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(54) LIQUID CRYSTAL PANEL, METHOD AND DEVICE FOR MANUFACTURING LIQUID CRYSTAL PANEL, AND POLARIZING PLATE STAMPING DEVICE

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(57) **ABSTRACT**

A liquid crystal fabrication method includes the steps of: dropping liquid crystal **(104)** on a first substrate **(101)** at an upper surface inside regions enclosed by a sealing agent **(103)** disposed thereon; overlaying a second substrate **(102)** on the first substrate **(101)** downward to stick the substrates together; sticking a polarizing plate **(106)** on an upper surface of the first and second substrates **(101, 102)**; and collectively dividing the first and second substrates and the polarizing plate.

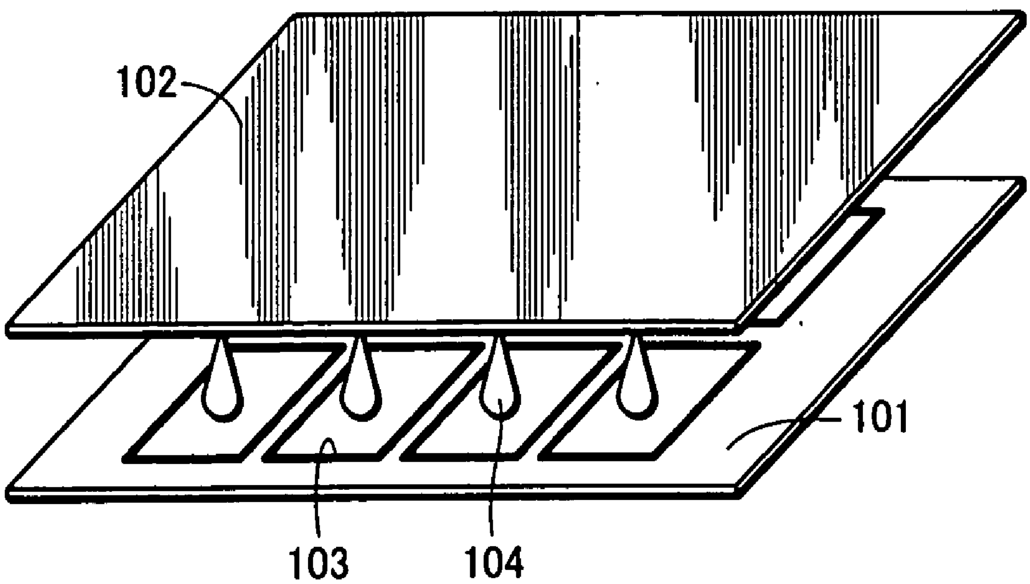


FIG.1

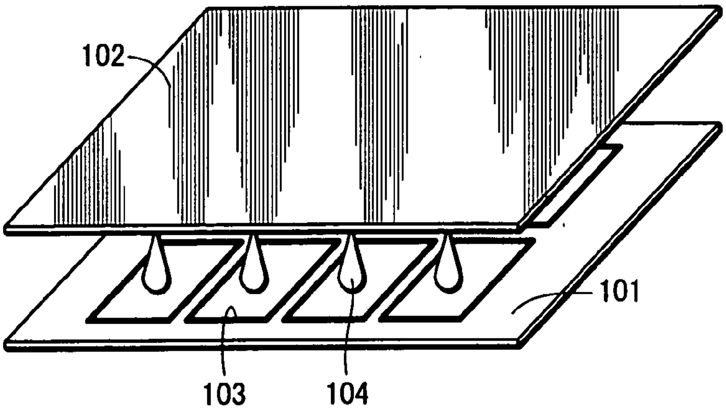


FIG.2

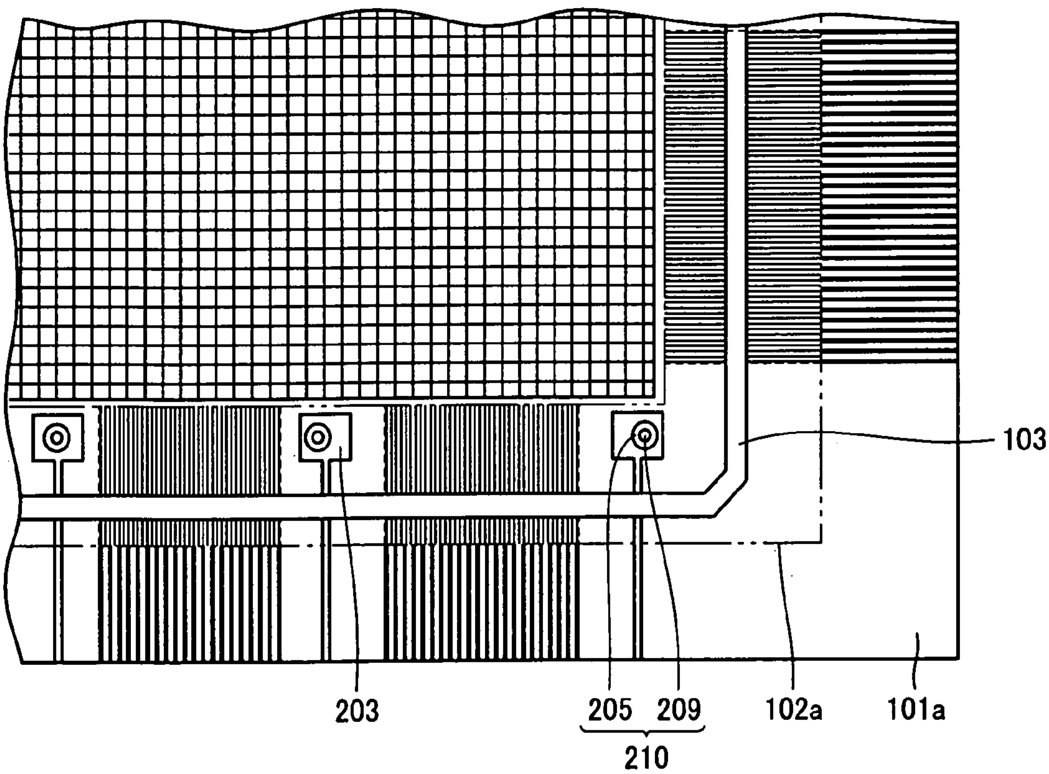


FIG.3

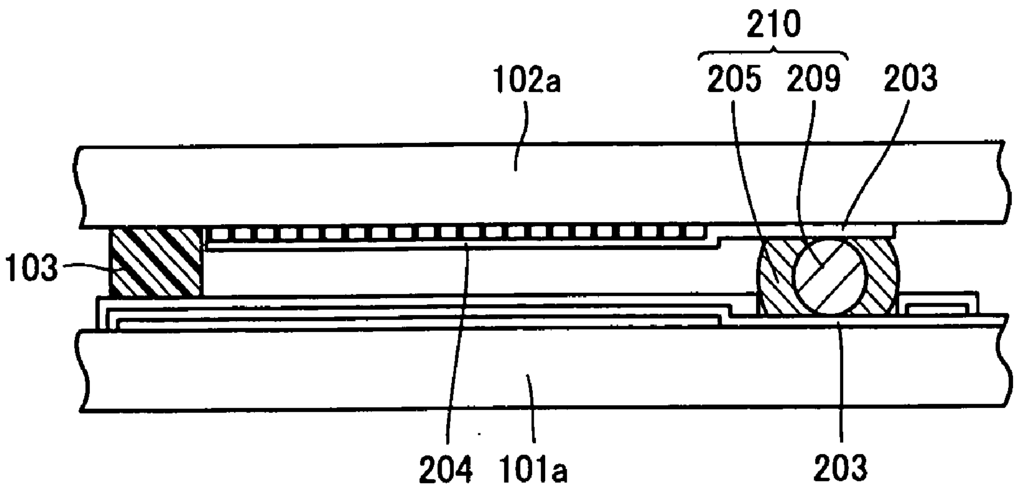


FIG.4

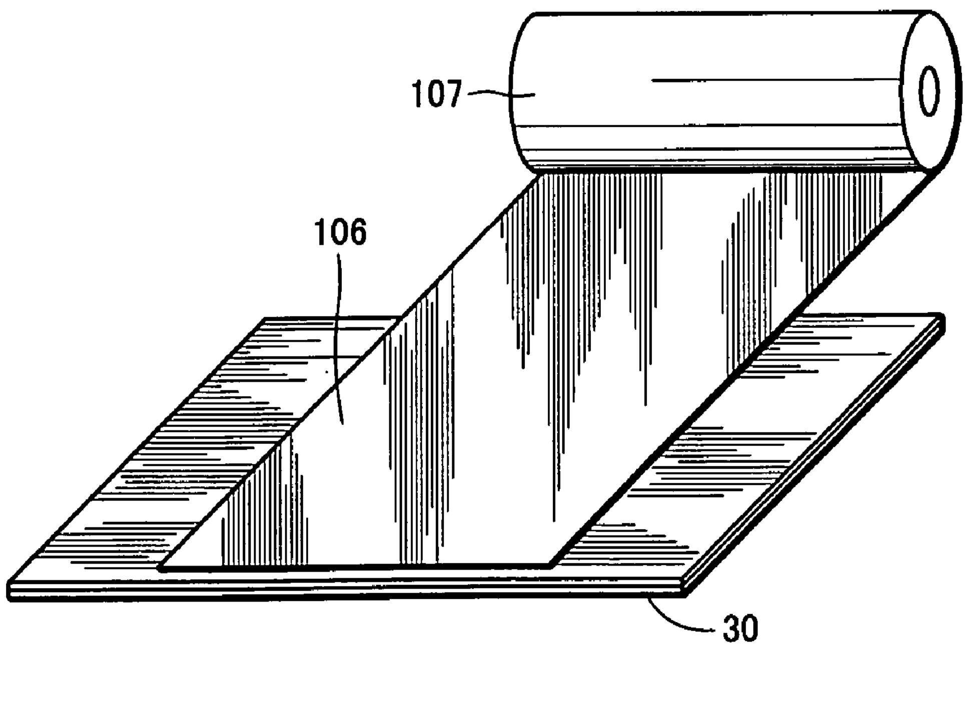
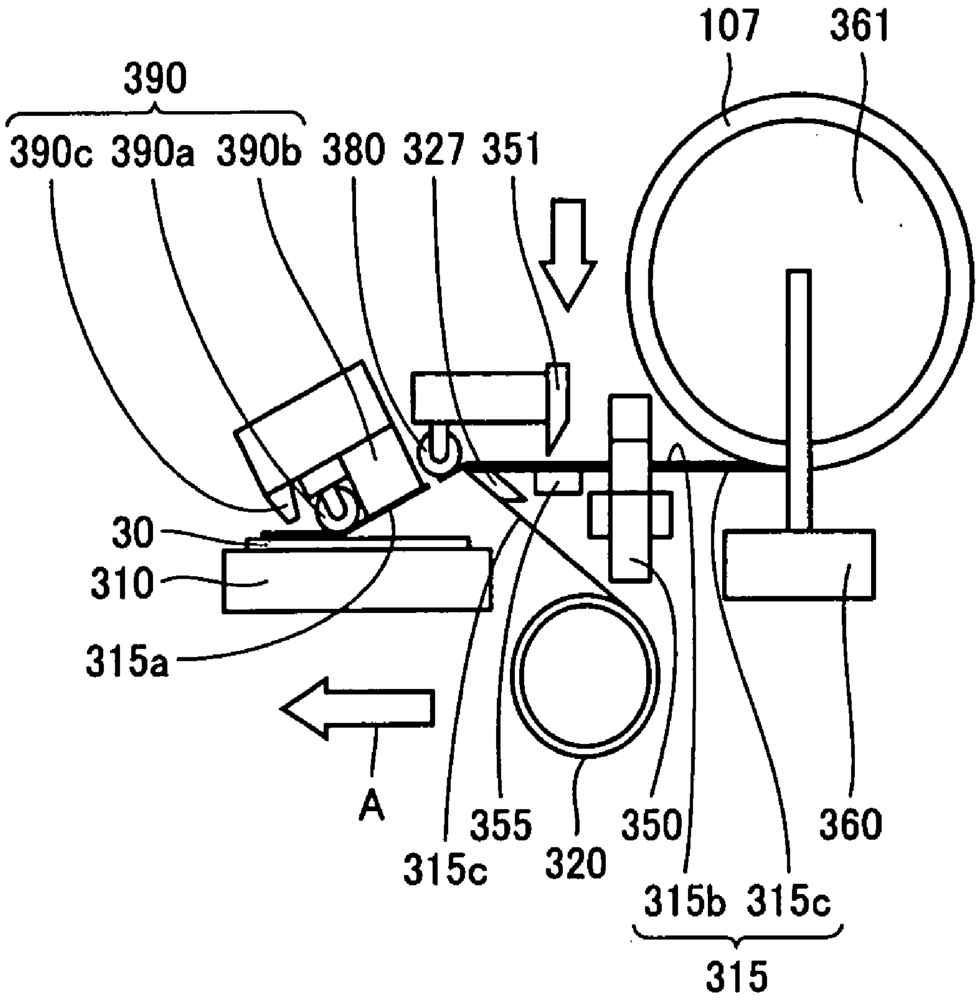


FIG.5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390c
390a
390b
380
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351
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361
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A
315c
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315b
315c
315

FIG.6

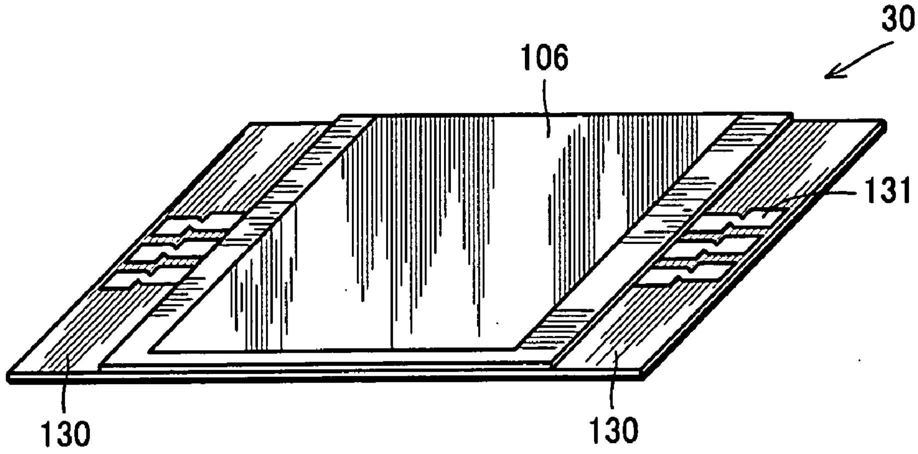


FIG.7

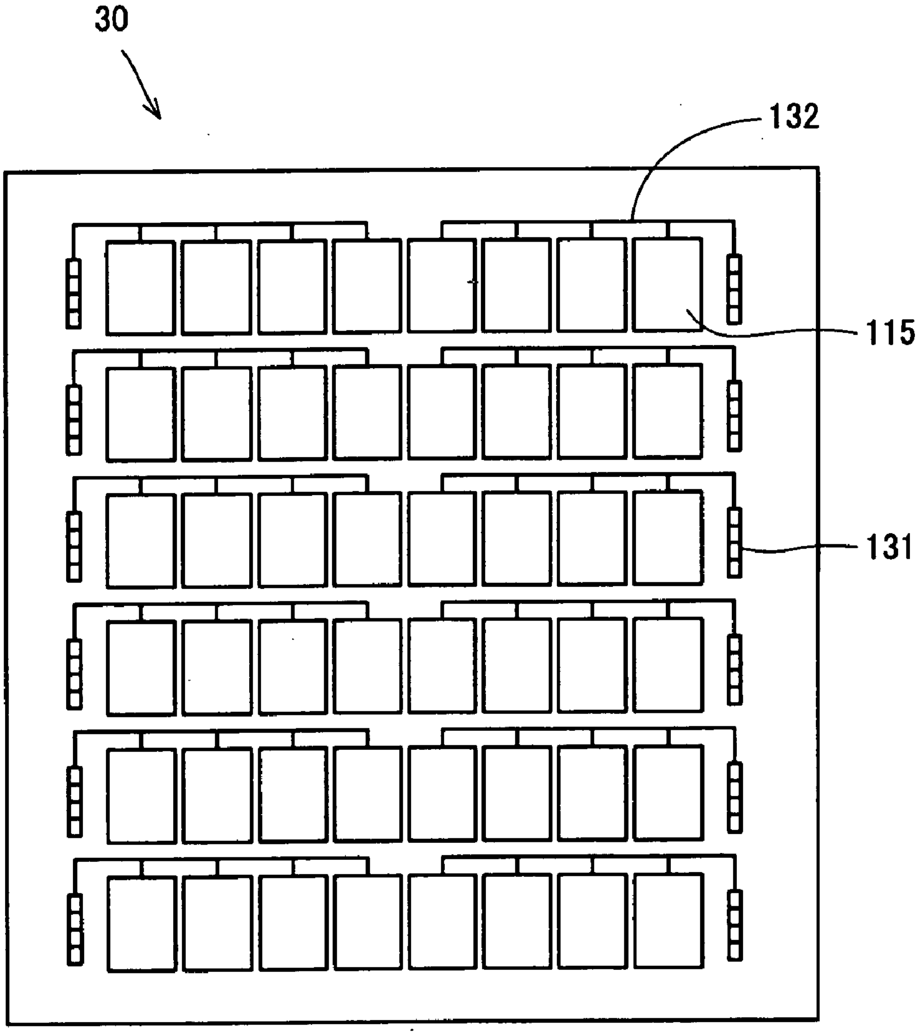


FIG.8

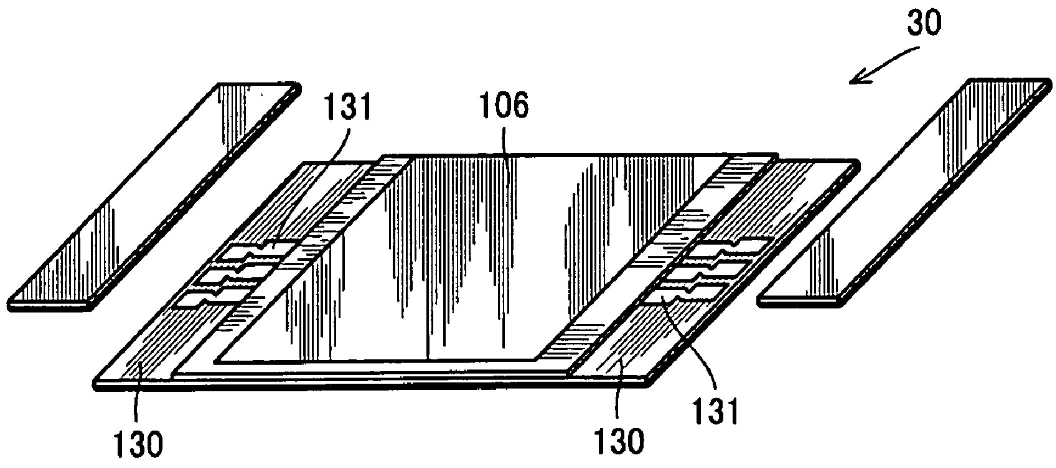


FIG.9

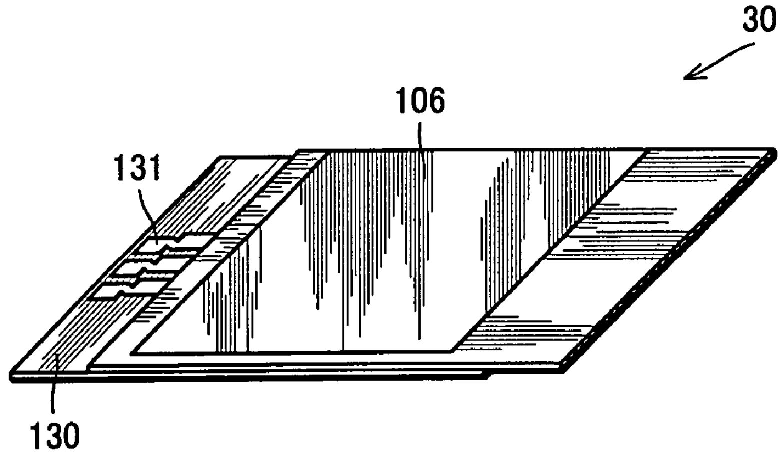


FIG.10

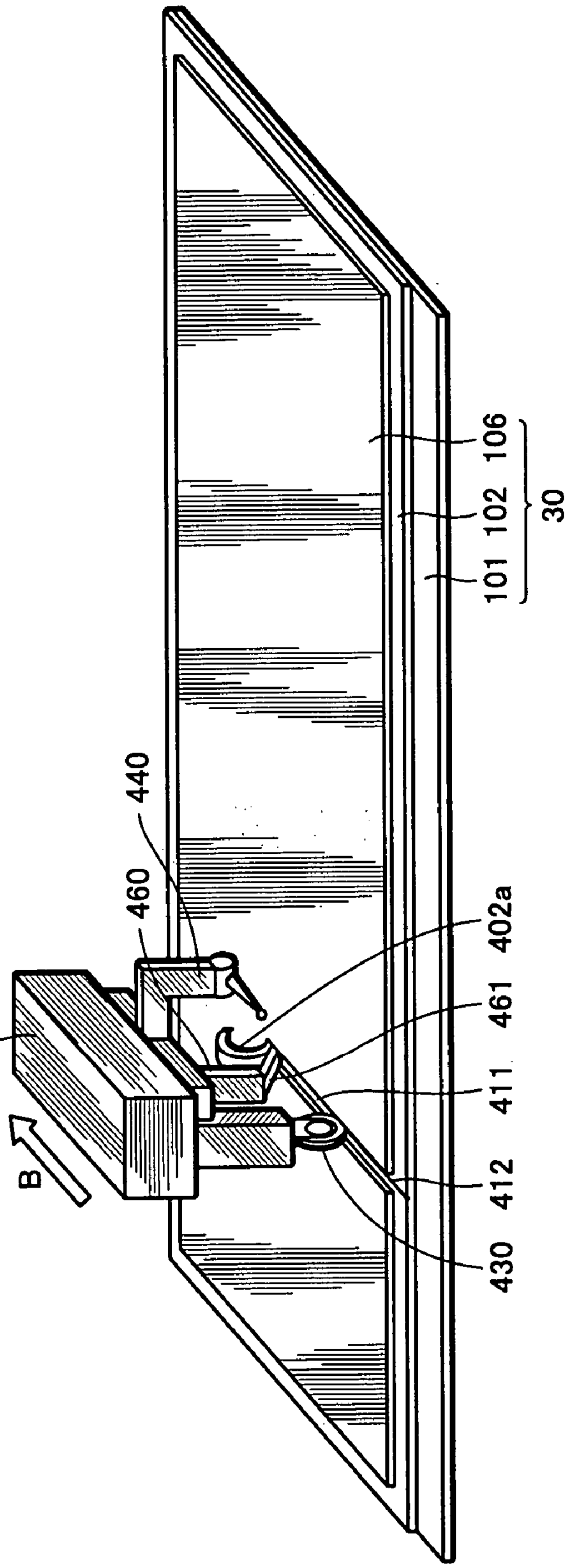


FIG.11

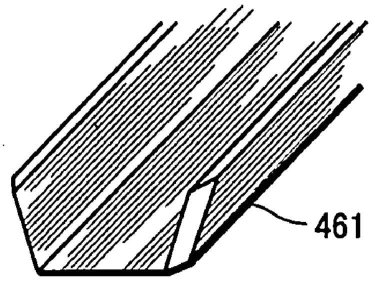


FIG.12

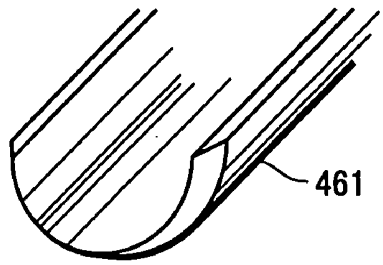


FIG.13

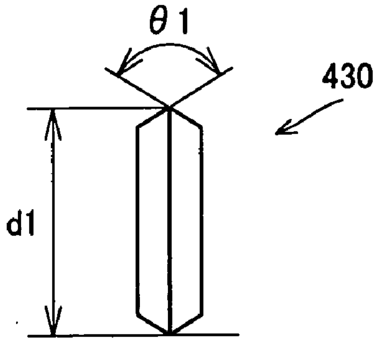


FIG.14

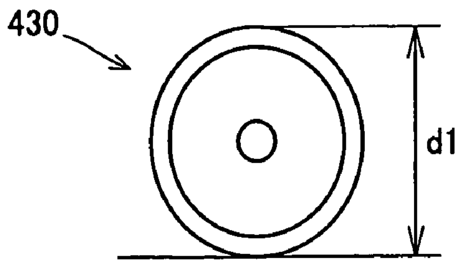


FIG. 15

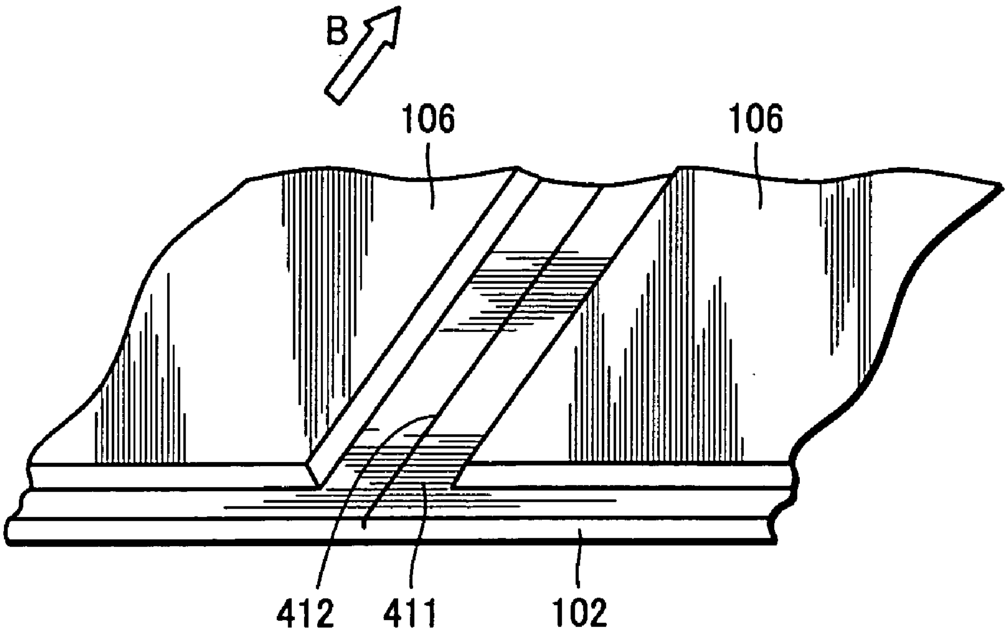


FIG. 16

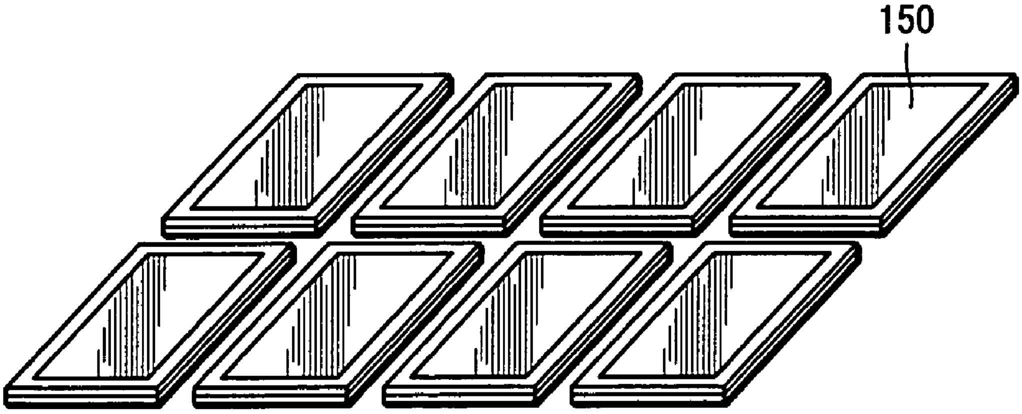


FIG.17

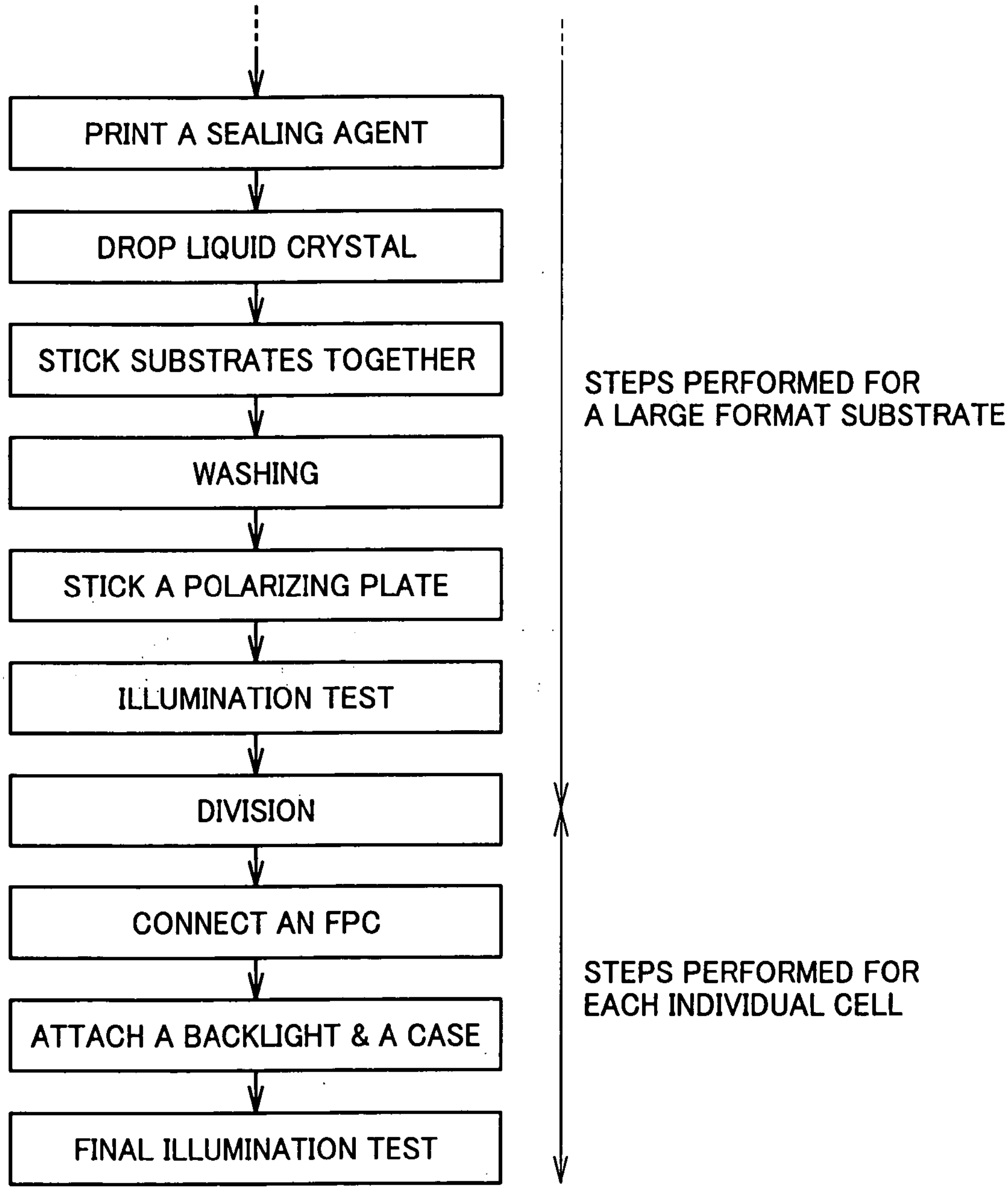

PRINT A SEALING AGENT
DROP LIQUID CRYSTAL
STICK SUBSTRATES TOGETHER
WASHING
STICK A POLARIZING PLATE
ILLUMINATION TEST
DIVISION
CONNECT AN FPC
ATTACH A BACKLIGHT & A CASE
FINAL ILLUMINATION TEST
STEPS PERFORMED FOR A LARGE FORMAT SUBSTRATE
STEPS PERFORMED FOR EACH INDIVIDUAL CELL

FIG.18

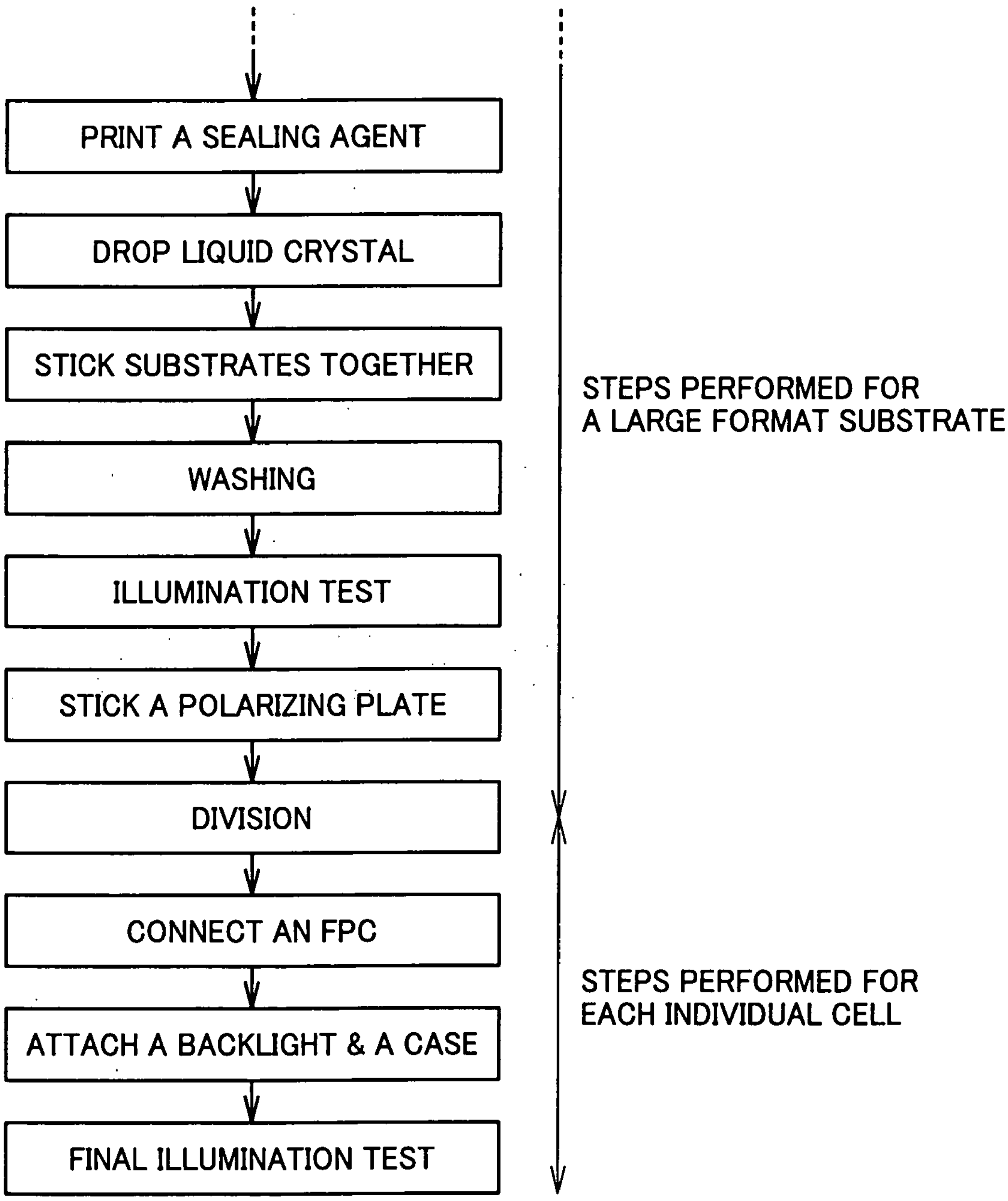

PRINT A SEALING AGENT
DROP LIQUID CRYSTAL
STICK SUBSTRATES TOGETHER
WASHING
ILLUMINATION TEST
STICK A POLARIZING PLATE
DIVISION
CONNECT AN FPC
ATTACH A BACKLIGHT & A CASE
FINAL ILLUMINATION TEST
STEPS PERFORMED FOR
A LARGE FORMAT SUBSTRATE
STEPS PERFORMED FOR
EACH INDIVIDUAL CELL

FIG.19

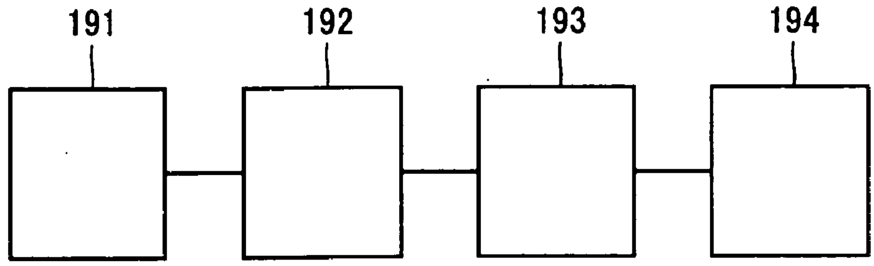


FIG.20

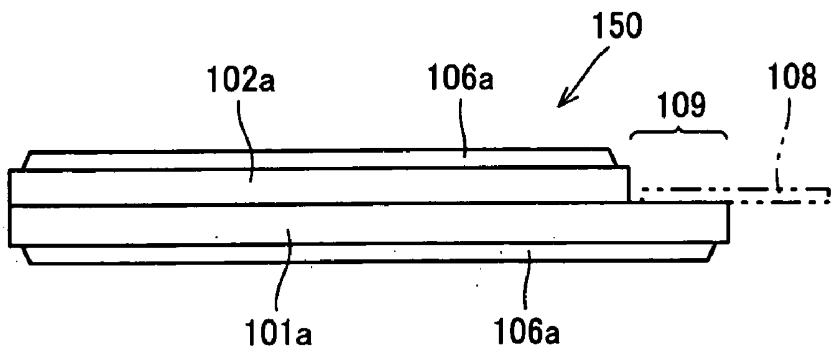


FIG.21

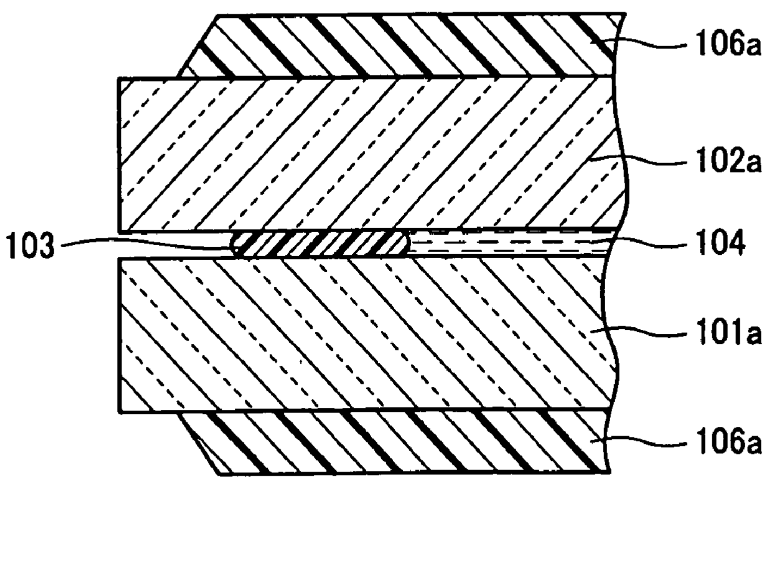


FIG.22

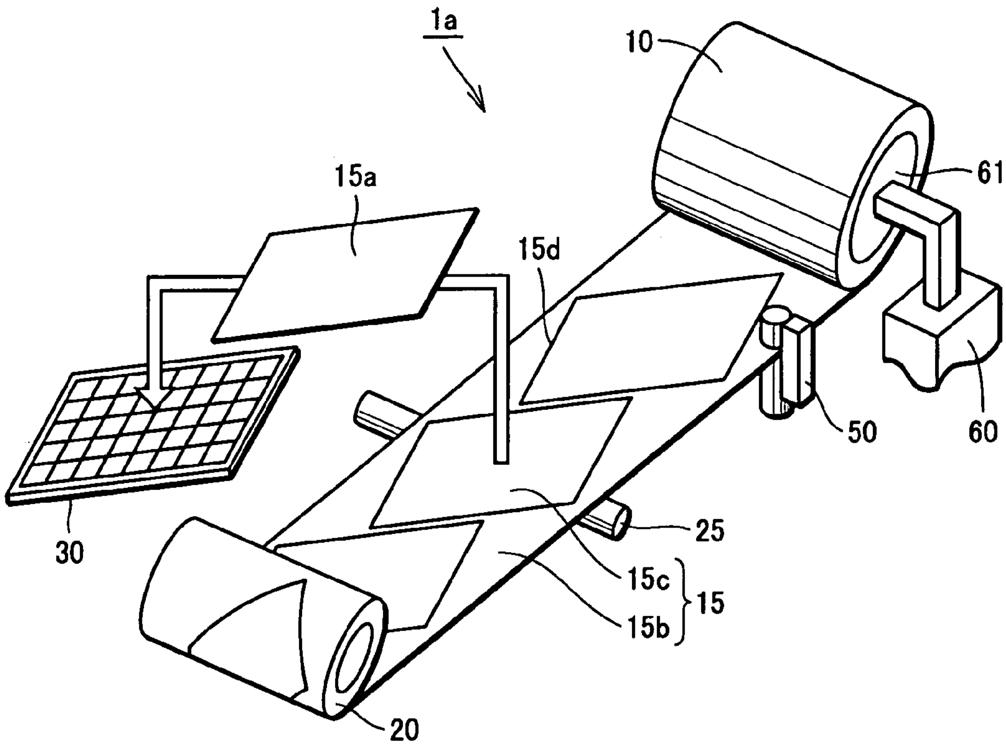
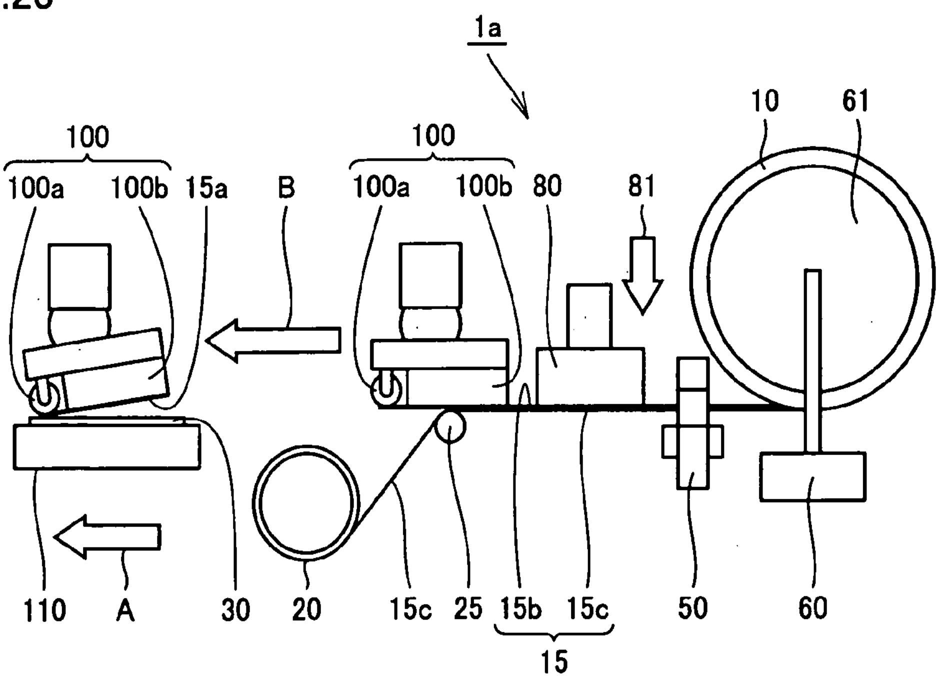

1a
10
61
15a
15d
50
60
30
25
15c
15
15b
20

FIG.23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100a
100b
15a
B
100
100a
100b
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10
61
110
A
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20
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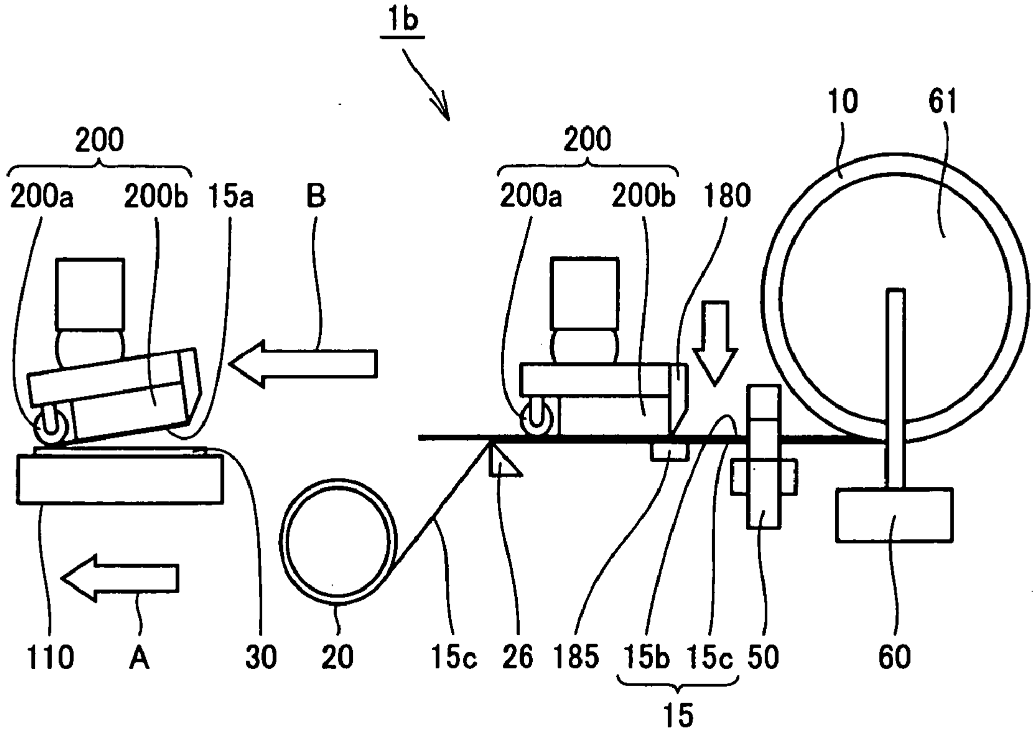
15b
15c
15
50
60

FIG.24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200a
200b
15a
B
200
200a
200b
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110
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15c
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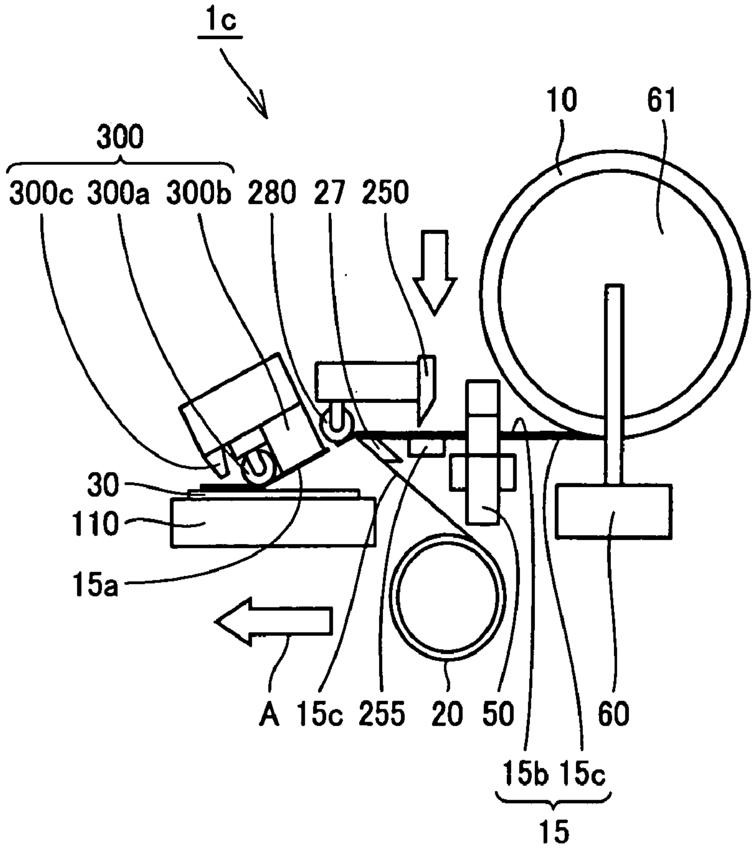
15c
50
60
15

FIG.25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300c
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300b
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15a
A
15c
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15c
15

FIG.26 PRIOR ART

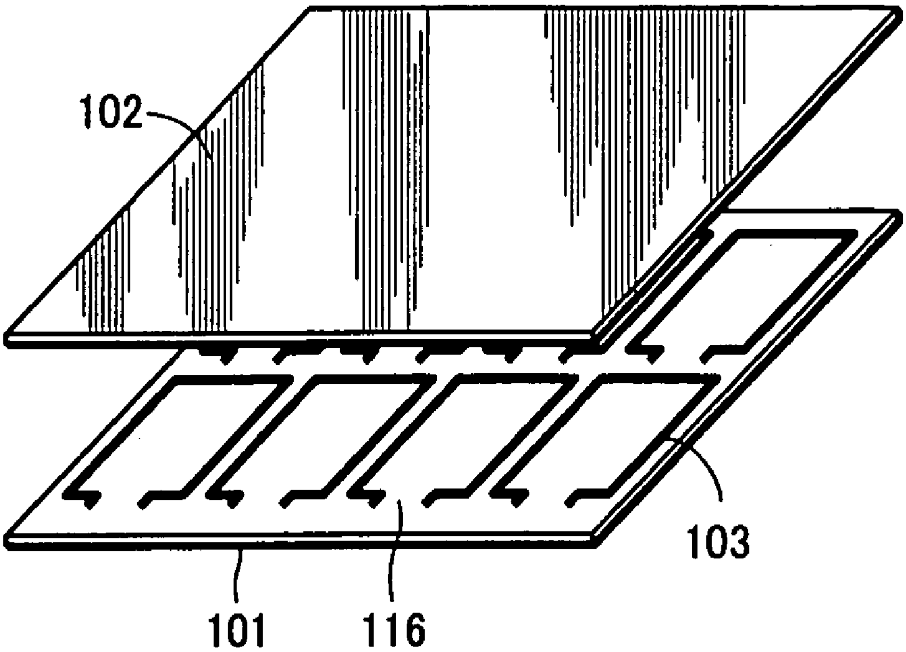


FIG.27 PRIOR ART

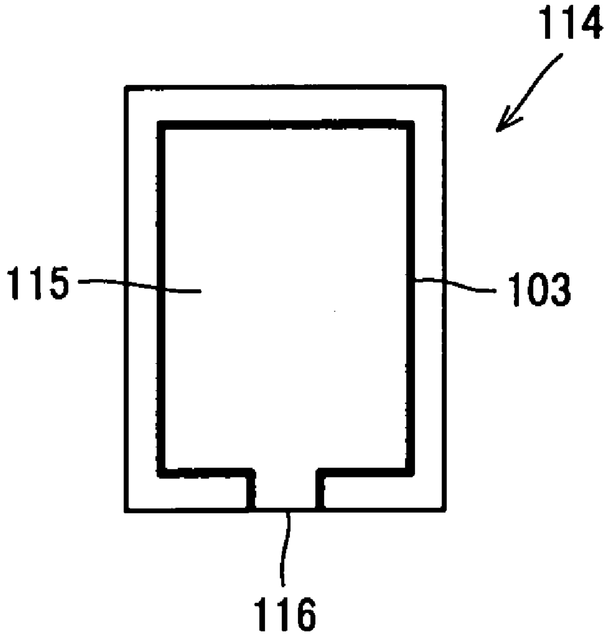


FIG.28 PRIOR ART

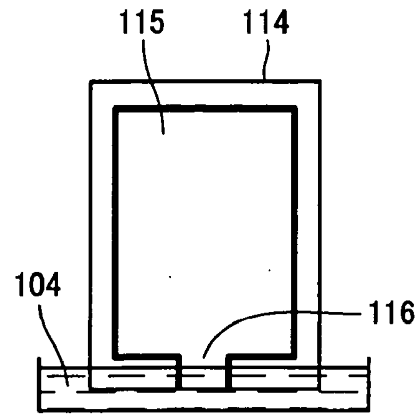


FIG.29 PRIOR ART

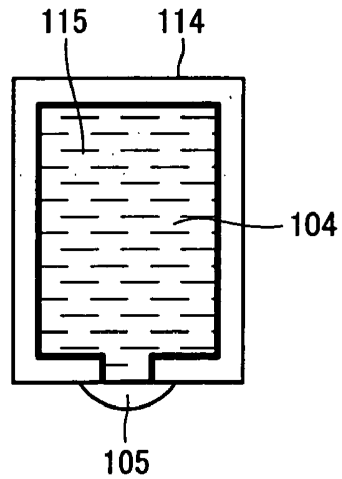


FIG.30 PRIOR ART

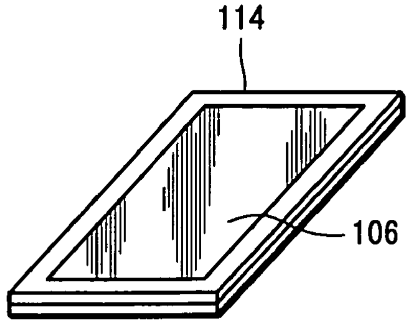
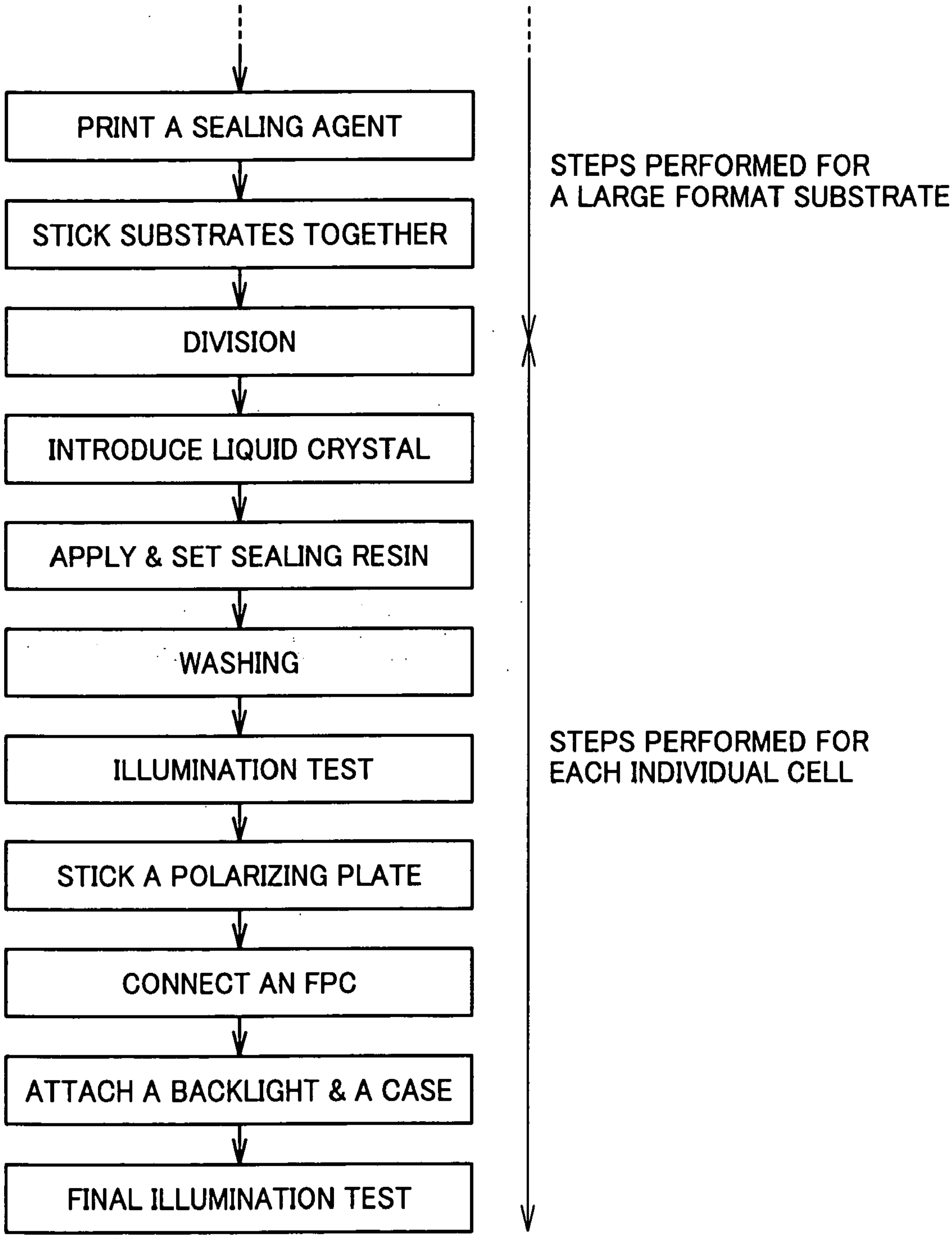


FIG.31 PRIOR ART



LIQUID CRYSTAL PANEL, METHOD AND DEVICE FOR MANUFACTURING LIQUID CRYSTAL PANEL, AND POLARIZING PLATE STAMPING DEVICE

TECHNICAL FIELD

[0001] The present invention relates to liquid crystal panels (also referred to as "liquid crystal display panels"), methods of fabricating the same, and apparatuses used to fabricate the same. Furthermore, the present invention relates to apparatuses used to stick a polarizing plate and particularly to apparatuses used in a liquid crystal panel fabrication process to stick a polarizing plate that is supplied in a roll.

BACKGROUND ART

[0002] In general a liquid crystal panel has a structure formed of two glass substrates stacked one on the other in parallel and stuck together with a predetermined small gap posed therebetween and filled with liquid crystal. As a method of fabricating such a crystal panel, a conventional, general method will be described with reference to FIGS. **26-31**. As shown in **FIG. 26**, when a thin film transistor (TFT) glass substrate **101** and a color filter (CF) glass substrate **102** are to be stuck together, a sealing agent **103** is arranged on one of the substrates. In the **FIG. 26** example, TFT glass substrate **101** has a surface with sealing agent **103** adhesively fixed thereon. Sealing agent **103** is arranged in a frame to define a region to serve as a space confining liquid crystal (hereinafter referred to as a "liquid crystal cell"). It is, however, not completely closed. As shown in **FIG. 26**, it has an opening to serve as an inlet **116**. TFT and CF glass substrates **101** and **102** are substrates having a large size allowing a plurality of crystal panels to be provided therefrom, and on the substrate a plurality of sealing agents **103** are arranged. Sealing agent **103** is thermosetting resin or the like.

[0003] TFT and CF glass substrates **101** and **102** are stuck together by sealing agent **103** and heated to allow sealing agent **103** to set to provide a large format substrate formed of the stuck substrates. TFT and CF glass substrates **101** and **102** are then divided for each individual region surrounded by sealing agent **103**. Thus, as shown in **FIG. 27, a** panel **114** including a liquid crystal cell **115** is obtained. Panel **114** is accommodated in a vacuum apparatus and liquid crystal cell **115** has its interior and exterior both vacuumed. Then, as shown in **FIG. 28**, inlet **116** defined by an opening of sealing agent **103** is immersed in liquid crystal **104** and the vacuum apparatus's internal atmosphere is gradually returned to atmospheric pressure. By a difference in pressure between the interior and exterior of liquid crystal cell **115**, and capillarity, liquid crystal **104** is introduced into liquid crystal cell **115**. Liquid crystal cell **115** is thus filled with liquid crystal **104**. Subsequently, sealing resin **105**, ultraviolet ray curing resin, is applied to inlet **116**. Ultraviolet radiation is provided to illuminate sealing resin **105** to allow it to set to seal liquid crystal **104** in liquid crystal cell **115** to obtain panel **114**, as shown in **FIG. 29**.

[0004] Panel **114** is structured for example to have one side with a terminal portion (not shown) exposed. To this terminal portion a probe pin is connected, and an inspection is conducted. If the inspection does not reveal any abnormality, a polarizing plate **106** supplied in a sheet in a size corresponding to panel **114** is stuck on one or opposite sides of panel **114**, as shown in **FIG. 30**.

[0005] The conventional liquid crystal panel fabrication method is represented in a flow chart, as shown in **FIG. 31**. In **FIG. 31**, at the step of sticking a polarizing plate a liquid crystal panel is completed. Note that **FIG. 31** also shows a process performed after the liquid crystal panel is completed. More specifically, by connecting a flexible printed circuit (FPC) to a terminal portion of the liquid crystal panel and attaching a backlight and a case, a liquid crystal display device is obtained.

[0006] However, the polarizing plate must be stuck slowly to prevent generation of static electricity. For example, sticking a single plate requires a time of approximately 8 to 10 seconds. In particular, a small size liquid crystal panel used for example in mobile phones is produced by dividing a single, large format glass substrate to provide several hundreds of liquid crystal panels. In that case, such a conventional art as described above requires a significantly increased number of operations in the steps for example of sticking the polarizing plate, conducting an inspection, and the like, which is significantly time consuming.

[0007] This disadvantage may be addressed, as disclosed in Japanese Patent Laying-Open No. 6-342139, by sticking a polarizing plate on an elongate substrate provided with regions arranged in a row to serve as cells, and then dividing the same for each cell. This method does provide a reduced cycle time for the step of sticking the polarizing plate (a reduced time required for the step of sticking the polarizing plate for a single liquid crystal panel). In recent years, however, a single large format glass substrate has also been used to produce several hundreds of liquid crystal panels, and in such a case the method employing the elongate substrate as described above does not provide a cycle time sufficiently effectively reduced.

[0008] Conventionally when a glass substrate of large size is used to produce liquid crystal panels of medium or small size the glass substrate has been divided into small pieces to form discrete cells and a polarizing plate has been stuck on each cell. This approach, however, requires sticking a polarizing plate on each single cell and also when the influence of static electricity is considered the apparatus cannot simply be rapidly operated. As such, to stick a single polarizing plate on one side of the cell, a time of approximately eight to ten seconds would be required. In addition, the substrate having been divided provides a large number of cells and a large number of apparatuses is accordingly required. As such it is desirable that in a condition with as many as cells included, collectively a polarizing plate is stuck thereon and then divided to achieve a significantly reduced cycle time of the step of sticking the polarizing plate.

[0009] More specifically, it is significantly effective if a collective polarizing plate can be stuck for example on a glass substrate divided in an elongate geometry to facilitate the step of introducing liquid crystal, a large size substrate formed by introducing liquid crystal in droplets and sticking substrates together, or a similar substrate. For example from a glass substrate having a side of 600 to 700 mm no less than 200 cells can be obtained, and when a polarizing plate is stuck on the glass substrate having a side of 600 to 700 mm it can be stuck thereon with efficiency increased by approximately double digits dramatically. Normally, a polarizing plate to be stuck on cells is previously cut in a form matching a single cell, and thereafter undergoes an inspection, one by one. As such the component costs significantly. If a polarizing plate supplied in a roll can be stuck on cells, not only can an inspection of discrete cells be eliminated but the dust that is caused when a substrate is cut into pieces can also be prevented.

[0010] Conventionally a rolled polarizing plate has been stuck on a glass substrate for example as disclosed in Japanese Patent Laying-Open No. 60-192914. Furthermore, an elongate polarizing plate has been stuck on a glass substrate by a method for example as disclosed in Japanese Patent Laying-Open No. 1-260417.

[0011] Japanese Patent Laying-Open No. 60-192914 discloses that a rolled polarizing plate is unrolled and a liquid crystal display panel is stuck directly thereon and subsequently the polarizing plate is cut. With this method, however, the polarizing plate has a large portion wasted. Furthermore, a portion unnecessary as a liquid crystal panel would also have a polarizing plate stuck thereon, which renders it difficult to perform a subsequent division step. To produce a transmission liquid crystal display device, in particular, it is necessary that a liquid crystal panel has opposite sides with a polarizing plate stuck thereon. The axes of polarization are orthogonal to each other and if the polarizing plate is large a marker (a reference for a division step to provide cells) provided in a glass substrate cannot be read.

[0012] Furthermore in such a configuration as disclosed in Japanese Patent Laying-Open No. 1-260417 if the substrate and the polarizing plate are of large size a pneumatic chuck mechanism moving the elongate polarizing plate and a press for half-cutting are spaced wide apart and consequently the apparatus itself would have a significantly increased size disadvantageously.

[0013] Furthermore, the apparatus described in Japanese Patent Laying-Open No. 1-260417 cuts a polarizing plate first in a strip and then in a size in accordance with a liquid crystal display device. The polarizing plate needs to be cut twice and the apparatus is accordingly required to have an increased size disadvantageously.

DISCLOSURE OF THE INVENTION

[0014] A first object of the present invention is to reduce a period of time required to produce a single liquid crystal panel when a large number of such liquid crystal panels are collectively produced.

[0015] A second object of the present invention is to provide an apparatus that can stick a polarizing plate on a substrate at a desired portion with a reduced number of steps and hence more efficiently.

[0016] To achieve the first object the present invention provides a liquid crystal panel including: a first substrate; a second substrate overlapping the first substrate with a liquid crystal layer posed therebetween; a sealing agent disposed between the first and second substrates to surround the liquid crystal layer; and a polarizing plate stuck on at least one of the first and second substrates at a surface opposite the liquid crystal layer. The polarizing plate has an end receding from an end of one substrate and having a surface inclined. Thus the polarizing plate is stuck collectively on a large format substrate formed of substrates stuck together and then along a line to be followed for division the polarizing plate is scraped off and then the substrate is provided with a crack and divided into individual liquid crystal panels. The liquid crystal panels can be fabricated effectively.

[0017] In the present invention preferably the sealing agent continuously surrounds an entire perimeter of the liquid crystal layer. As such, a large format substrate having a surface previously provided with a sealing agent forming an enclosure that has received liquid crystal dropped therein and another substrate can be stuck together to collectively fabricate a plurality of liquid crystal cells to provide an efficiently producible liquid crystal panel.

[0018] In the present invention preferably the first substrate has a terminal portion protruding outer than the second substrate. The first substrate has a surface with the polarizing plate stuck thereon. The polarizing plate also extends on a back side of the terminal portion. Thus the polarizing plate is stuck collectively on a large format substrate formed of substrates stuck together and then along a line to be followed for division the polarizing plate is scraped off and then the substrate is provided with a crack and divided into individual liquid crystal panels. The liquid crystal panels can be fabricated effectively.

[0019] To achieve the first object the present invention provides a method of fabricating a liquid crystal panel, including the steps of: dropping liquid crystal on a first substrate at an upper surface inside regions enclosed by a sealing agent disposed thereon; overlaying a second substrate on the first substrate downward to stick the substrates together; sticking a polarizing plate on an upper surface of the second substrate; and collectively dividing the first and second substrates and the polarizing plate. In accordance with the present invention in fabricating a liquid crystal cell and sticking a polarizing plate a large format substrate including a plurality of liquid crystal cells can exactly be used to collectively do so. Liquid crystal cells can effectively be produced.

[0020] In the present invention preferably the step of dividing forms a groove in a surface of the polarizing plate to expose a surface of the first and second substrates at the groove and thereafter divides the first and second substrates. This can prevents the substrate from cracking at an undesired position and the polarizing plate from undesirably peeling off. The substrate can efficiently and accurately be divided into individual crystal panels.

[0021] In the present invention preferably the step of dividing is preceded by the step of collectively inspecting liquid crystal cells defined by the sealing agent, via an interconnection electrically connected to each liquid crystal cell for inspection. Conventionally, individual liquid crystal panels are each inspected. In the present invention, a plurality of liquid crystal panels can collectively, simultaneously be inspected. This can provide a reduced inspection time required per liquid crystal panel.

[0022] In the present invention preferably the step of inspecting is performed after the step of overlaying and before the step of sticking.

[0023] In the present invention preferably the step of inspecting is performed after the step of sticking.

[0024] In the present invention preferably there is included the step of exposing a terminal portion provided at the first substrate. This allows a terminal to be exposed at the terminal portion so that from this terminal a signal for an inspection can be supplied so as to facilitate the inspection.

[0025] In the present invention preferably the step of exposing is performed in the step of overlaying by displacing the substrates from each other. A terminal portion can be exposed without dividing the substrate.

[0026] In the present invention preferably the step of exposing is performed after the step of overlaying by dividing and partially removing one of the substrates. This ensures that if substrates of the same size are stuck together the terminal portion can be exposed at a desired position.

[0027] To achieve the first object the present invention provides a liquid crystal panel fabrication apparatus including: means for dropping liquid crystal on a first substrate at an upper surface inside regions enclosed by a sealing agent disposed thereon; means for overlaying a second substrate on the first substrate downward to stick the substrates together; means for sticking a polarizing plate on an upper surface of the first and second substrates; and means for collectively dividing the first and second substrates and the polarizing plate. Substrates of a large format can collectively be stuck together to form a substrate formed of the stuck substrates and including a plurality of liquid crystal cells and a polarizing plate can collectively be stuck thereon so that a large number of liquid crystal cells can efficiently be produced.

[0028] To achieve the second object the present invention provides an apparatus sticking a polarizing plate, including: means holding a roll of a polarizing plate formed in a strip; means cutting in a geometry of a liquid crystal substrate the polarizing plate continuously extracted from the roll; and means sticking on the liquid crystal substrate the polarizing plate cut. The apparatus thus configured extracts a polarizing plate in the form of a strip continuously extracted from a roll and cuts the polarizing plate in the geometry of a liquid crystal substrate. This cut substrate is stuck on the liquid crystal substrate by the sticking means so that from the polarizing plate in the form of the strip a polarizing plate that follows the liquid crystal substrate can immediately be obtained. As the cut polarizing plate can immediately be stuck on the liquid crystal substrate at a desired portion, the polarizing plate can be stuck on the substrate significantly more efficiently.

[0029] Still preferably the roll is a roll of a combination of a support and the polarizing plate overlying the support, and the means cutting does not cut the support in cutting the polarizing plate.

[0030] Still preferably the apparatus sticking the polarizing plate further includes means detecting an axis of polarization of the polarizing plate unrolled. The means cutting is driven by a direction of an axis of polarization detected by the detection means to adjust a direction followed to cut the polarizing plate. As such, the polarizing plate can be cut in accordance with the direction of the axis of polarization so that the direction of the axis of polarization of the cut polarizing plate can be recognized. As a result, a high quality liquid crystal display device allowing a direction of an axis of polarization to be controlled with precision can be provided.

[0031] Still preferably the means cutting cuts the polarizing plate to have a size substantially equal to that of the liquid crystal substrate. Still preferably the means cutting includes press means. Still preferably the means cutting includes a linear blade. Still preferably the linear blade is attached to the means sticking.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] In the drawing:

[0033] **FIG. 1** is a first illustration of a method of fabricating a liquid crystal panel in accordance with the present invention in a first embodiment;

[0034] **FIG. 2** is a partial, plan view of the liquid crystal panel in accordance with the present invention in the first embodiment;

[0035] **FIG. 3** is a partial cross section of the liquid crystal panel in accordance with the present invention in the first embodiment;

[0036] **FIG. 4** is a second illustration of the method fabricating the liquid crystal panel in accordance with the present invention in the first embodiment;

[0037] **FIG. 5** illustrates equipment for performing the step of sticking a polarizing plate that is employed in the method of fabricating the liquid crystal panel in accordance with the present invention in the first embodiment;

[0038] **FIG. 6** illustrates a first method of exposing a terminal portion for inspection in the method of fabricating the liquid crystal panel in accordance with the present invention in the first embodiment;

[0039] **FIG. 7** is a plan view of substrates stuck together, as obtained in the course of the method of fabricating the liquid crystal panel in accordance with the present invention in the first embodiment;

[0040] **FIG. 8** illustrates a second method of exposing a terminal portion for inspection in the method of fabricating the liquid crystal panel in accordance with the present invention in the first embodiment;

[0041] **FIG. 9** illustrates a third method of exposing a terminal portion for inspection in the method of fabricating the liquid crystal panel in accordance with the present invention in the first embodiment;

[0042] **FIG. 10** illustrates equipment for performing the step of dividing that is employed in the method of fabricating the liquid crystal panel in accordance with the present invention in the first embodiment;

[0043] **FIG. 11** is a perspective view of a first exemplary blade used in the method of fabricating the liquid crystal panel in accordance with the present invention in the first embodiment;

[0044] **FIG. 12** is a perspective view of a second exemplary blade used in the method of fabricating the liquid crystal panel in accordance with the present invention in the first embodiment;

[0045] **FIG. 13** is a side view of a wheel cutter used in the method of fabricating the liquid crystal panel in accordance with the present invention in the first embodiment;

[0046] **FIG. 14** is a front view of the wheel cutter used in the method of fabricating the liquid crystal panel in accordance with the present invention in the first embodiment;

[0047] **FIG. 15** is a third illustration of the method fabricating the liquid crystal panel in accordance with the present invention in the first embodiment;

[0048] **FIG. 16** is a fourth illustration of the method fabricating the liquid crystal panel in accordance with the present invention in the first embodiment;

[0049] **FIG. 17** is a flow chart of the method of fabricating the liquid crystal panel in accordance with the present invention in the first embodiment;

[0050] **FIG. 18** is a flow chart of an exemplary variation of the method of fabricating the liquid crystal panel in accordance with the present invention in the first embodiment;

[0051] **FIG. 19** represents a concept of a liquid crystal panel fabrication apparatus in accordance with the present invention in a second embodiment;

[0052] **FIG. 20** is a side view of a liquid crystal panel in accordance with the present invention in a third embodiment;

[0053] **FIG. 21** is a partially enlarged cross section of the liquid crystal panel in accordance with the present invention in the third embodiment;

[0054] **FIG. 22** represents a concept of one embodiment of a polarizing plate sticking apparatus of the present invention;

[0055] **FIG. 23** is a side view of the polarizing plate sticking apparatus of the present invention in a fourth embodiment;

[0056] **FIG. 24** is a side view of the polarizing plate sticking apparatus of the present invention in a fifth embodiment;

[0057] **FIG. 25** is a side view of the polarizing plate sticking apparatus of the present invention in a sixth embodiment;

[0058] **FIG. 26** is a first illustration of a method of fabricating a liquid crystal panel in accordance with conventional art;

[0059] **FIG. 27** is a plan view of substrates stuck together, as obtained in the course of the method of fabricating the liquid crystal panel in accordance with the conventional art;

[0060] **FIG. 28** is a second illustration of the method of fabricating the liquid crystal panel in accordance with the conventional art;

[0061] **FIG. 29** is a third illustration of the method of fabricating the liquid crystal panel in accordance with the conventional art;

[0062] **FIG. 30** is a fourth illustration of the method of fabricating the liquid crystal panel in accordance with the conventional art; and

[0063] **FIG. 31** is a flow chart of the method of fabricating the liquid crystal panel in accordance with the conventional art.

BEST MODES FOR CARRYING OUT THE INVENTION

[0064] First Embodiment

[0065] Method of Fabrication

[0066] With reference to FIGS. **1-17** the present invention in a first embodiment provides a liquid crystal panel fabrication method as will be described hereinafter. Initially, TFT glass substrate **101** and CF glass substrate **102** are stuck together. More specifically, before the substrates are stuck together, sealing agent **103** is arranged on one of the two substrates. Sealing agent **103** may be applied by means of a dispenser through a small syringe or it may be applied by screen-printing. In the **FIG. 1** example, TFT glass substrate **101** has a surface having sealing agent **103** arranged thereon. Sealing agent **103** is arranged to surround continuously an entire periphery of a region to be provided with a liquid crystal layer. In other words, this sealing agent **103** does not have the opening that the conventional sealing agent shown in **FIG. 26** does. The present invention exhibits a particularly significant effect when a large format substrate is used to produce medium- and small-size liquid crystal panels therefrom in large numbers. Such medium- and small-size liquid crystal panels are mainly applied in mobile phones, car navigation systems and the like, which are required to endure temperature higher than office automation equipment, which mainly employs a large size crystal panel. Accordingly, sealing agent **103** is formed for example of heat-resistive, photo-curing resin or the like.

[0067] Common Transition Electrode

[0068] TFT and CF glass substrates **101** and **102** are both provided with electrodes, respectively, for applying voltage to liquid crystal. When a liquid crystal panel is completed, however, desirably, a terminal portion provided only at one substrate exclusively is used to externally extract the electrodes. Accordingly, from the substrate without the terminal to the substrate with the terminal the electrode need to be extracted. To do so, a common transition electrode is used.

[0069] The "common transition electrode" is an electrode posed between glass substrates opposite with a liquid crystal layer posed therebetween to allow electrical conduction between electrodes of surfaces of the glass substrates, respectively. Although the glass substrates before they are stuck together are large format substrates that have not yet been divided into individual liquid crystal panels, for the sake of illustration the substrates are divided into individual liquid crystal panels and a portion of one such liquid crystal panel is shown in **FIG. 2**, enlarged. Inside sealing agent **103** on glass substrate **101***a*, **102***a* a plurality of common electrode pads **203** are arranged having their respective, small, round common transition electrodes **210** arranged therein. From common electrode pad **203** an interconnection extends across sealing agent **103** toward an outer edge of the liquid crystal panel. Common transition electrode **210** is configured to include at the center a small, round, conductive granule **209** having an external surface wrapped with a conductive material **205**. When the substrates are stuck together, common transition electrode **210** is sandwiched between upper and lower common electrode pads **203** and squashed thereby. As a result, as shown in **FIG. 3** in cross section, with conductive granule **209** interposed, upper and lower glass substrates **101***a* and **102***a* face each other, and conductive material **205** having been squashed and deformed surrounds conductive granule **209**. Electrical conduction is thus achieved between the electrode on a surface of glass substrate **101***a* and that on a surface of glass substrate **102***a*. Note that **FIG. 3** is provided to show common transition electrode **210** squashed and as a liquid crystal panel it is a cross section in an example in configuration different from **FIG. 2**. In the present embodiment a liquid crystal panel is fabricated with liquid crystal already introduced inside. Accordingly, in sticking the glass substrates together, hot press cannot be applied, and the substrates must be stuck together with a pressure smaller than conventional. As such, if common transition electrode **210** as conventional is used, conductive material **205** covering conductive granule **209** is not squashed to form an appropriate cell gap (a distance between the substrates). Accordingly, conductive granule **209** smaller than conventional is used to obtain the appropriate cell gap.

[**0070**] When the substrates are stuck together by applying a pressure smaller than conventional, an inorganic filler contained in an adhesive serving as a medium applying conductive granule **209** of common transition electrode **210** is insufficiently excluded between conductive granule **209** and common electrode pad **203** and tends to provide unsatisfactory connection. Accordingly, an adhesive which does not contain such a filter or an adhesive containing a conductive filler is used to eliminate unsatisfactory connection and provide steady electrical connection of the common transition electrode.

[**0071**] Step of Dropping Liquid Crystal and Step of Sticking Substrates Together

[**0072**] In the step of dropping liquid crystal, liquid crystal **104** is dropped on TFT glass substrate **101** inside sealing agent **103** or on opposite CF glass substrate **102** at a location corresponding to inside a portion with which the sealing agent is to brought into contact. Liquid crystal **104** is dropped by an amount matching the volume of a cell and accumulates inside sealing agent **103**. Then in the step of sticking the substrate together glass substrate **102** is laid thereon and exposed for example to ultraviolet light to allow sealing agent **103** to set to hermetically seal liquid crystal **104** in the cell. Thus a large format substrate **30** formed of the substrates stuck together is obtained.

[**0073**] Step of Sticking a Polarizing Plate

[**0074**] The substrates are stuck together to obtain large format substrate **30**. Substrate **30** then has a surface washed. In the step of sticking a polarizing plate, as shown in **FIG. 4, a** polarizing plate **106** is stuck on a surface of substrate **30**. Polarizing plate **106** is supplied from a roll **107** of the polarizing plate for large format substrate **30**. If a liquid crystal panel to be fabricated is of reflective type, polarizing plate **106** may be stuck on one side alone of substrate **30**. If the liquid crystal panel is of transmission type, polarizing plate **106** is stuck on opposite sides of substrate **30**.

[**0075**] Equipment used to stick the polarizing plate will be described with reference to **FIG. 5** more specifically. Roll **107** of the polarizing plate is supported by a reel **361** supported by a holding means **360**. A polarizing plate **315***b* is overlaid on a separator **315***c* to provide a combination **315** of the two and supplied in roll **107** supplying the polarizing plate. Initially, combination **315** is extracted from roll **107** and moves past a detector **350** detecting a direction of an axis of polarization of polarizing plate **315***b*. On a cutting stage **355** a cutting blade **351** moves downward toward combination **315**. Blade **351** does not cut separator **315***c* and only cuts polarizing plate **315***b* overlying the separator. Separator **315***c* is guided by a peeling member **327** in a direction different than polarizing plate **315***b* and taken up on a take up roll **320**. Polarizing plate **315***b* with separator **315***c* peeled off proceeds and then pressed by a guide roller **380** to move in a slightly downward direction. A head **390** operating to stick the polarizing plate on a substrate includes a press and contact roller **390***a*, a suction platform **390***b* and a position detection sensor **390***c*. Polarizing plate **315***b* slides on a surface of suction platform **390***b*, moves past under roller **390***a* and is thus guided to position detection sensor **390***c* for detection, while a polarizing plate sticking stage **310** is moved upward to bring substrate **30** on stage **310** into contact with polarizing plate **315***b*. Stage **310** can be moved in a direction indicated by an arrow A to stick polarizing plate **315***b* on substrate **30**. Note that in accordance with a direction of an axis of polarization detected by detector **350** stage **310** can be rotated to stick polarizing plate **315***b* in accordance with a direction of an axis of polarization required for substrate **30**.

[**0076**] Polarizing plate **315***b* can be stuck only at a portion pressed by roller **390***a* against substrate **30** to prevent air bubbles from entering therebetween. While in this example polarizing plate **315***b* is cut with blade **351**, it may alternatively be cut by laser, which can advantageously be used as it does not produce chips. Polarizing plate **315***b* that is supplied in roll **107** allows a continuous sticking operation. Separator **315** can be peeled off polarizing plate **315***b* immediately before the polarizing plate is stuck on the substrate to prevent the polarizing plate from having a surface with dust thereon. In the step of sticking the polarizing plate, desirably, not only is polarizing plate **315***b* stuck on substrate **30** but thereafter to eliminate air bubbles and the like substrate **30** is also subjected to a pressurization, degassing apparatus.

[**0077**] Step of Exposing a Terminal Portion

[**0078**] In the step of exposing a terminal portion, an inspection terminal portion **130** is exposed at an end of large format substrate **30** formed of substrates stuck together. Inspection terminal portion **130** is a region corresponding to a protrusion of one of the two glass substrates. In inspection terminal portion **130** an inspection terminal **131** is arranged. Inspection terminal portion **130** is exposed by a method, as follows: initially, as shown in **FIG. 6**, one of the glass substrates that is not provided with inspection terminal **131** is sized to be smaller than the other that is provided with inspection terminal **131** and the glass substrates are superimposed on each other. As shown in **FIG. 7**, from inspection terminal **131** an inspection interconnection **132** extends toward each liquid crystal cell **115** included in substrate **30**. Note that inspection terminals **131** is not limited in number, position or the like to the **FIG. 7** example.

[**0079**] Inspection terminal portion **130** can be exposed by another method. As shown in **FIG. 8**, substrate **30** formed of two substrates stuck together has an end having only one substrate cut off and removed. Inspection terminal portion **130** can be exposed by still another method. As shown in **FIG. 9**, the substrates are offset and stuck together to expose inspection terminal portion **130**. For the first and third methods the step of exposing the terminal portion will be included in the step of sticking the substrates together.

[0080] Step of Collective Inspection

[0081] Then, in the step of collective inspection, a probe pin is connected to inspection terminal **131** exposed and a drive signal for an illumination test is supplied to cause liquid crystal cells **115** in substrate **30** to collectively illuminate. Since this test is conducted with large format substrate **30**, portions corresponding to a plurality of liquid crystal panels can be inspected at a time. By applying the drive signal for the illumination test, a defective pixel, a point defect, and an uneven indication can be found. When liquid crystal cell **115** is found to be defective, information thereof is supplied to a production management system by a computer to prevent the process from proceeding with the subsequent step to further perform an operation uselessly.

[0082] In the step of the collection inspection, liquid crystal cell **115** located at a center of large format substrate **30** is distant from inspection terminal **131** and may suffer a delay of the signal, as compared with liquid crystal cell **115** located at a periphery of substrate **30**. To prevent this, desirably at a portion directed to liquid crystal cell **115** distant from inspection terminal **131** inspection interconnection **132** has a bus line with an increased width.

[0083] Step of Division

[0084] Then, in the step of division, substrate **30** is divided in a size of individual liquid crystal panels. In this division step, the two glass substrate stuck together and polarizing plate **106** stuck on a surface thereof are collectively divided. As a result, liquid crystal panels are provided to each include liquid crystal cell **115** defined by sealing agent **103**.

[0085] Equipment used to perform the division step will be described with reference to **FIG. 10** more specifically. A movable unit **410** includes a cutting mechanism **460** at a front side and a wheel cutter **430** at a rear side, as seen in a direction B, in which the unit moves. Movable unit **410** moves along a space between liquid crystal cells **115** arranged in large format substrate **30** (see **FIG. 7**). As the unit moves, polarizing plate **106** is cut away by a blade **461**. As blade **461**, a blade having such a form as a curving knife as shown in **FIGS. 11 and 12** is usable. After blade **461** has cut away polarizing plate **106**, glass substrate **102** is exposed in a strip which forms a strip region **411**. Blade **461** cutting polarizing plate **106** produces a chip **402***a*, which is removed along blade **461**. The equipment that employs such cutting mechanism **460** can readily form strip region **411**. Furthermore it can also facilitate management of a cutting amount, maintenance and the like.

[0086] Wheel cutter **430** forms a crack in the glass substrate for dividing the substrate. It has a geometry, as specifically shown in **FIGS. 13 and 14**. Wheel cutter **430** has a diameter dl of approximately 2.5 mm to ensure that the cutter has strength, and its cutting edge has an angle $\theta 1$ of an obtuse angle of approximately 120° to 150° to consider lifetime. Wheel cutter **430** is supported by movable unit **410** via a spring (not shown) to apply a predetermined force against the glass substrate. A distance sensor **440** is a contact sensor detecting a position of an upper surface of polarizing plate **106**. By utilizing distance sensor **440**, movable unit **410** is controlled to invariably maintain a distance between cutting mechanism **460** and wheel cutter **430**, and an upper surface of polarizing plate **106**. Distance sensor **440** is not limited to a contact sensor and it may be a non-contact sensor.

[0087] Along strip region **411** formed by blade **461** wheel cutter **430** moves to form a crack **412** for division. In strip region **411** crack **412** is formed, as shown in **FIG. 15**, enlarged.

[0088] While the **FIGS. 10 and 15** example show that glass substrate **102** is divided, substrate **30**, formed of glass substrates **101**, **102** stuck together, has front and rear surfaces both subjected to an operation by movable unit **410**. In this condition when substrate **30** is subjected to mechanical strength, glass substrates **101**, **102** are readily divided, or without any mechanical strength when the glass substrate have a surface scanned by wheel cutter **430** the substrate may be divided of themselves along crack **412**. When such equipment is used to divide large format substrate **30**, the glass substrates does not crack at an undesired position nor does polarizing plate **106** peel off undesirably so that as shown in **FIG. 16**, the substrate can efficiently and accurately be divided into individual liquid crystal panels **150**. While the **FIG. 16** example shows only eight liquid crystal panels **150**, the number of the panels is not limited to eight and can be set as appropriate. For example the substrate may be divided into several hundreds of panels.

[0089] Function and Effect

[0090] The liquid crystal panel fabrication method in the present embodiment is represented in a flow chart, as shown in **FIG. 17**. In **FIG. 17**, the process through to the division step provides a complete liquid crystal panel. Note that **FIG. 17** also shows a process performed after a liquid crystal panel is completed. More specifically, a flexible printed circuit (FPC) is connected to a terminal portion of the liquid crystal panel and a backlight and a case are attached to obtain a liquid crystal display device. In the conventional method (see **FIG. 31**) the substrate is divided at an earlier stage. Accordingly, a large number of steps need to be performed for each individual liquid crystal panel. In the present liquid crystal panel fabrication method, the larger number of steps can be performed for a large format substrate that is not yet divided. This allows a liquid crystal panel and hence a liquid crystal display device to be produced significantly more efficiently. This can provide a significantly reduced time required per liquid crystal panel.

[0091] While in the above described fabrication method, as shown in **FIG. 17**, the step of sticking the polarizing plate is followed by an illumination test corresponding to the collective inspection step, the collective inspection step may precede the step of sticking the polarizing plate, as shown in **FIG. 18**. In that case, desirably, after the collective inspection step and before the step of sticking the polarizing plate a washing step is again performed. Alternatively, in some case, the liquid crystal panel may be completed without performing the collective inspection step.

[0092] If the step of exposing the terminal is dividing and partially removing a glass substrate, as shown in **FIG. 8**, then in any of the systems of **FIGS. 17 and 18**, a washing step needs to be included after the step of exposing the terminal and before the step of sticking the polarizing plate.

[0093] Note that in any of the systems of **FIGS. 17 and 18**, desirably a washing step is performed after the division as the division step and before the connection of the FPC. The division step may rely on any other appropriate method than that described with reference to **FIG. 10**.

[**0094**] Second Embodiment

[**0095**] Fabrication Apparatus

[**0096**] Reference will now be made to **FIG. 19** to describe a liquid crystal panel fabrication apparatus in accordance with the present invention. This apparatus includes a liquid crystal dropping portion **191**, a substrate sticking portion **192**, a polarizing plate sticking portion **193**, and a dividing portion **194**. Each portion is arranged to be able to operate in liaison with each other. Each portion is not required to be a discrete existence and partial or entire apparatus may serve as more than one of the portions described above. When the apparatus is supplied with a large format glass substrate, liquid crystal dropping portion **191** performs the step of dropping liquid crystal, substrate sticking portion **192** performs the step of sticking substrates together to provide a large format substrate formed of the substrates stuck together with a plurality of liquid crystal cells therebetween. Furthermore the substrate formed of the substrate stuck together is subjected by polarizing plate sticking portion **193** to the step of sticking a polarizing plate. This step is also performed on the large format substrate. Then at dividing portion **194** the large format substrate formed of the stuck substrates is divided into individual liquid crystal panels. This liquid crystal panel fabrication apparatus may include other than each portion described above a collective inspection portion and a washing portion, as appropriate, in accordance with the concept of the liquid crystal panel fabrication method described in the first embodiment.

[**0097**] Third Embodiment

[**0098**] Liquid Crystal Panel

[**0099**] Reference will be made to **FIGS. 20 and 21** to describe a configuration of a liquid crystal panel in accordance with the present invention in a third embodiment. This liquid crystal panel **150** in a side view is shown in **FIG. 20**. In the figure, thickness is represented exaggerated for the sake of illustration. A liquid crystal cell (not shown) is sandwiched by glass substrates **101***a*, **102***a* obtained by dividing glass substrates **101**, **102**. A polarizing plate **106***a* is stuck on a side of glass substrate **101***a*, **102***a* that is opposite the liquid crystal layer, i.e., on each outer surface. Inherently there is a small gap between glass substrates **101***a* and **102***a* and in that gap a liquid crystal layer, a sealing agent and various types of electrodes are arranged, although in **FIG. 20** the gap is not shown.

[**0100**] **FIG. 21** is an enlarged cross section of an end of liquid crystal panel **150** and therearound. Polarizing plate **106***a* has an end receding from an end of each glass substrate **101***a*, **102***a* and having an inclination. This is attributed to the division step using the equipment shown in **FIG. 10** to produce liquid crystal panel **150**. As shown in **FIG. 15**, strip region **411** exposing a surface of the glass substrate is formed, and with polarizing plate **106** having an end surface with an inclination the glass substrates are divided. Accordingly, polarizing plate **106***a* has an end formed as described above (see **FIG. 21**).

[**0101**] Furthermore for this liquid crystal panel **150** sealing agent **103** surrounds an entire perimeter of the liquid crystal layer continuously. Herein to "surround an entire perimeter continuously" means that a perimeter is surrounded completely without discontinuity by an enclosure.

[**0102**] Furthermore, for this liquid crystal panel **150**, as shown in **FIG. 20**, glass substrates **101***a* and **102***a* do not completely overlap. Glass substrate **101***a* alone protrudes to provide a terminal portion **109** for connection of FPC **108**. Terminal portion **109** is also provided with polarizing plate **106***a* extending on a surface of glass substrate **101***a* opposite the liquid crystal layer, i.e., a surface opposite that to which FPC **108** is connected.

[**0103**] While **FIGS. 20 and 21** exemplarily show a structure with two glass substrates both provided with polarizing plate **106***a*, for some system, aim and the like of the liquid crystal panel, only one of the glass substrates may be provided with the polarizing plate.

[**0104**] Note that while in each embodiment the substrate has been described as a "glass substrate," the substrate is not limited to a glass substrate and may be formed of a different material.

[**0105**] In accordance with the present invention in fabricating a liquid crystal cell and sticking a polarizing plate a large format substrate including a plurality of liquid crystal cells can exactly be used to collectively do so. This can provide a reduced period of time required for per liquid crystal panel so as to effectively produce liquid crystal cells.

[**0106**] Fourth Embodiment

[**0107**] **FIG. 22** represents a concept of one example of an apparatus sticking a polarizing plate in accordance with the present invention. **FIG. 23** is a side view of the apparatus. With reference to **FIGS. 22 and 23**, a polarizing plate sticking apparatus **1***a* includes: a holding means **60** holding a roll **10** of a polarizing plate **15***a* formed in a strip; a press die **80** serving as a means cutting continuously pulled and thus unrolled polarizing plate **15***a* to match a geometry of a liquid crystal substrate **30**; and a head **100** serving as a means sticking cut polarizing plate **15***a* on liquid crystal substrate **30**.

[**0108**] Roll **10** is a roll of a combination **15** of a separator **15***c* serving as a support and a polarizing plate **15***b* formed thereon. Press die **80** cuts polarizing plate **15***b* alone and does not cut separator **15***c*.

[**0109**] Apparatus **1***a* further includes a detector **50** serving as a means detecting an axis of polarization of polarizing plate **15***b* unrolled. Press die **80** is driven by an axis of polarization detected by detector **50** to adjust a direction followed to cut polarizing plate **15***b*.

[**0110**] Press die **80** cuts polarizing plate **15***b* to have substantially the same size as liquid crystal substrate **30**. Press die **80** includes a press means.

[**0111**] A reel **61** is attached to holding means **60** and combination **15** is wound around reel **51** to form roll **10**. Polarizing plate **15***b* in combination **15** is fed from roll **10** and before polarizing plate **15***b* is taken up by a take-up roll **20** detector **50** initially detects an axis of polarization. In accordance with the direction of the axis of polarization press die **80** is adjusted to have an angle for cutting the polarizing plate, and moves in a direction **81** to provide polarizing plate **15***b* with an incision **15***d* to cut (half cut) polarizing plate **15***b* to provide cut polarizing plate **15***a*. In doing so, separator **15***c* is not cut. Press die **80** is arranged to have an inclination for example of 45° relative to a direction of unrolled polarizing plate **15***b*. Press die **80** is set at a desired angle to accommodate the model of interest.

[**0112**] Detector **50** detects a direction of an axis of polarization of polarizing plate **15***b*. Detector **50** is configured of a light emitting portion, a light receiving portion, and a single sheet of polarizer (not shown). The polarizer is rotated to vary an amount of light passing through polarizing plate **15***b* and the polarizer. This variation is detected to detect an axis of polarization of polarizing plate **15***b*.

[**0113**] Polarizing plate **15***a* cut by press die **80** is sucked by head **100** on a suction platform **100***b* through vacuum. As it moves past a peeling roller **25**, cut polarizing plate **15***a* alone is separated from separator **15***c*. After it is completely peeled off separator **15***c*, polarizing plate **15***a* sucked by head **100** is moved to a polarizing plate sticking stage **110**, as indicated by an arrow B, and placed on large format, liquid crystal substrate **30**. Then polarizing plate **15***a* has an end pressed by a roller **100***a* of head **100** and stage **110** moves in a direction A to stick polarizing plate **15***a* on liquid crystal substrate **30**. To stick polarizing plate **15***a* on liquid crystal substrate **30** with high precision, polarizing plate **15** and liquid crystal substrate **30** placed on stage **110** are joined together after on head **100** polarizing plate **15***a* has an end surface brought into contact with a jig (not shown) to mechanically position the same.

[**0114**] Note that if separator **15***c* and polarizing plate **15***b* are completely cut, rather than half cut, on head **100** separator **15***c* needs to be peeled off by means of an adhesive tape or the like. Peeling roller **25** may be replaced with a flat member, although a roller is desirable since on separator **15***c* the polarizing plate rolled still remains.

[**0115**] Thus the present invention in the fourth embodiment provides polarizing plate sticking apparatus **1***a* that allows press die **80** to cut polarizing plate **15***b* in a geometry corresponding to liquid crystal substrate **30** and then immediately sticks cut polarizing plate **15***a* by means of polarizing plate sticking head **100**. This eliminates the necessity of initially cutting a polarizing plate in an elongate geometry as conventional. The polarizing plate can be stuck on the substrate more efficiently.

[**0116**] When an elongate polarizing plate is stuck directly on liquid crystal substrate **30**, as conventional, the polarizing plate is stuck on a portion which does not require it. Accordingly, it needs to be cut to provide a determined geometry. In accordance with the present invention the polarizing plate can be cut only once to correspond to a geometry of liquid crystal substrate **30**. The polarizing plate can be stuck only at a desired portion. Furthermore, a reduced number of cutting steps can be provided to stick the polarizing plate more efficiently. Furthermore, the polarizing plate can efficiently be utilized.

[**0117**] Fifth Embodiment

[**0118**] **FIG. 24** is a side view of an apparatus sticking a polarizing plate in accordance with the present invention in a fifth embodiment. With reference to **FIG. 24**, the present invention in the fifth embodiment provides a polarizing plate sticking apparatus **1***b* including a cutting means formed of a linear blade **180** cutting a polarizing plate. Blade **180** is attached to a head **200** serving as a means sticking cut polarizing plate **15***a* on liquid crystal substrate **30**.

[**0119**] In the fourth embodiment a longitudinal direction of polarizing plate **15***b* in a strip and a direction of an axis of polarization of polarizing plate **15***b* in the strip are parallel to each other. To allow each side of cut polarizing plate **15***a* and an axis of polarization of cut polarizing plate **15***a* to form an angle of 45°, in the fourth embodiment an inclination of 45° is introduced in cutting polarizing plate **15***b*. In **FIG. 24**, unrolled polarizing plate **15***b* has an axis of polarization previously inclined for example by 45° relative to the longitudinal direction of unrolled polarizing plate **15***b*. This eliminates the necessity of inclining blade **180** to cut polarizing plate **15***b*, and polarizing plate **15***a* thus cut can be stuck on liquid crystal substrate **30**. In **FIG. 24**, polarizing plate **15***a* is not required to have inclination relative to liquid crystal substrate **30** and can be stuck thereon vertically.

[**0120**] Polarizing plate **15***b* in the form of a strip is fed from roll **10** and has a direction of an axis of polarization thereof detected by detector **50**. Then, polarizing plate sticking head **200** is positionally adjusted. Head **200** has a press roller **200***a* and a suction platform **200***b* and by suction platform **200***b* polarizing plate **15***b* is sucked and held. Polarizing plate **15***b* thus sucked is cut on a cutting stage **185** straight by blade **180** provided integral to head **200**. In this case, as well as in the fourth embodiment, separator **15***c* is not cut, i.e., half-cutting is performed.

[**0121**] Thereafter, similarly as has been described in the fourth embodiment, polarizing plate **15***a* sucked on head **200** is separated from separator **15***c* as it moves past a peeling member **26**. Polarizing plate **15***a* is placed on a liquid crystal substrate **30** provided in the form of a large size substrate and placed on stage **110**. The head **200** roller **200***a* presses an end of polarizing plate **15***a* and stage **110** moves in a direction A to stick polarizing plate **15***a* on liquid crystal substrate **30**.

[**0122**] This apparatus allows polarizing plate sticking head **200** and polarizing plate cutting blade **180** to be integrated together. As such, a polarizing plate adapted for a large size substrate can be cut by the apparatus having a reduced size.

[**0123**] As head **200** is positionally aligned, polarizing plate **15***a* is stuck on liquid crystal substrate **30** obliquely. However, such is not particularly disadvantageous as the polarizing plate has an axis of polarization with a direction adapted for liquid crystal substrate **30**.

[**0124**] Polarization sticking apparatus **1***b* of the present invention in the fifth embodiment is as effective as polarizing plate sticking apparatus **1***a* of the invention in the fourth embodiment.

[**0125**] Sixth Embodiment

[**0126**] **FIG. 25** is a side view of the polarizing plate sticking apparatus of the present invention in a sixth embodiment. With reference to the figure, the sixth embodiment provides a polarizing plate sticking apparatus **1***c* including: a blade **250** serving as a means cutting in a geometry of liquid crystal substrate **30** polarizing plate **15***b* continuously unrolled and extracted from roll **10**; and head **300** serving as a means sticking cut polarizing plate **15***a* on liquid crystal substrate **30**.

[0127] In apparatus **1***c*, polarizing plate **15***b* sent from roll **10** has a direction of an axis of polarization detected by detector **50**. Note that this direction of the axis of polarization is similar to that in the fifth embodiment. Polarizing plate **15***b* is cut by blade **250** on a cutting stage **255** and sent by separator **15***c*.

[0128] After it has moved past a peeling member **27**, polarizing plate **15***a* will move straight ahead by its rigidity. However, a guide roller **280** guides the polarizing plate slightly downward. The polarizing plate is guided as it slides under head **300** on a surface of a suction platform **300***b* and moves past under a press and contact roller **300** until it is detected by a position detection sensor **300***c*. In doing so, stage **110** is moved to join liquid crystal substrate **30** mounted thereon and polarizing plate **15***a* together. By moving stage **110** in a direction A, polarizing plate **15***a* can be stuck on liquid crystal substrate **30**. Note that by rotating stage **110** in accordance with a direction of an axis of polarization detected, polarizing plate **15***a* can be stuck in accordance with an axis of polarization suitable to liquid crystal substrate **30**.

[0129] As described above, the present invention can provide an apparatus that can stick a polarizing plate on a liquid crystal substrate collectively and hence efficiently. As a result, the cycle time and the number of apparatuses can significantly be reduced.

[0130] The embodiments disclosed herein should be considered in all terms as illustrative, not limitative. The scope of the present invention is defined only by the attached claims, not by the description above, and is intended to encompass all modifications within the meaning and scope of the claims and equivalents.

INDUSTRIAL APPLICABILITY

[0131] The present invention can achieve a significant contribution in fabricating a large number of liquid crystal panels when it is applied to the process for fabricating the liquid crystal panels. Furthermore the present invention is useful in the process in improving the efficiency of the step of sticking a polarizing plate at a desired portion.

1. A liquid crystal panel comprising:

a first substrate;

a second substrate (**102***a*) overlapping said first substrate (**101***a*) with a liquid crystal layer (**104**) posed therebetween;

a sealing agent (**103**) disposed between said first substrate (**101***a*) and said second substrate (**102***a*) to surround said liquid crystal layer (**104**); and

a polarizing plate (**106***a*) stuck on at least one of said first and second substrates at a surface opposite said liquid crystal layer, said polarizing plate (**106***a*) has an end receding from an end of said one substrate and having a surface with an inclination.

2. The liquid crystal panel of claim 1, wherein said sealing agent (**103**) continuously surrounds an entire perimeter of said liquid crystal layer (**104**).

3. The liquid crystal panel of claim 2, wherein said first substrate (**101***a*) has a terminal portion (**109**) protruding outer than said second substrate (**102***a*), said first substrate has a surface with said polarizing plate (**106***a*) stuck thereon, and said polarizing plate (**106***a*) also extends on said terminal portion (**109**).

4. A method of fabricating a liquid crystal panel, comprising the steps of:

dropping liquid crystal (**104**) on a first substrate (**101**) at an upper surface inside regions enclosed by a sealing agent (**103**) disposed thereon;

overlaying a second substrate (**102**) on said first substrate (**101**) downward to stick said substrates together;

sticking a polarizing plate (**106**) on an upper surface of said second substrate; and

collectively dividing said first substrate (**101**), said second substrate (**102**) and said polarizing plate (**106**).

5. The method of claim 4, wherein the step of dividing forms a groove (**411**) in a surface of said polarizing plate to expose a surface of said first and second substrates (**101, 102**) at said groove (**411**) and thereafter divides said first and second substrates (**101, 102**).

6. The method of claim 4, wherein the step of dividing is preceded by the step of collectively inspecting liquid crystal cells (**115**) defined by said sealing agent, via an interconnection (**132**) electrically connected to said each liquid crystal cell for inspection.

7. The method of claim 6, wherein the step of inspecting is performed after the step of overlaying and before the step of sticking.

8. The method of claim 6, wherein the step of inspecting is performed after the step of sticking.

9. The method of claim 4, further comprising the step of exposing a terminal portion provided at said first substrate.

10. The method of claim 9, wherein the step of exposing is performed in the step of overlaying by displacing said substrates from each other.

11. The method of claim 9, wherein the step of exposing is performed after the step of overlaying by dividing and partially removing one of said substrates.

12. A liquid crystal panel fabrication apparatus comprising:

means for dropping liquid crystal (**104**) on a first substrate (**101**) at an upper surface inside regions enclosed by a sealing agent (**103**) disposed thereon;

means for overlaying a second substrate (**102**) on said first substrate (**101**) downward to stick said substrates together;

means for sticking a polarizing plate (**106**) on an upper surface of said first and second substrates (**101, 102**); and

means for collectively dividing said first and second substrates and said polarizing plate.

13. An apparatus sticking a polarizing plate, comprising:

means holding a roll (**10**) of a polarizing plate (**15***b*) formed in a strip;

means cutting in a geometry of a liquid crystal substrate (**30**) said polarizing plate continuously extracted from said roll (**10**); and

means sticking on said liquid crystal substrate (**30**) said polarizing plate cut (**15***a*).

14. The apparatus of claim 13, wherein said roll (**10**) is a roll of a combination (**15**) of a support (**15***c*) and said polarizing plate (**15***b*) overlying said support, and said means cutting does not cut said support (**15***c*) in cutting said polarizing plate (**15***b*).

15. The apparatus of claim 13, further comprising means detecting (**50**) an axis of polarization of said polarizing plate unrolled, wherein said means cutting is driven by a direction of an axis of polarization detected by said means detecting (**50**) to adjust a direction followed to cut said polarizing plate.

16. The apparatus of claim 13, wherein said means cutting cuts said polarizing plate to have a size substantially equal to that of said liquid crystal substrate.

17. The apparatus of claim 13, wherein said means cutting includes press means (**80**).

18. The apparatus of claim 13, wherein said means cutting includes a linear blade (**180**, **250**).

19. The apparatus of claim 18, wherein said linear blade is attached to said means sticking.

* * * * *

专利名称(译)	液晶面板，制造液晶面板的方法和装置，以及偏振片冲压装置		
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摘要(译)

一种液晶制造方法，包括以下步骤：将液晶（104）滴在第一基板（101）上，所述第一基板（101）位于由设置在其上的密封剂（103）包围的区域内的上表面;将第二基板（102）向下覆盖在第一基板（101）上以将基板粘在一起;将偏振板（106）粘贴在第一和第二基板（101,102）的上表面上;并且共同划分第一和第二基板和偏振板。