

DESCRIPTION

Plasma Addressed Liquid Crystal Display Apparatus

Technical Field

This invention relates to a plasma addressed liquid crystal display apparatus adapted for driving liquid crystal by making use of plasma to thereby display an image (pictorial image).

Background Art

As an image display apparatus for driving liquid crystal to carry out display of an image (pictorial image), a plasma addressed liquid crystal display apparatus utilizing discharge plasma is disclosed in the Japanese Patent Application Laid Open No. 265931/1992 publication, etc.

The proposed plasma addressed liquid crystal display apparatus comprises, as shown in FIG. 1, a liquid crystal side glass 12 having a plurality of electrodes 11 arranged in parallel to each other, a base (substrate) glass 14 having a plurality of discharge electrodes 13 arranged in parallel to each other in the state perpendicular to the electrodes 11, a thin plate glass 15 provided between the liquid crystal side glass 12 and the base glass 14, a liquid crystal layer 16 provided between the liquid crystal side glass 12 and the thin plate glass 15, a plurality of barrier ribs 18 formed on the discharge electrodes 13 within a discharge chamber 17 formed between the base glass 14 and the thin plate glass 15, and a frit 19 provided so as to seal the discharge chamber 17.

The liquid crystal side glass 12 is flat and non-conductive, and sufficiently transparent from an optical point of view. A plurality of belt-shaped electrodes 11 are formed on one principal surface of the liquid crystal side glass 12, and liquid crystal layer 16 comprised of nematic liquid crystal, etc. is disposed in a manner in contact with the electrodes 11. In more practical sense, a plurality of electrodes 11 formed with a predetermined width on the principal surface of the liquid crystal side glass 12 opposite to the base glass 14 are formed by transparent conductive material, e.g., indium tin oxide (ITO), etc., and is transparent from an optical point of view. In addition, these electrodes 11 are disposed in parallel to each other, and are disposed, e.g., in a vertical direction of the display screen.

The liquid crystal layer 16 is held by the thin plate glass 15 which is a thin dielectric plate and the liquid crystal side glass 12 in the state put therebetween. By the liquid crystal side glass 12, the liquid crystal layer 16 and the thin plate glass 15, so called liquid crystal cell is constituted. This thin plate glass 15 functions as an insulating shielding layer between the liquid crystal layer 16 and discharge chamber 17 which will be described later.

On the other hand, the base glass 14 on which a plurality of discharge electrodes 13 are formed as a belt-shaped electrode and the thin plate glass 15 are adapted so that their peripheries

are sealed by frit 19 which is sealing agent. In addition, a space formed between the base glass 14 and the thin plate glass 15 serves as discharge chamber 17 for producing discharge plasma.

Respective discharge electrodes 13 are equi-distantly disposed on the base glass 14. Moreover, barrier ribs 18 respectively serving as barrier are formed on these discharge electrodes 13 by printing as described later. The discharge chamber 17 is partitioned by these plural barrier ribs 18 so that it is divided into respective plasma chambers P_1 , P_2 ... which form discharge channels respectively independent.

In more practical sense, plural discharge electrodes 13 formed on the principal surface of the base glass 14 opposite to the liquid crystal side glass 12 are directly formed on the base glass 14 by printing conductive paste including, e.g., silver powder, etc. Moreover, these discharge electrodes 13 are also arranged in parallel to each other, wherein the arrangement direction thereof is the direction perpendicular to the electrodes 11 formed on the previously described liquid crystal side glass 12. Namely, these discharge electrodes 13 are arranged in a horizontal direction with respect to the display screen. Accordingly, respective plasma chambers P_1 , P_2 ... correspond to e.g., respective scanning lines within the display picture on screen. Ionizable gas is hermetically sealed into respective plasma chambers P_1 , P_2 As such ionizable gas, helium, neon, argon or mixture gas thereof is used.

Barrier ribs 18 are formed every scanning units on the belt-shaped discharge electrodes 13. In more practical sense, the barrier ribs 18 are formed by printing, plural times, in a stacked manner, glass paste into which ceramic such as alumina, etc. is mixed by the printing method, e.g., the screen printing method, and also serves to limit the distance between the base glass 14 and the thin plate glass 15 (hereinafter referred to as gap interval of discharge chamber 17). The gap interval of the discharge chamber 17 can be controlled by adjusting the number of screen printing operations when forming barrier ribs 18 or quantity of glass paste at the time of each printing, etc. Ordinarily, the gap interval is caused to be about 200 μm .

The discharge electrodes 13 function as the anode electrode or the cathode electrode, and discharge electrodes are constituted by pairing these electrodes. In the case where barrier ribs 18 are formed on the discharge electrodes 13 as described above, respective one discharge electrodes 13 are commonly used with respect to adjacent plasma chambers in respective plasma chambers P_1 , P_2 ... partitioned by these barrier ribs 18. Namely, e.g., the discharge electrode 13 between the plasma chamber P_1 and the plasma chamber P_2 serves as both discharge electrode of the plasma chamber P_1 and discharge electrode of the plasma chamber P_2 .

A manufacturing process for the above-described plasma addressed liquid crystal display apparatus will be briefly

described.

Initially, a plurality of discharge electrodes 13 are made up on glass base 14 to make up barrier ribs 18 by printing so that they are stacked on these discharge electrodes 13. Further, frit 19 is coated at the peripheries of the barrier ribs 18 to form discharge chamber 17. Thereafter, thin plate glass 15 is stuck (attached) onto the upper portions of the barrier ribs 18 to vacuum-evacuate the inside of the discharge chamber 17 thereafter to inject gas therein.

Meanwhile, the thickness of the thin plate glass 15 is about 50 μm . The thin plate glass 15 functions an insulating shielding layer between the liquid crystal layer 16 and the discharge chamber 17 as described above. In the vacuum evacuating process and the gas injection process described above, as shown in FIG. 1, large stress is applied to the portions indicated by Q_1 and Q_2 of the thin plate glass 15, i.e., the portions Q_1 , Q_2 in which the thin plate glass 15 is in contact with the edge portions of the barrier ribs 18. In addition, small cracks, so called micro cracks exist within glass.

Accordingly, in the above-described plasma addressed liquid crystal display apparatus, there was the problem that micro cracks of the portions Q_1 , Q_2 of the thin plate glass 15 become large by carrying out vacuum evacuation and injection of gas, so the thin plate glass 15 is cracked or broken.

In view of actual circumstances as described above, an

object of this invention is to provide a plasma addressed liquid crystal display apparatus capable of preventing the thin plate glass from being cracked or broken.

Disclosure of the Invention

A plasma addressed liquid crystal display apparatus according to this invention comprises a first base (substrate) having a plurality of first electrodes arranged substantially in parallel to each other on one principal surface of the first base, a second base having a plurality of second electrodes arranged substantially in parallel to each other in the state substantially perpendicular to the first electrodes on the principal surface opposite to the first electrodes on the first base, a dielectric sheet provided between the first and second bases, a liquid crystal layer provided between the first base and the dielectric sheet, a plurality of barriers formed along the second electrodes within a discharge chamber formed between the second base and the dielectric sheet, and a seal member provided in a manner to seal the discharge chamber. In the plasma addressed liquid crystal display apparatus, the spacing between the barriers and the spacing between the barrier positioned nearest to the seal member and the seal member are set to 1.8 mm or less.

In this case, the dielectric sheet has a thickness of 50 μm or less, and the barriers are formed on the second electrodes, or are formed between the second electrodes. Moreover, the

second electrode consists of an anode electrode and a cathode electrode, wherein barriers are respectively formed on the anode electrodes and the cathode electrodes, or the barriers are formed only on the anode electrodes.

In addition, it is more preferable that the spacing between the barriers and the spacing between the barrier positioned nearest to the seal member and the seal member are set to 0.8 mm or less.

Brief Description of the Drawings

FIG. 1 is a cross sectional diagram showing the configuration of a conventional plasma addressed liquid crystal display apparatus.

FIG. 2 is a cross sectional diagram showing the configuration of a plasma addressed liquid crystal display apparatus of a first embodiment to which this invention is applied.

FIG. 3 is a front view showing the configuration of the plasma addressed liquid crystal display apparatus.

FIG. 4 is a cross sectional diagram showing the essential part of the plasma addressed liquid crystal display apparatus.

FIG. 5 is a cross sectional diagram showing the essential part of the plasma addressed liquid crystal display apparatus.

FIG. 6 is a cross sectional diagram showing the essential part of a plasma addressed liquid crystal display apparatus of a second embodiment to which this invention is applied.

FIG. 7 is a cross sectional diagram showing the essential part of a plasma addressed liquid crystal display apparatus of a third embodiment to which this invention is applied.

Best Mode for Carrying Out the Invention

Preferred embodiments of a plasma addressed liquid crystal display apparatus according to this invention will now be described with reference to the attached drawings.

The plasma addressed liquid crystal display apparatus to which this invention is applied comprises, as shown in FIG. 2, for example, a liquid crystal side glass 22 having a plurality of electrodes 21 arranged on one principal surface thereof substantially in parallel to each other, a base (substrate) glass 24 having a plurality of discharge electrodes 23 arranged substantially in parallel to each other in the state substantially perpendicular to the electrodes 21 on the principal surface opposite to the electrodes 21 on the liquid crystal side glass 22, a dielectric sheet 25 provided between the liquid crystal side glass 22 and the base glass 24, a liquid crystal layer 26 provided between the liquid crystal side glass 22 and the dielectric sheet 25, a plurality of barrier ribs 28 formed along the discharge electrodes 23 within a discharge chamber 27 formed between the base glass 24 and the dielectric sheet 25, and a seal member 29 provided in a manner to seal the discharge chamber 27.

The liquid crystal side glass 22 is flat and non-conductive,

and is sufficiently transparent from an optical point of view. A plurality of belt-shaped electrodes 21 having a predetermined width are arranged substantially in parallel to each other on the principal surface opposite to the dielectric sheet 25. The arrangement direction of these electrodes 21 is, e.g., a vertical direction of the display screen. In addition, the electrode 21 is formed by transparent conductive material, e.g., indium tin oxide (ITO), etc., and is transparent from an optical point of view.

The liquid crystal layer 26 is comprised of, e.g., nematic liquid crystal, etc., and is put between the liquid crystal side glass 22 and the dielectric sheet 25 in the state in contact with the electrodes 21.

The dielectric sheet 25 is comprised of, e.g., glass in a thin plate form. In order to sufficiently ensure electric coupling between the liquid crystal layer 26 and discharge chamber 27 which will be described later, the thickness of the thin plate glass is caused to be thin thickness of , e.g., 50 μm . Namely, so called liquid crystal cell is constituted by the liquid crystal side glass 22, the liquid crystal layer 26 and the dielectric sheet 25. The dielectric sheet 25 functions as an insulating shielding layer between the liquid crystal layer 26 and the discharge chamber 27.

On the other hand, on the base glass 24, a plurality of discharge electrodes 23 are arranged substantially in parallel

to each other in the state substantially perpendicular to the electrodes 21 on the principal surface opposite to the electrodes 21 on the liquid crystal side glass 22. Namely, the arrangement direction of the plural discharge electrodes 23 is, e.g., the horizontal direction of the display screen, and the discharge electrodes 23 are formed every scanning units. These discharge electrodes 23 are directly formed in a belt form on the base glass 24 by printing conductive paste including, e.g., silver powder, etc. so that they have a predetermined width.

Further, in the plasma addressed liquid crystal display apparatus of the structure in which barrier ribs 28 which will be described later are formed on the discharge electrodes 23 as shown in FIG. 2, for example, the discharge electrodes 23 are arranged so that the spacing between barrier ribs 28 and the spacing between the barrier rib 28 and seal member 29 which will be described later become equal to 1.8 mm or less. In this embodiment, the spacing between the barrier ribs 28 is caused to be 0.65 mm, and the spacing between the barrier rib 28 and the seal member 29 is caused to be 1.0 mm.

The base glass 24 on which the plural discharge electrodes 23 are formed as a belt-shaped electrode is sealed and supported at the periphery thereof by seal member 29, and is disposed with a predetermined spacing from the dielectric sheet 25. The seal member 29 is formed by coating, e.g., powdered glass (frit) so that the thickness becomes equal to a predetermined value.

Ordinarily, the thickness of the seal member 29 is caused to be about 200 μm . In addition, a space formed between the base glass 24 and the dielectric sheet 25 serves as discharge chamber 27 which forms discharge channels.

The discharge chamber 27 formed between the base glass 24 and the dielectric sheet 25 is partitioned along the discharge electrodes 23, i.e., by a plurality of barrier ribs 28 which are barriers respectively formed on the discharge electrodes 23 as shown in FIG. 2, for example, and is thus divided into plasma chambers P_1 , P_2 ... respectively independent. Namely, the barrier ribs 28 are also formed every scanning units on the respective belt-shaped discharge electrodes 23. Accordingly, respective plasma chambers P_1 , P_2 ... correspond to, e.g., respective scanning lines within the display picture on screen. The barrier rib 28 is formed by printing, plural times, in a stacked manner, glass paste into which ceramic, e.g., alumina, etc. is mixed by the printing method, e.g., the screen printing method, and thus also serves to limit the distance between the base glass 24 and the dielectric sheet 25. The spacing between the base glass 24 and the dielectric sheet 25 can be controlled by adjusting the number of screen printing operations when forming barrier ribs 28 or quantity of glass paste at the time of each printing, etc. Ordinarily, such spacing is caused to be about 200 μm .

Ionizable gas is hermetically sealed into the plasma

chambers $P_1, P_2 \dots$ formed in this way. As such ionizable gas, helium, neon, argon or mixture gas thereof, etc. is used.

In the plasma addressed liquid crystal display apparatus, e.g., a video signal is delivered to the electrodes 21 arranged in a vertical direction with respect to the display screen, and a predetermined voltage is applied across a pair of discharge electrodes 23 within a plasma chamber P_i corresponding to the scanning line to produce plasma discharge within the plasma chamber P_i to thereby carry out picture image display.

In more practical sense, the discharge electrodes 23 function as the anode electrode or the cathode electrode in a time series manner by applied potential. When, e.g., one discharge electrode 23 is grounded (is caused to undergo application of voltage of 0 volts), and a negative potential is applied to all the remaining discharge electrodes 23, the grounded discharge electrode 23 becomes anode electrode, and discharge electrodes on the both sides of the grounded discharge electrode 23 become the cathode electrode. Thus, plasma discharge takes place within the plasma chambers on the both sides of the grounded discharge electrode 23. By shifting discharge electrode 23 to be grounded in order, e.g., in synchronism with the horizontal scanning of a video signal, it is possible to shift plasma chambers subject to discharge in order in synchronism with the horizontal scanning.

Further, the liquid crystal layer 26 functions as a sampling

capacitor of analog voltages applied to electrodes₂₁ formed on the liquid crystal side glass 22, and (arbitrary) plasma chamber P_1 functions as a sampling switch. Thus, picture image display is carried out. Namely, the liquid crystal layer 26 can be grasped as capacitor model, and is decomposed into capacitive liquid crystal cell formed at the portion where the electrodes 21 and the plasma chamber P_1 overlap with each other.

Assuming now that an analog voltage is applied to the discharge electrode 23, voltage of 0 volts is applied to one discharge electrode 23 as strobe, and discharge plasma takes place within the plasma chamber P_1 , the so-called plasma switching operation is caused to take place. Thus, the portion in contact with the plasma chamber P_1 of the dielectric sheet 25 and the discharge electrode 23 serving as the anode electrode are placed in the state where they are electrically connected by discharge plasma. From a viewpoint of the circuit, there results the state equivalent to the state where the capacitor switch is turned ON. As a result, the analog voltage applied to the electrode 21 is applied to the capacitor model. Thereafter, when the plasma discharge is stopped, the capacitor switch is turned OFF. As a result, the analog voltage which has been applied immediately before the capacitor switch is turned OFF is held (stored) in the capacitor model. Also after the discharge plasma has disappeared, for a time period until the next strobe is carried out, i.e., e.g., field time period of corresponding

picture image, there remains the state where the above-mentioned analog voltage is stored in the capacitor model. When the capacitive liquid crystal cell is driven, picture image based on the video signal is displayed on the plasma addressed liquid crystal display apparatus.

A portion of a manufacturing process of the above-described plasma addressed liquid crystal display apparatus in which barrier ribs are formed on the discharge electrodes will now be described. FIG. 3 is a front view of the plasma addressed liquid crystal display apparatus, FIG. 4 is an enlarged cross sectional view of the essential part when cut along the C-C' lines of FIG. 3, and FIG. 5 is an enlarged cross sectional view when cut along the D-D' lines of FIG. 3.

Initially, as shown in FIGS. 4 and 5, conductive paste including, e.g., silver powder, etc. is printed on the base glass 24 with a predetermined width and at equal intervals, and is then baked (fired) to thereby form a plurality of discharge electrodes 23 on the base glass 24. At this time, a plurality of discharge electrodes 23 are formed so that the spacing (interval) A between the barrier rib 28 formed on the discharge electrode 23 at the next process step and the seal member 29 and the spacing between barrier ribs 28, i.e., the pitch interval B of the barrier rib 28 become equal to 1.8 mm or less. In more practical sense, e.g., the spacing A is set to 1.0 mm and the pitch interval B is set to 0.65 mm.

As shown in FIG. 5, discharge prevention covers 30 (only one is illustrated in the figure) are formed at the both end portions of the plural discharge electrodes 23. Further, barrier ribs 28 are respectively formed on the plural discharge electrodes 23 by the screen printing. Namely, glass paste into which ceramic, e.g., alumina, etc. is mixed is printed, in a stacked manner, plural times, on the discharge electrodes 23 by the screen printing method so that the thickness becomes equal to about 200 μm to form barrier ribs 28 at intervals of 0.65 mm. Thereafter, the upper portions of the plural barrier ribs 28 thus formed are caused to undergo polishing and baking.

Then, e.g., frit is coated at the periphery of the barrier ribs 28 so that the thickness becomes equal to about 200 μm to thereby form seal member 29. At this time, the seal member 29 is formed so that the spacing A between the barrier rib 28 and the seal member 29 becomes equal to 1.8 mm or less, i.e., 1.0 mm.

Thereafter, dielectric sheet 25 is stuck on the upper portions of the barrier ribs 28 to form discharge chamber 27 consisting of plasma chambers $P_1, P_2 \dots$ thereafter to evacuate the inside of the discharge chamber 27 into vacuum. Then, ionizable gas such as helium or neon, etc. is injected.

Meanwhile, the thickness of the dielectric sheet 25 consisting of thin plate glass is about 50 μm as described above. In the vacuum evacuation process and the gas injection process, large stress is applied to the portions Q_1, Q_2 of the dielectric

sheet 25 in contact with the edge portions of the barrier ribs 28 as shown in the FIG. 2 mentioned above. However, since the pitch interval B of barrier rib 28 is set to 0.65 mm and the spacing A between the barrier rib 28 and the seal member 29 is 1.0 mm in this embodiment so that these values A and B are caused to be both 1.8 mm or less, stress applied to the thin plate glass is 5 kg/cm^2 or less. As a result, there was no possibility that the dielectric sheet 25 is cracked or broken. Moreover, even if small cracks, so called micro cracks exist within glass, there was no possibility that the micro cracks become large so that the dielectric sheet 25 is cracked or broken. It is to be noted that although the spacing A between the barrier rib 28 and the seal member 29 and the pitch interval B of the barrier rib 28 change in dependency upon the thickness of the dielectric sheet 25, it is more preferable that they are 0.8 mm or less.

It is to be noted that while, in the above-described embodiment (hereinafter referred to as the first embodiment), the plasma addressed liquid crystal display apparatus is of a structure in which barrier ribs 28 are formed on the discharge electrodes 23, this invention is not limited to this first embodiment, but may be applied to plasma addressed liquid crystal display apparatuses, e.g., of a structure such that dedicated cathode and anode electrodes are respectively provided at the plasma chambers.

In more practical sense, a plasma addressed liquid crystal

display apparatus of a second embodiment to which this invention is applied comprises, as the essential part thereof is shown in FIG. 6, for example (see FIG. 2 in connection with the components which are not shown in FIG. 6), liquid crystal side glass 22 having a plurality of electrodes 21 arranged substantially in parallel to each other on one principal surface, base (substrate) glass 24 having plural anode electrodes 31 and plural cathode electrodes 32 arranged substantially in parallel to each other in the state substantially perpendicular to the electrodes 21 on the principal surface opposite to the electrodes 21 on the liquid crystal side glass 22, dielectric sheet 25 provided between the liquid crystal side glass 22 and the base glass 24, liquid crystal layer 26 provided between the liquid crystal side glass 22 and the dielectric sheet 25, a plurality of barrier ribs 28 formed on the anode electrodes 31 within discharge chamber 27 formed between the base glass 24 and the dielectric sheet 25, and seal member 29 provided in a manner to seal the discharge chamber 27.

Namely, in the plasma addressed liquid crystal display apparatus of the second embodiment, the belt-shaped anode electrode 31 has a width similar to that of the discharge electrode 23 of the first embodiment, but the belt-shaped cathode electrode 32 is narrower than that of the discharge electrode 23, and barrier ribs 28 are formed only on the anode electrodes 31. It is to be noted that the same reference numerals are

respectively attached to the same components as the components of the plasma addressed liquid crystal display apparatus of the first embodiment, and explanation of their detail and operations will be omitted.

Also in the plasma addressed liquid crystal display apparatus of the second embodiment, the spacing A between the barrier rib 28 and the seal member 29 and the pitch interval B of the barrier rib 28 are set to 1.8 mm or less, e.g., are respectively set to 1.0 mm and 0.65 mm. As a result, in the vacuum evacuation process and the gas injection process, there was no possibility that the dielectric sheet 25 is cracked or broken.

Further, a plasma address liquid crystal display apparatus of a third embodiment to which this invention is applied comprises, as the essential part thereof is shown in FIG. 7, for example (see FIG. 2 in connection with the components which are not shown in the figure), liquid crystal side glass 22 having a plurality of electrodes 21 arranged in parallel to each other on one principal surface, base (substrate) glass 24 having plural anode electrodes 33 and plural cathode electrodes 34 arranged in parallel to each other in the state substantially perpendicular to the electrodes 21 on the principal surface opposite to the electrodes 21 on the liquid crystal side glass 22, dielectric sheet 25 provided between the liquid crystal side glass 22 and the base glass 24, liquid crystal layer 26 provided between the

liquid crystal side glass 22 and the dielectric sheet 25, a plurality of barrier ribs 28 formed between the anode electrodes 33 and the cathode electrodes 34 which are adjacent to each other within discharge chamber 27 formed between the base glass 24 and the dielectric sheet 25, and seal member 29 provided in a manner to seal the discharge chamber 27.

Namely, the plasma addressed liquid crystal display apparatus of the third embodiment is of a structure in which pairs of anode electrodes 33 and cathode electrodes 34 are respectively provided every respective plasma chambers, and barrier ribs 28 are provided between the anode electrodes 33 and the cathode electrodes 34 which are adjacent to each other within the plasma chambers. It is to be noted that the same reference numerals are respectively attached to the same components as the components of the plasma addressed liquid crystal display apparatus of the first embodiment, and explanation of their detail and operations will be omitted.

Also in the plasma addressed liquid crystal display apparatus of the third embodiment, the spacing A between the barrier rib 28 and the seal member 29 and the pitch interval B of the barrier rib 28 are set to 1.8 mm or less, e.g., are respectively set to 1.0 mm and 0.65 mm. As a result, in the vacuum evacuation process and the gas injection process, there was no possibility that the dielectric sheet 25 is cracked or broken.

Industrial Applicability

As apparent from the foregoing description, the plasma addressed liquid crystal display apparatus according to this invention is adapted so that the spacing between plural barriers and the spacing between the barrier positioned nearest to the seal member and the seal member are set to 1.8 mm or less, thereby making it possible to prevent the dielectric sheet from being cracked or broken in the vacuum evacuation process step and the gas injection process step of the manufacturing process for the plasma addressed liquid crystal display apparatus. Thus, so called yield can be improved to more degree as compared to the conventional apparatus.



What is claimed is:

1. A plasma addressed liquid crystal display apparatus comprising:

a first base having a plurality of first electrodes arranged substantially in parallel to each other on one principal surface of the first base;

a second base having a plurality of second electrodes arranged substantially in parallel to each other in the state substantially perpendicular to the first electrodes on a principal surface opposite to the first electrodes on the first base;

a dielectric sheet provided between the first and second bases;

a liquid crystal layer provided between the first base and the dielectric sheet;

a plurality of barriers formed along the second electrodes within a discharge chamber formed between the second base and dielectric sheet; and

a seal member provided in a manner to seal the discharge chamber,

wherein the spacing between the barriers and the spacing between the barrier nearest to the seal member and the seal member are set to 1.8 mm or less.

2. A plasma addressed liquid crystal display apparatus as set forth in claim 1,



wherein the barriers are formed on the second electrodes.

3. A plasma addressed liquid crystal display apparatus as set forth in claim 1,

wherein the barriers are formed between the second electrodes.

4. A plasma addressed liquid crystal display apparatus as set forth in claim 1,

wherein the second electrode consists of an anode electrode and a cathode electrode;

the barriers being respectively formed between the anode electrodes and the cathode electrodes.

5. A plasma addressed liquid crystal display apparatus as set forth in claim 1,

wherein the second electrode consists of an anode electrode and a cathode electrode,

the barriers being formed only on the anode electrodes.

6. A plasma addressed liquid crystal display apparatus as set forth in claim 1,

wherein the spacing between the barriers and the spacing between the barrier positioned nearest to the seal member and the seal member are set to 0.8 mm or less.

7. A plasma addressed liquid crystal display apparatus as set forth in claim 1,

wherein the dielectric sheet has a thickness of 50 mm or less.

ABSTRACT

A plasma addressed liquid crystal display apparatus according to this invention comprises a first base having plural first electrodes arranged substantially in parallel to each other on one principal surface, a second base having plural second electrodes arranged substantially in parallel to each other in the state substantially perpendicular to the first electrodes on the principal surface opposite to the first electrodes on the first base, a dielectric sheet provided between the first and second bases, a liquid crystal layer provided between the first base and the dielectric sheet, a plurality of barriers formed along the second electrodes within a discharge chamber formed between the second base and the dielectric sheet, and a seal member provided in a manner to seal the discharge chamber. In the plasma addressed liquid crystal display apparatus, the spacing between barriers and the spacing between the barrier positioned nearest to the seal member and the seal member are set to 1.8 mm or less. Thus, in the vacuum evacuation process step and the gas injection process step of the manufacturing process for the plasma addressed liquid crystal display apparatus, the dielectric sheet can be prevented from being cracked or broken. As a result, yield can be improved to more degree as compared to the conventional apparatus.

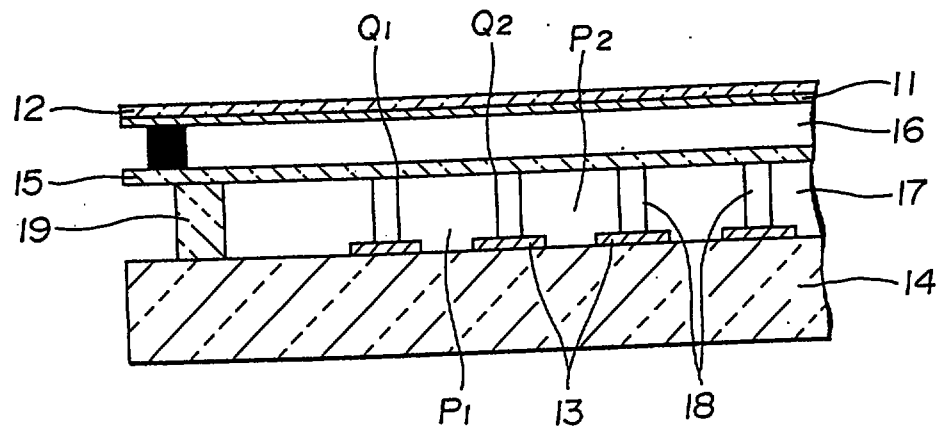


FIG.1

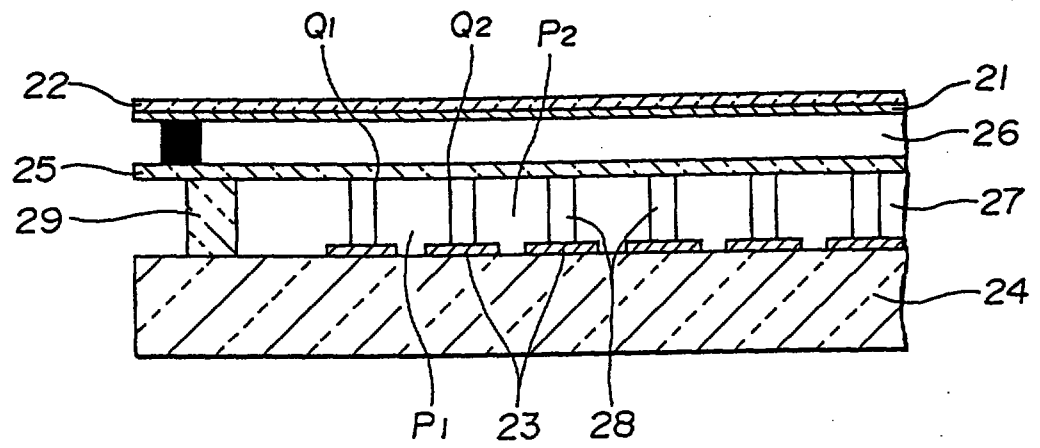


FIG.2

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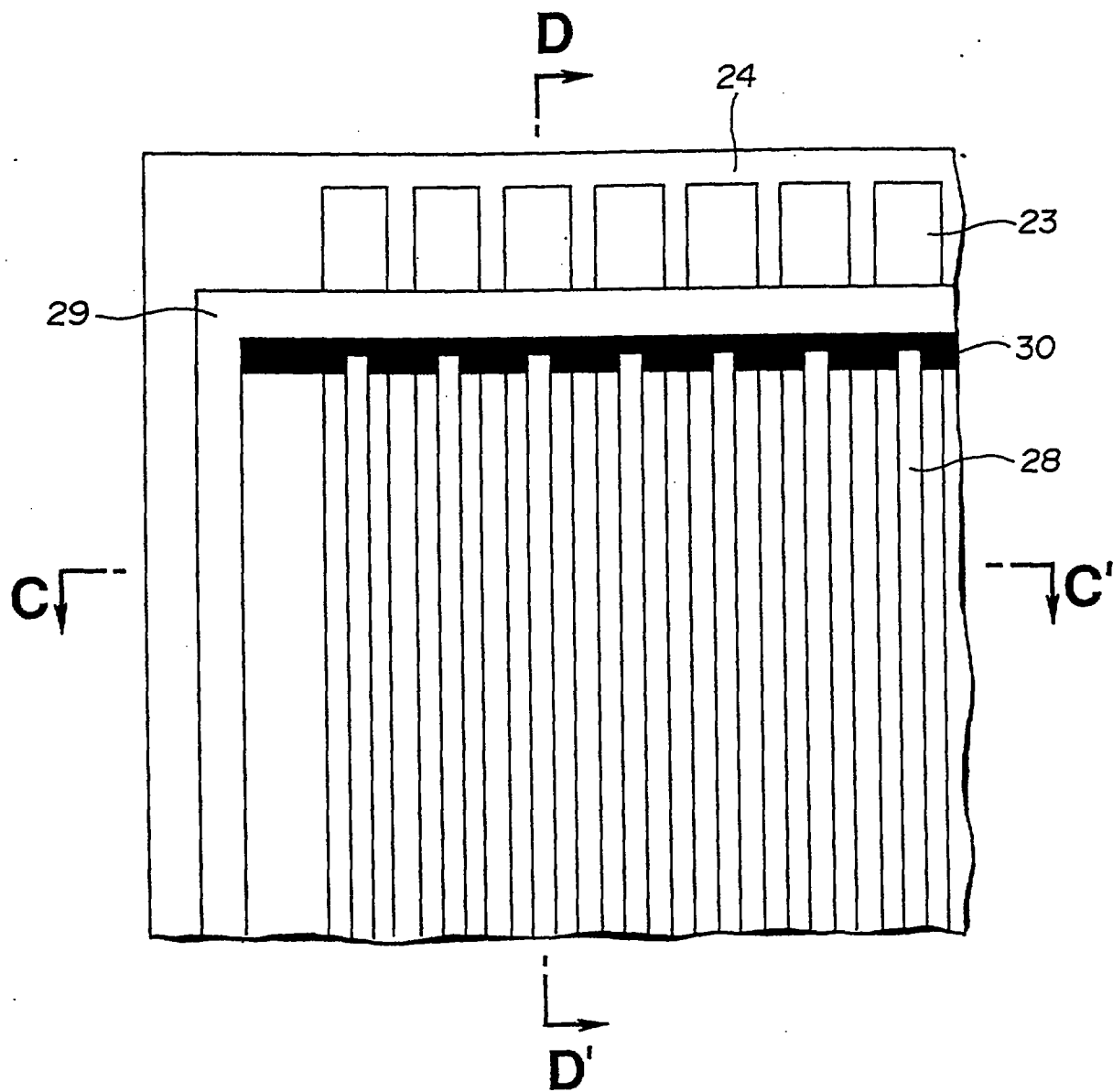


FIG.3

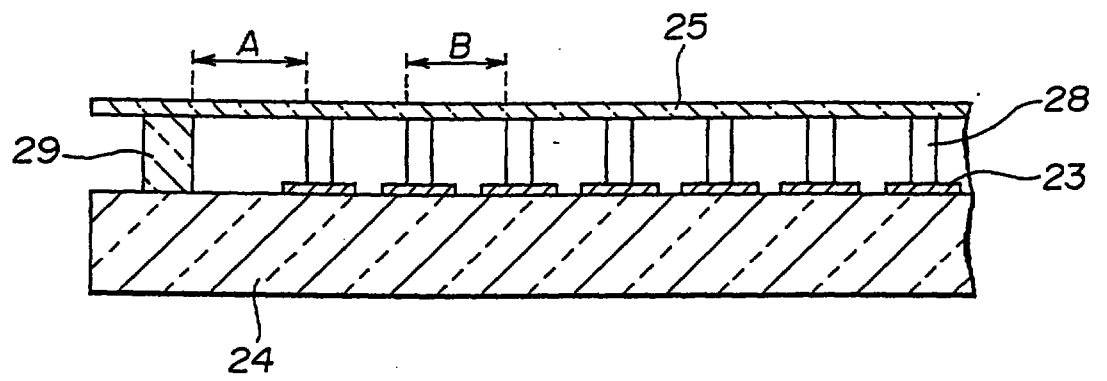


FIG.4

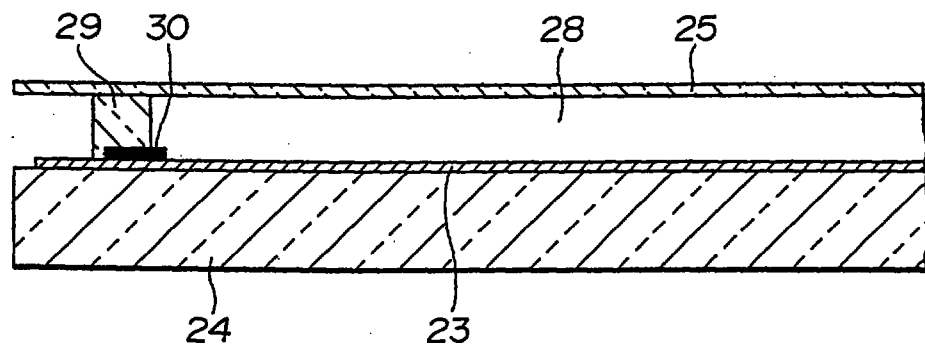


FIG.5

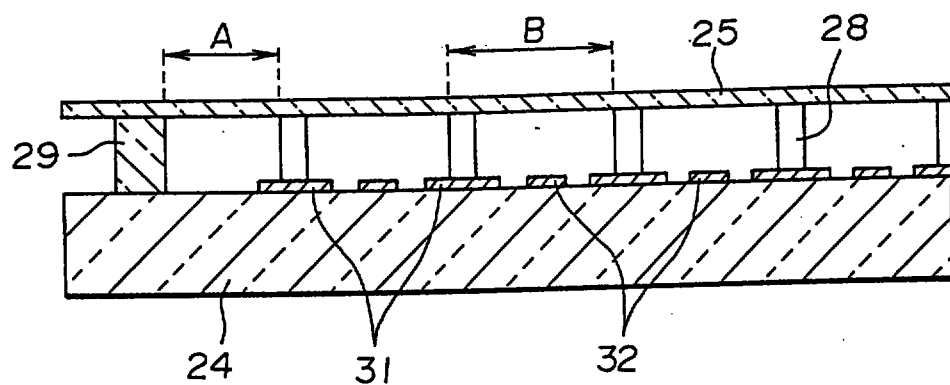


FIG. 6

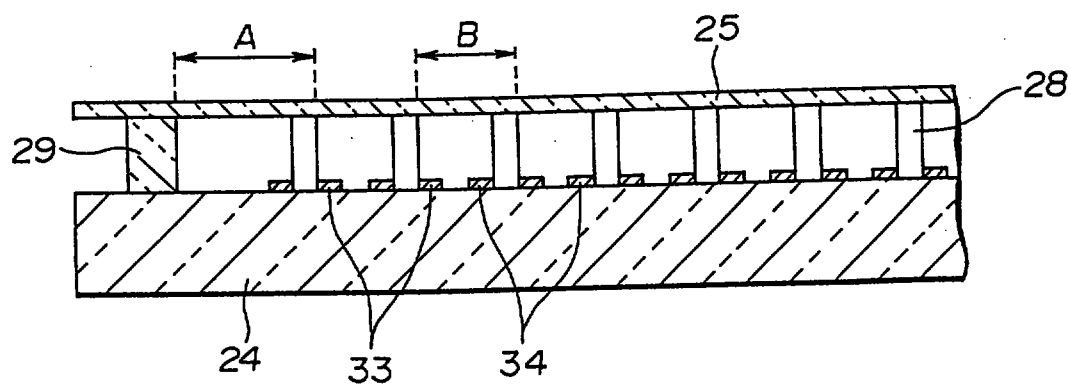


FIG. 7

13-457 20 80