6. 3D-Panel nach Anspruch 1, ferner eine Signalsteuermodul umfassend, das dafür konfiguriert ist, die Signalelektrodenleitung des entsprechenden Substrat zu aktivieren, wenn das erste oder das zweite Substrat als eine Arbeitselektrode verwendet wird.

7. 3D-Panel nach Anspruch 6, wobei in einem Fall, in dem das erste Substrat als die Arbeitselektrode dient, die erste gemeinsame Elektrodenleitung (3) geöffnet wird, mit einem Signal auf die erste Signalelektrodenleitung (5) zugegriffen wird, mit einem gemeinsamen Elektrodensignal auf die zweite gemeinsame Elektrodenleitung (3') und die zweite Signalelektrodenleitung (5') zugegriffen wird und das erste Substrat als Gitter fungiert;
wobei in einem Fall, in dem das zweite Substrat als

die Arbeitselektrode dient, die zweite gemeinsame Elektrodenleitung (3') geöffnet wird, mit einem Signal auf die zweite Signalelektrodenleitung (5') zugegriffen wird, mit einem gemeinsamen Elektrodensignal auf die erste gemeinsame Elektrodenleitung (3) und die erste Signalelektrodenleitung (5) zugegriffen wird und das zweite Substrat als Gitter fungiert.

8. 3D-Anzeigevorrichtung, das 3D-Panel nach einem der Ansprüche 1-7 umfassend.

9. Verfahren zum Herstellen eines 3D-Panels, die folgenden Schritte umfassend:

Ausbilden einer ersten gemeinsamen Elektrodenschicht auf einem ersten Basissubstrat (1), das als erste gemeinsame Elektrode (2) von Pixeln verwendet wird;
Ausbilden einer ersten leitfähigen Schicht auf der ersten gemeinsamen Elektrode (2) und Strukturieren der ersten leitfähigen Schicht, um eine erste gemeinsame Elektrodenleitung (3) auszubilden;
Ausbilden einer ersten Isolationsschicht (4) auf der ersten gemeinsamen Elektrodenleitung (3); Ausbilden einer zweiten leitfähigen Schicht auf der ersten Isolationsschicht (4) und Strukturieren der zweiten leitfähigen Schicht, um eine erste Signalelektrodenleitung (5) auszubilden;
Ausbilden einer zweiten Isolationsschicht (6) auf der ersten Signalelektrodenleitung (5) und Ausbilden von Durchkontaktierungen auf der zweiten Isolationsschicht (6), wobei die Durchkontaktierungen einen Teilbereich der ersten Signalelektrodenleitung (5) freilegen; Ausbilden einer ersten Signalelektrodenschicht auf der zweiten Isolationsschicht (6) und Strukturieren der ersten Signalelektrodenschicht, um eine erste Signalelektrode (7) auszubilden, die mittels Durchkontaktierungen elektrisch mit der ersten Signalelektrodenleitung (5) verbunden ist, um ein erstes Substrat zu erhalten;
Erhalten eines zweiten Substrats durch Wiederholen der gleichen Schritte wie oben zum Herstellen des ersten Substrats erwähnt;
Befestigen der Kanten des ersten und des zweiten Substrats aneinander, so dass die erste Signalelektrode (7) des ersten Substrats der zweiten Signalelektrode (7') des zweiten Substrats zugewandt ist und Flüssigkristalle zwischen dem ersten Substrat und dem zweiten Substrat eingefüllt werden, wodurch das 3D-Panel ausgebildet wird, und wobei sowohl die erste Signalelektrode (7) als auch die zweite Signalelektrode (7') aus einer Vielzahl von abisolierten Elektroden bestehen und die erste Signalelektrode (7) und die zweite Signalelektrode (7') so angeordnet sind, dass eine Anordnungsrichtung der abisolierten Elektroden in der ersten Signalelektrode (7) mit derjenigen der abisolierten Elektroden in der zweiten Signalelektrode (7') verschränkt ist, und wobei die Vielzahl von abisolierten Elektroden in der ersten Signalelektrode (7) gleichmäßig angeordnet sind und eine erste Periode aufweisen;
wobei die Vielzahl von abisolierten Elektroden in der zweiten Signalelektrode (7') gleichmäßig angeordnet sind und eine zweite Periode aufweisen, die sich von der ersten Periode unterscheidet.

10. Verfahren nach Anspruch 9, wobei die Signalelektrodenleitung des entsprechenden Substrats aktiviert wird, wenn das erste oder zweite Substrat als Arbeitselektrode verwendet wird.

Revendications

1. Panneau 3D, comprenant :

un premier substrat ;
un second substrat ; et
des cristaux liquides remplis entre le premier substrat et le second substrat, dans lequel le premier substrat et le second substrat sont dotés d'une électrode commune et d'une électrode de signal, le premier substrat comprend, en séquence, de haut en bas, un premier substrat de base (1), une première électrode commune (2), un premier conducteur d'électrode commune (3), une première couche d'isolation (4), un premier conducteur d'électrode de signal (5), une deuxième couche d'isolation (6) et une première électrode de signal (7) ; et
le second substrat comprend, en séquence, de bas en haut, un second substrat de base (1'), une seconde électrode commune (2'), un second conducteur d'électrode commune (3'), une troisième couche d'isolation (4'), une seconde électrode de signal (5'), une quatrième couche d'isolation (6') et une seconde électrode de signal (7'), dans lequel la première électrode de signal (7) disposée pour faire face à la seconde électrode de signal (7'), et à la fois la première électrode de signal (7) et la seconde électrode de signal (7') sont composées d'une pluralité d'électrodes dénudées, et un sens de disposition des électrodes dénudées dans la première électrode de signal (7) est entrelacée avec celui des électrodes dénudées de la seconde électrode de signal (7'), la pluralité d'électrodes dénudées dans la première électrode de signal (7) sont disposées de manière uniforme et ont une première période ;
la pluralité d'électrodes dénudées dans la se-

conde électrode de signal (7') sont disposées de manière uniforme et présentent une seconde période qui est différente de la première période.

2. Panneau 3D selon la revendication 1, dans lequel l'espacement entre la pluralité d'électrodes dénudées dans la première électrode de signal (7) est supérieur ou égal à 10 micromètres ; et
l'espacement entre la pluralité d'électrodes dénudées dans la seconde électrode de signal (7') est supérieur ou égal à 10 micromètres.

3. Panneau 3D selon la revendication 1, dans lequel le premier conducteur d'électrode commune (3) et le premier conducteur d'électrode de signal (5) se présentent sous la forme d'un cadre, et une partie d'accès au signal est prévue sur un côté du premier substrat de base (1) ; et
le second conducteur d'électrode commune (3') et le second conducteur d'électrode de signal (5') se présentent sur la forme d'un cadre, et une partie d'accès au signal est prévue sur un côté du second substrat de base (1').

4. Panneau 3D selon la revendication 1, dans lequel l'ensemble de la première électrode commune (2), de la première électrode de signal (7), de la seconde électrode commune (2') et de la seconde électrode de signal (7') est constitué de matériaux conducteurs transparents.

5. Panneau 3D selon la revendication 1, dans lequel les première et seconde électrodes communes (2, 2') sont des électrodes planes.

6. Panneau 3D selon la revendication 1, comprenant en outre un module de commande de signal, configuré pour activer le conducteur d'électrode de signal du substrat correspondant lorsque le premier ou le second substrat est utilisé comme électrode de travail.

7. Panneau 3D selon la revendication 6, dans lequel, dans le cas où le premier substrat sert d'électrode de travail, le premier conducteur d'électrode commune (3) est ouvert, le premier conducteur d'électrode de signal (5) est accédé au moyen d'un signal, le second conducteur d'électrode commune (3') et le second conducteur d'électrode de signal (5') sont accessibles au moyen d'un signal d'électrode commune, et le premier substrat fonctionne comme un réseau ;
dans le cas où le second substrat sert d'électrode de travail, le second conducteur d'électrode commune (3') est ouvert, le second conducteur d'électrode de signal (5') est accessible au moyen d'un signal, le premier conducteur d'électrode commune (3) et le premier conducteur d'électrode de signal (5) sont accessibles au moyen d'un signal d'électrode commune, et le second substrat fonctionne comme un réseau.

8. Appareil d'affichage 3D, comprenant le panneau 3D selon l'une quelconque des revendications 1 à 7.

9. Procédé de production d'un panneau 3D, comprenant les étapes :

de formation d'une première couche d'électrode commune sur un premier substrat de base (1), qui est utilisée comme première électrode commune (2) des pixels ;
de formation d'une première couche conductrice sur la première électrode commune (2) et de structuration de la première couche conductrice pour former un premier conducteur d'électrode commune (3) ;
de formation d'une première couche d'isolation (4) sur le premier conducteur d'électrode commune (3) ;
de formation d'une seconde couche conductrice sur la première couche d'isolation (4) et de structuration de la seconde couche conductrice pour former un premier conducteur d'électrode de signal (5) ;
de formation d'une deuxième couche d'isolation (6) sur le premier conducteur d'électrode de signal (5), et de formation de trous d'interconnexion sur la deuxième couche d'isolation (6), les trous d'interconnexion exposant une région partielle du premier conducteur d'électrode de signal (5) ;
de formation d'une première couche d'électrode de signal sur la deuxième couche d'isolation (6) et de structuration de la première couche d'électrode de signal afin de former une première électrode de signal (7), qui est reliée électriquement au premier conducteur d'électrode de signal (5) au moyen de trous d'interconnexion, de manière à obtenir un premier substrat ;
d'obtention d'un second substrat par la répétition des mêmes étapes que celles mentionnées ci-dessus pour produire le premier substrat ;
de fixation des bords des premier et second substrats, de sorte que la première électrode de signal (7) du premier substrat soit face à la seconde électrode de signal (7') du second substrat, et que les cristaux liquides soient remplis entre le premier substrat et le second substrat, formant ainsi le panneau 3D, et la première électrode de signal (7) et la seconde électrode de signal (7') sont composées d'une pluralité d'électrodes dénudées, et la première électrode de signal (7) et la seconde électrode de signal (7') sont disposées de sorte qu'un sens de disposition des électrodes dénudées dans la pre-

mière électrode de signal (7) soit entrelacé avec celui des électrodes dénudées dans la seconde électrode de signal (7'), et la pluralité d'électrodes dénudées dans la première électrode de signal (7) sont disposées de manière uniforme et présentent une première période ;
la pluralité d'électrodes dénudées dans la seconde électrode de signal (7') sont disposées de manière uniforme et présentent une seconde période qui est différente de la première période.

10. Procédé selon la revendication 9, dans lequel le conducteur d'électrode de signal du substrat correspondant est activé lorsque le premier ou le second substrat est utilisé comme électrode de travail.

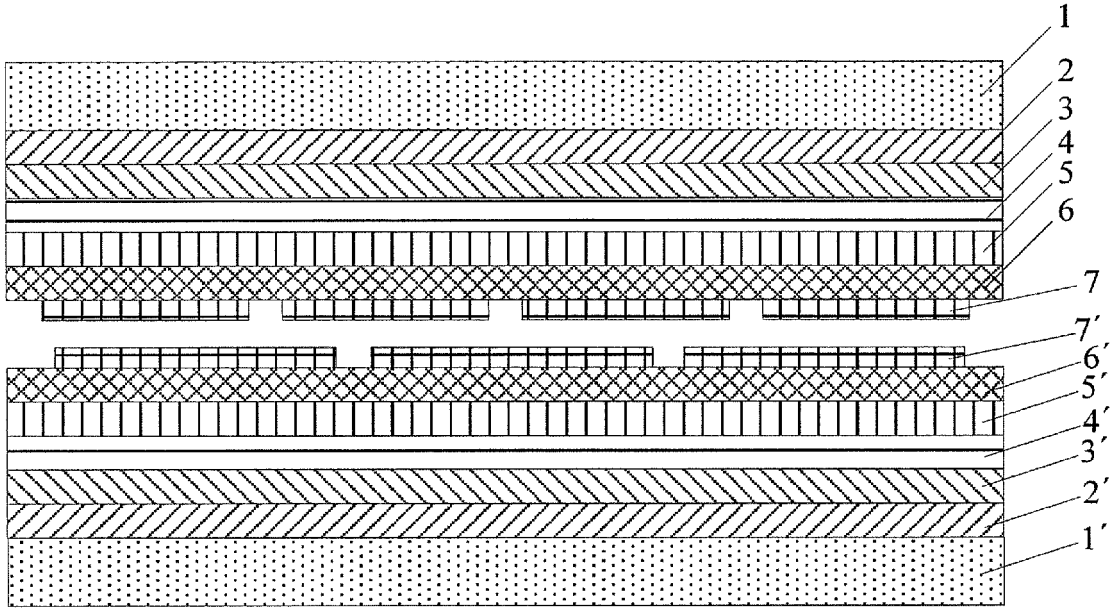

Fig. 1

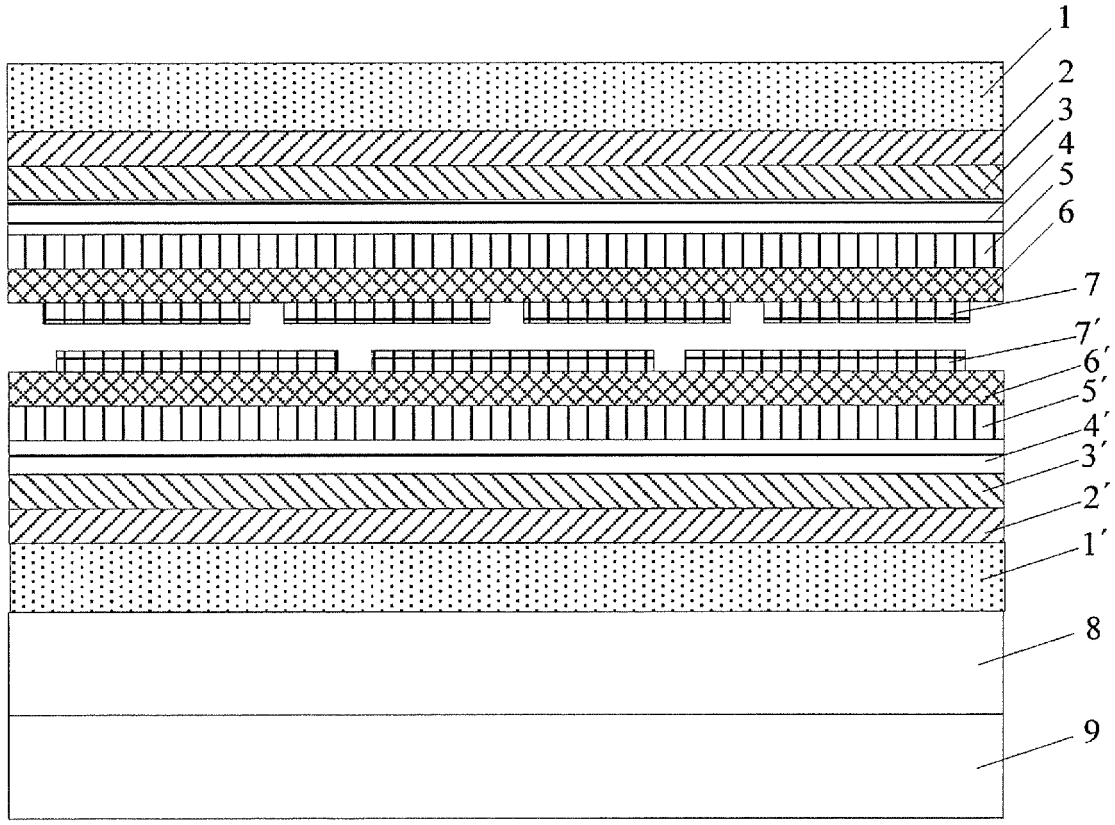

Fig. 2

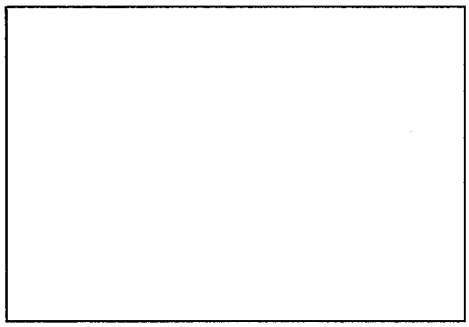

Fig. 3A

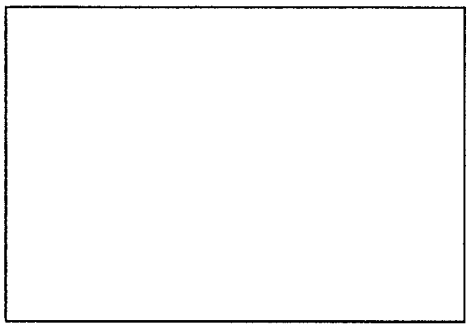

Fig. 3A'

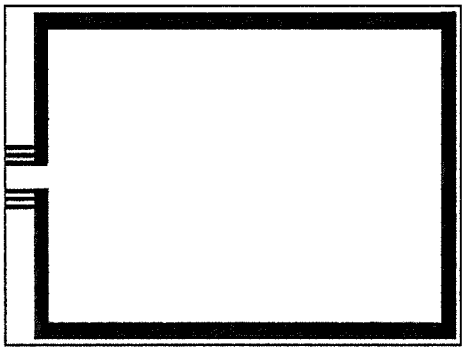

Fig. 3B

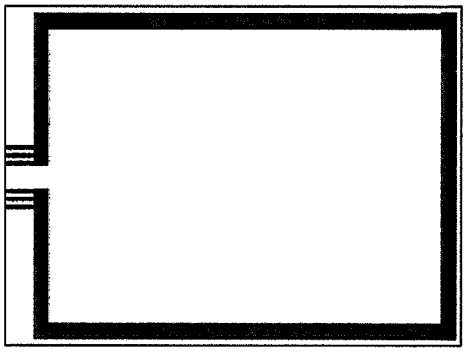

Fig. 3B'

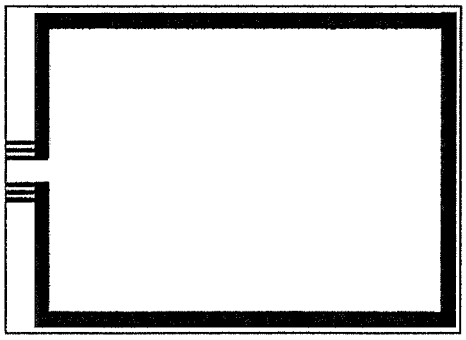

Fig. 3C

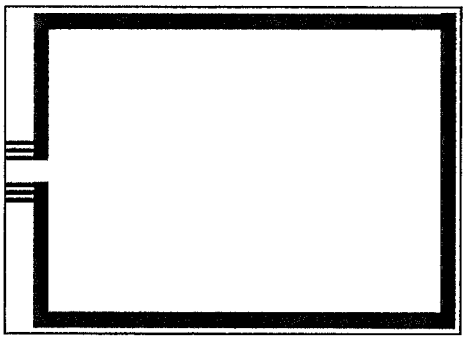

Fig. 3C'

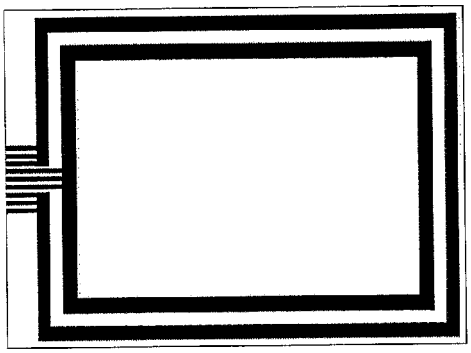

Fig. 3D

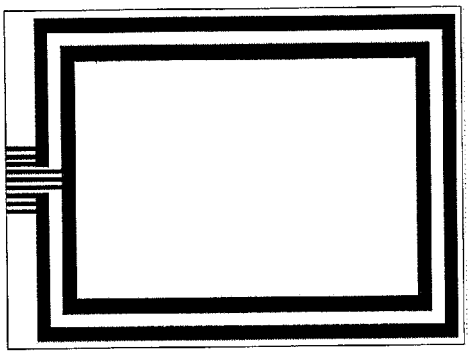

Fig. 3D'

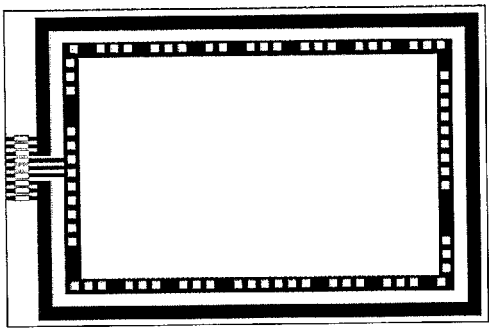

Fig. 3E

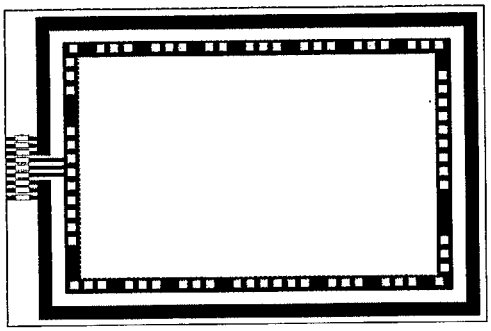

Fig. 3E'

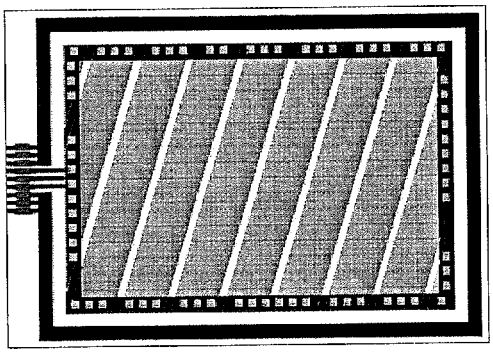

Fig. 3F

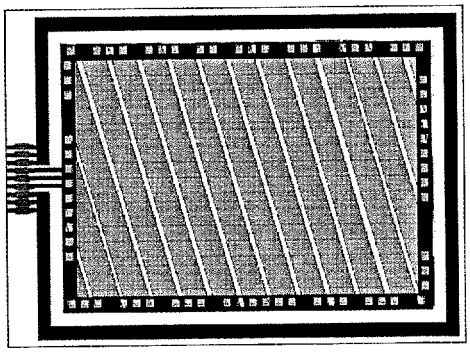

Fig. 3F'

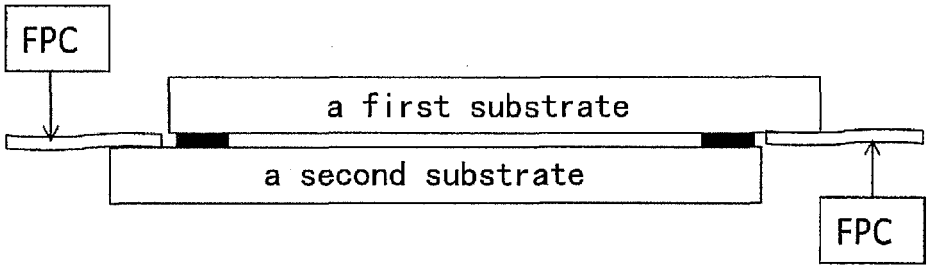

Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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- US 2013088653 A1 **[0007]**

专利名称(译)	3D面板及其制造方法和具有3D面板的3D显示装置		
公开(公告)号	EP3203312B1	公开(公告)日	2019-12-11
申请号	EP2015749962	申请日	2015-01-30
[标]申请(专利权)人(译)	京东方科技集团股份有限公司 北京京东方显示技术有限公司		
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摘要(译)

本发明的实施例提供了一种3D面板。 3D面板包括第一基板，第二基板以及配置为填充在第一基板和第二基板之间的液晶，其中第一基板和第二基板均设置有公共电极和信号电极。 由于本发明的3D面板的两侧的基板具有可以独立控制的电极，因此可以通过将信号切换到两个基板来实现上下基板之间的光栅电极功能的切换，从而改善了 3D面板的应用范围以及3D面板的兼容性和多功能性。 另外，本发明的实施例还公开了一种用于制造3D面板的方法和具有该3D面板的3D显示设备。

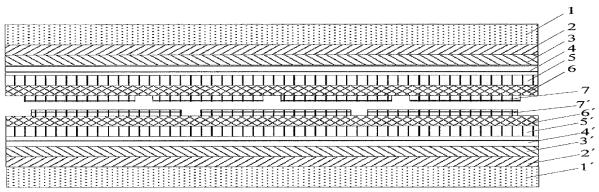

Fig. 1

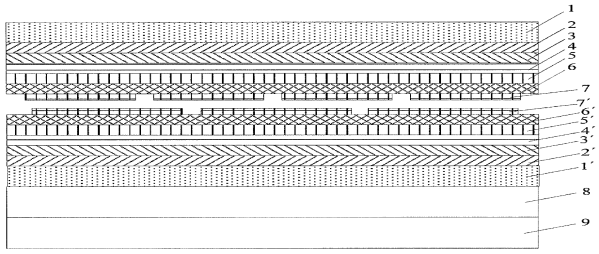

Fig. 2