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**Kobayashi**

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(54) **COLOR-FILTER SUBSTRATE, METHOD AND APPARATUS FOR MANUFACTURING COLOR-FILTER SUBSTRATE, AND LIQUID CRYSTAL DISPLAY AND METHOD FOR MANUFACTURING LIQUID CRYSTAL DISPLAY**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**
*G02F 1/1335* (2006.01)

(52) **U.S. Cl.** ..... **349/106**

(58) **Field of Classification Search** ..... None
See application file for complete search history.

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(57) **ABSTRACT**

To make it difficult to view streak unevenness in alignment generated at the boundary of alignment layers even when an alignment-layer material is applied onto a color-filter substrate several times to form an alignment layer. When an alignment-layer material is applied onto a color-filter substrate **1** having color filters (R, G, and B) on the surface with a droplet discharge head **3** to form an alignment-layer train **4***a*, the lateral front end L**1** of the train **4***a* is formed on the color filter (B) displaying blue. When the alignment-layer material is then applied to the following alignment-layer application train to form an alignment-layer train **4***b*, the lateral rear end L**2** of the train **4***b* is overlapped with the lateral front end L**1** of the preceding alignment-layer train **4***a* to form an overlapped portion **4***c*. Since the overlapped portion **4***c* is formed on the color filter (B) displaying blue which has the lowest visibility of the three primary colors of light, streak unevenness in alignment generated at the boundary is difficult to view from the exterior.

**2 Claims, 5 Drawing Sheets**

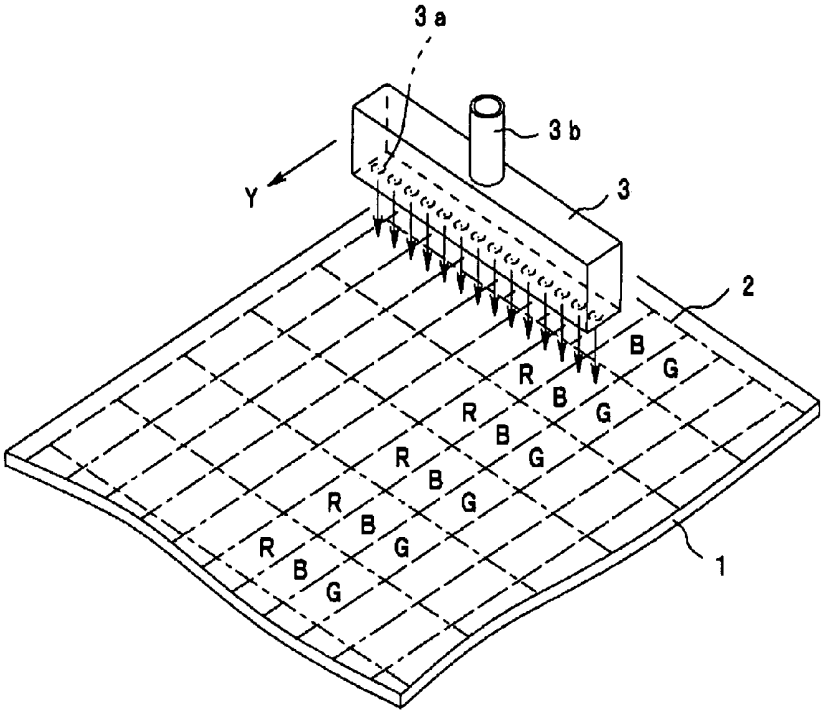


FIG.1

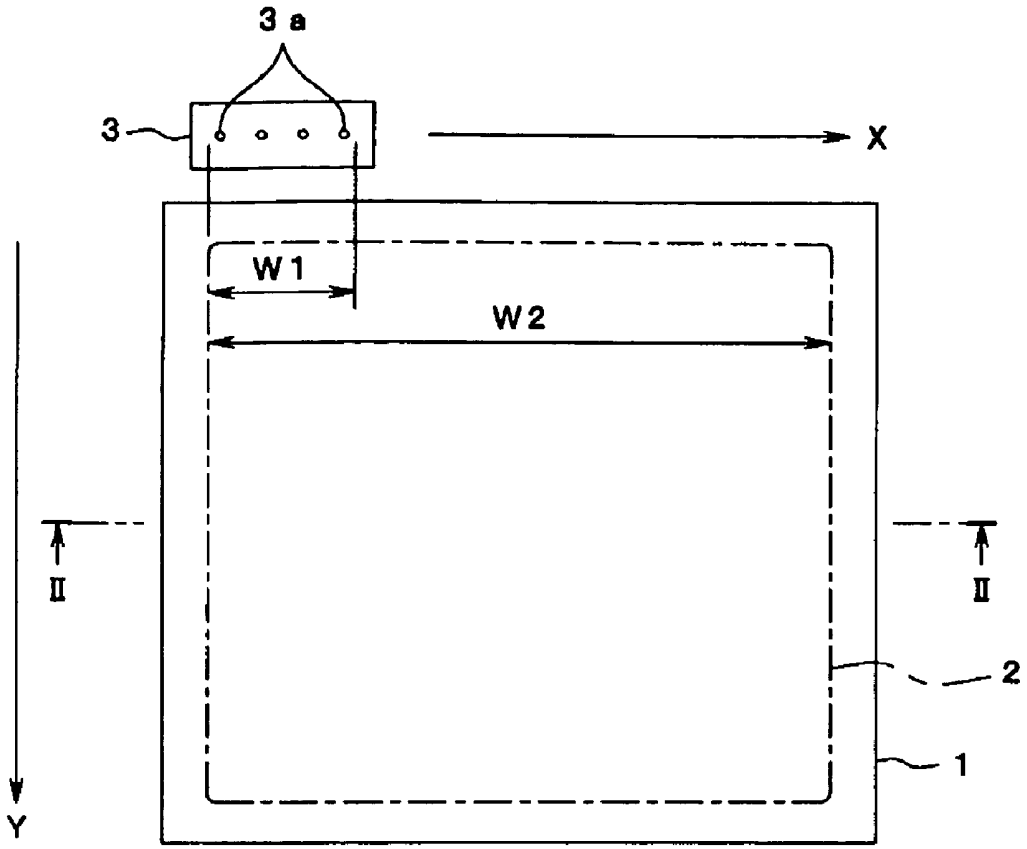



FIG.2

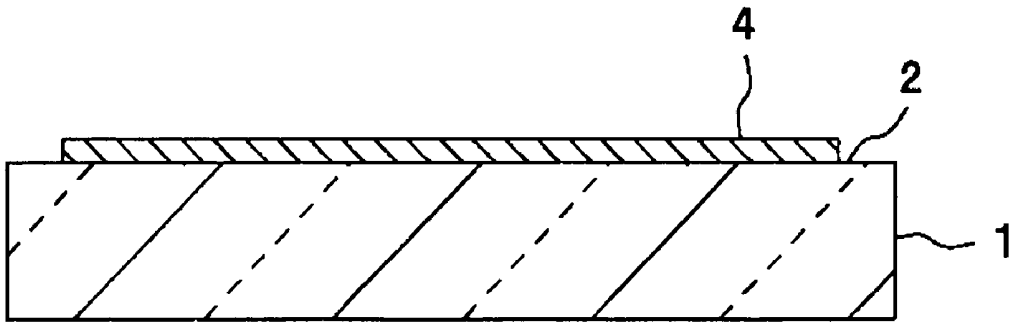


FIG.3

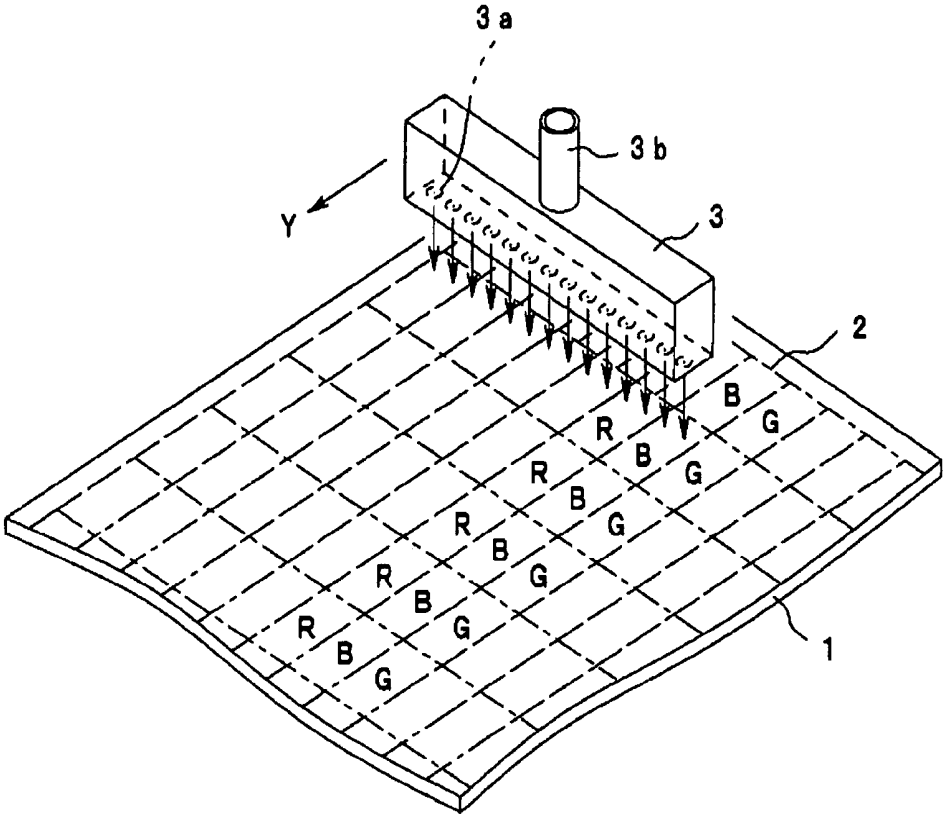



FIG.4 (a)

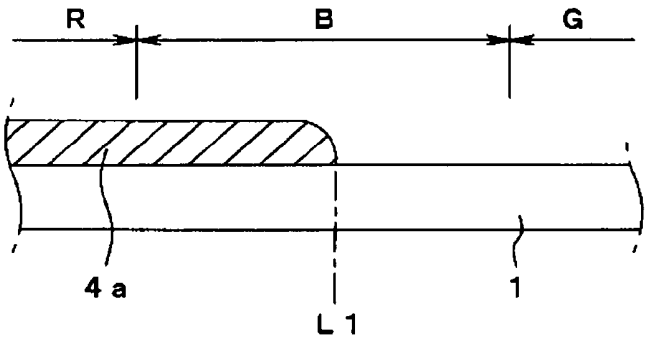



FIG.4 (b)

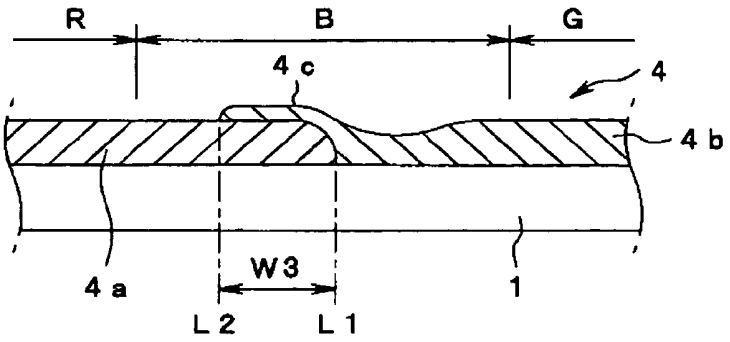


FIG.5

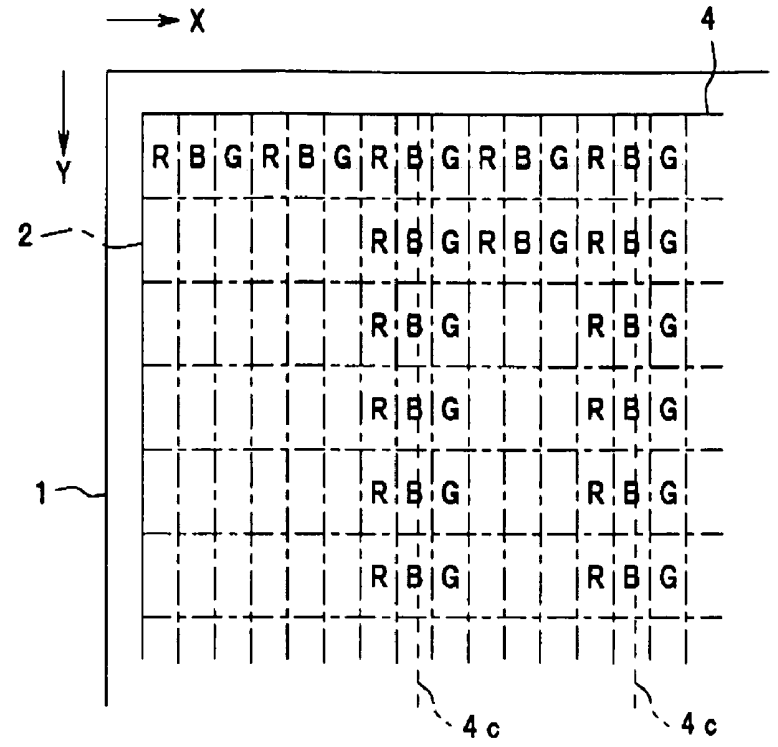



FIG.6

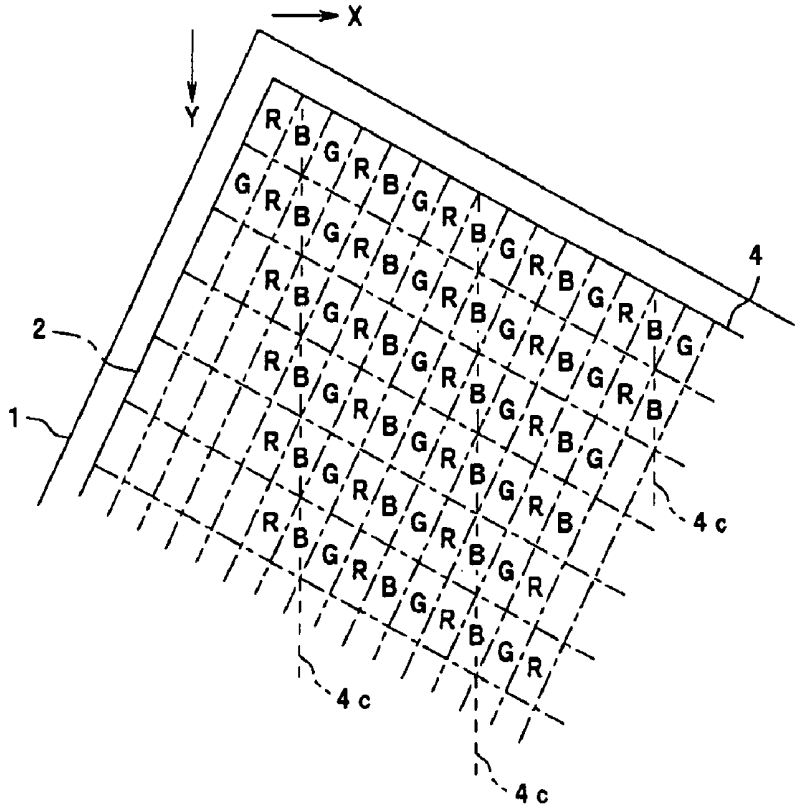
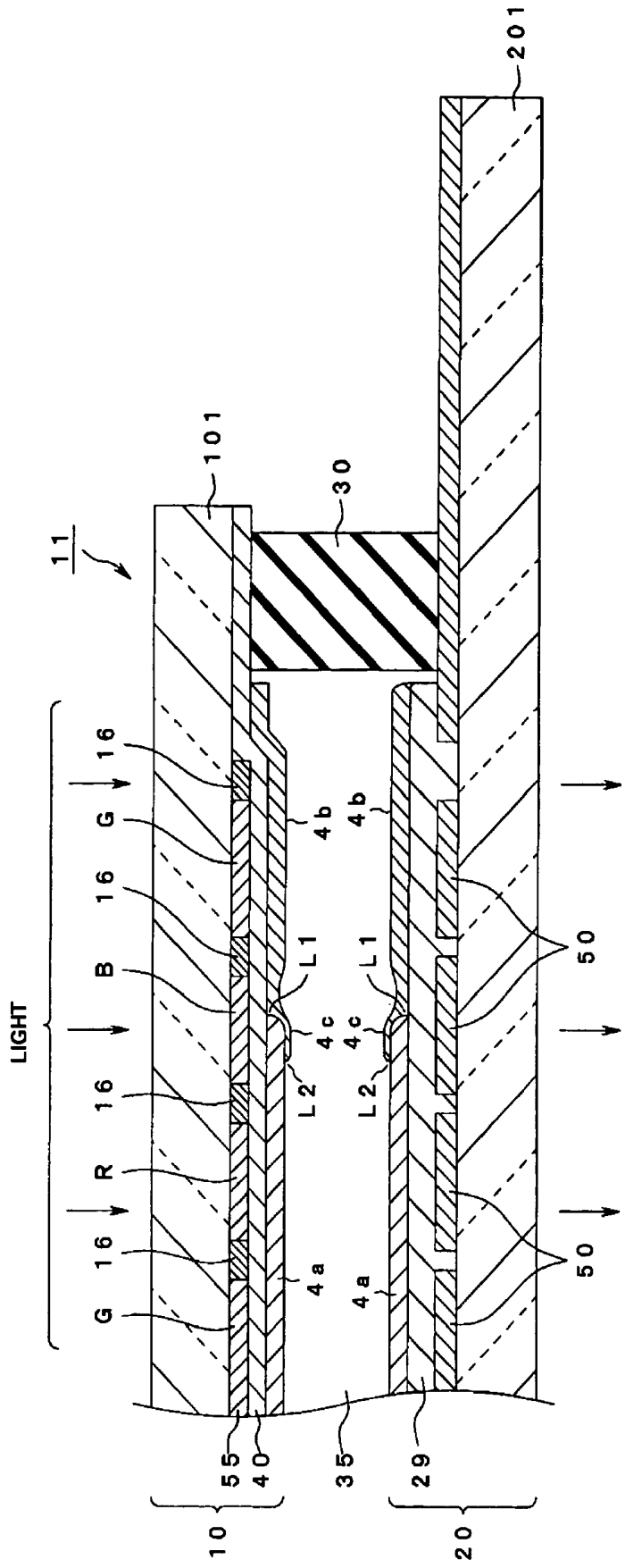


FIG.7


201
101
30
11
LIGHT
16
G
16
B
16
R
16
G
4b
4b
L1
L1
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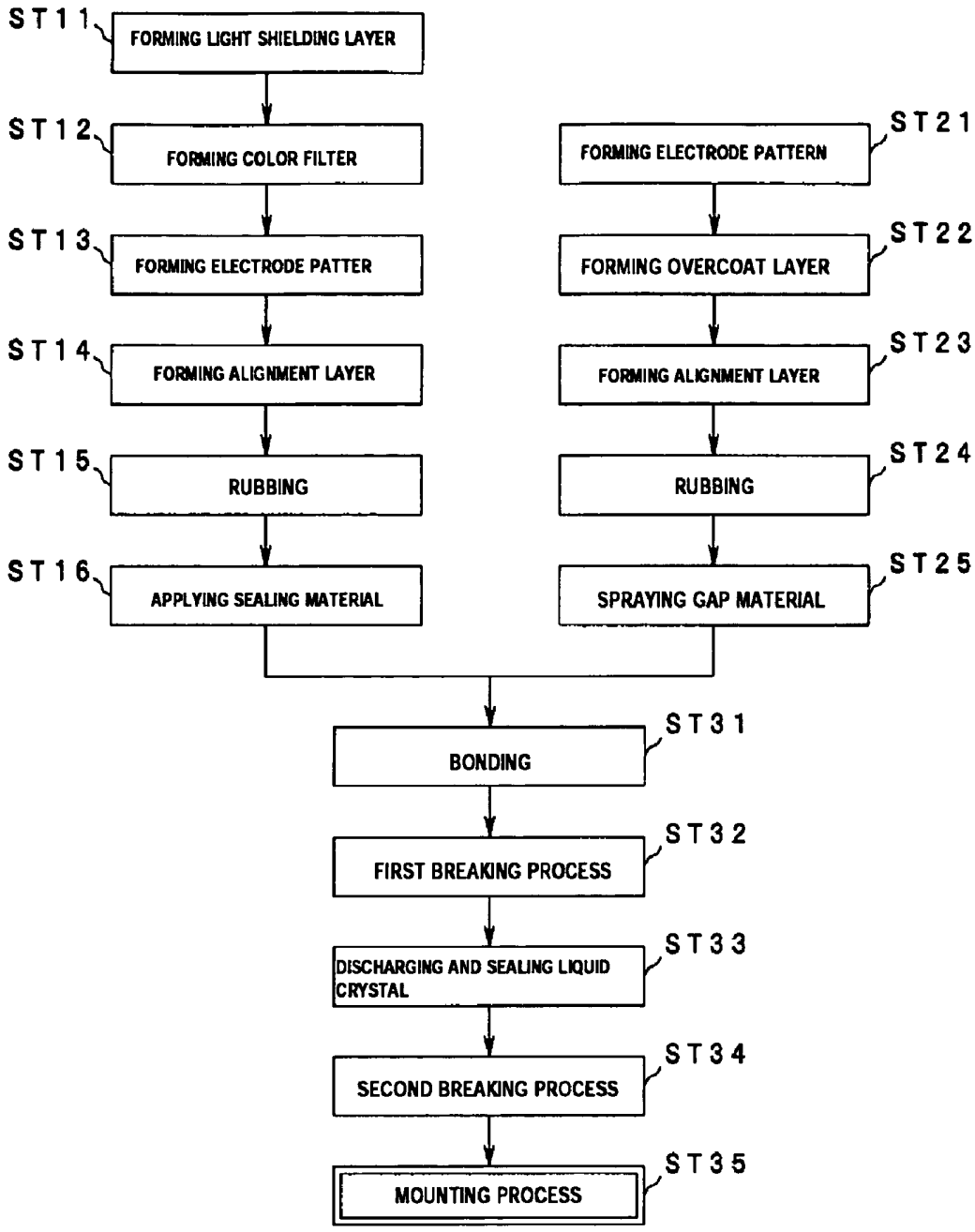
4c
L2
L2
4a
4a
50
50
55
40
35
29
10
20

FIG.8


ST11
FORMING LIGHT SHIELDING LAYER
ST12
FORMING COLOR FILTER
ST13
FORMING ELECTRODE PATTER
ST14
FORMING ALIGNMENT LAYER
ST15
RUBBING
ST16
APPLYING SEALING MATERIAL
ST21
FORMING ELECTRODE PATTERN
ST22
FORMING OVERCOAT LAYER
ST23
FORMING ALIGNMENT LAYER
ST24
RUBBING
ST25
SPRAYING GAP MATERIAL
ST31
BONDING
ST32
FIRST BREAKING PROCESS
ST33
DISCHARGING AND SEALING LIQUID CRYSTAL
ST34
SECOND BREAKING PROCESS
ST35
MOUNTING PROCESS

# COLOR-FILTER SUBSTRATE, METHOD AND APPARATUS FOR MANUFACTURING COLOR-FILTER SUBSTRATE, AND LIQUID CRYSTAL DISPLAY AND METHOD FOR MANUFACTURING LIQUID CRYSTAL DISPLAY

This is a Division of application Ser. No. 10/930,956 filed Sep. 1, 2004. The disclosure of the prior application is incorporated by reference herein in its entirety.

## BACKGROUND OF THE INVENTION

1. Field of Invention

The present invention relates to a color-filter substrate having an alignment layer divided in multiple alignment layer trains formed on a color filter, a method and an apparatus for manufacturing the color-filter substrate, a liquid crystal device, and a method for manufacturing the liquid crystal device.

2. Description of Related Art

Liquid crystal devices have been recently broadly used for displays of electronic equipment including cellular phones, portable computers, video cameras, projectors, etc. This type of liquid crystal device contains liquid crystal sealed between a pair of substrates and controls the state of the alignment of the liquid crystal by an electric field applied to the liquid crystal, thereby displaying images. Accordingly, liquid crystal devices have alignment layers on each of opposing surfaces of a pair of substrates, and control the state of the alignment of the liquid crystal under no electric field by the controlling force of the alignment layers. For color display in liquid crystal devices, a color filter layer is disposed under the alignment layer of one substrate.

Although flexography is well known as a method for forming an alignment layer on each substrate, a so-called droplet discharge method of forming an alignment layer on a substrate with a droplet discharge head has been recently proposed as a method of providing a relatively stable quality as compared with the flexography.

For example, a technique of forming a pattern by discharging a minute viscous material onto a substrate with an inkjet printer head has been disclosed.

## SUMMARY OF THE INVENTION

When the width of an alignment-layer application area on a substrate is larger than the width of a droplet discharge head, the droplet discharge head must be moved to and fro to apply an alignment-layer material to the alignment-layer application area of the substrate several times.

In that case, when the alignment-layer material is applied to the next train following the application to the preceding train, the alignment-layer material on the preceding train has already been dried and solidified or being dried and solidified. Accordingly, the end of the alignment-layer material on the next train is overlapped with the alignment layer formed by the application of the alignment-layer material to the preceding train to eliminate the boundary of the alignment layers.

However, the alignment-layer overlapped portion becomes different in thickness from the other parts, causing unevenness in thickness. The uneven alignment layer tends to affect the pre-tilt angle of liquid crystal, which can be viewed as streak unevenness in alignment.

Accordingly, in view of the above-described problem, the present invention is directed to a color-filter substrate in which, even when an alignment-layer material is applied several times, streak unevenness in alignment generated at the boundary thereof is difficult to see from the exterior to improve the quality of products, a method and an apparatus for manufacturing the color filter, a liquid crystal device, and a method for manufacturing the liquid crystal device.



In order to achieve the above object, according to a first invention, there is provided a color-filter substrate having an alignment layer on a plurality of color filters, wherein the alignment layer divided in a plurality of alignment layer trains is formed on the color filters, the adjacent ends of the alignment layer trains are overlapped with each other to form an overlapped portion, and the overlapped portion is formed on a position corresponding to a color filter displaying a specific color.

Since the structure is constructed such that the overlapped portion of the alignment layer train is formed at a position corresponding to a color filter displaying a specific color, it is difficult to view unevenness in alignment generated by the overlapped portion from the exterior.

A second invention is characterized in that the overlap width of the overlapped portion is set within the color filter displaying a specific color in the first invention.

Since the structure is constructed such that the overlap width of the overlapped portion is set within the color filter displaying a specific color, it is more difficult to view unevenness in alignment.

A third invention is characterized in that the specific color is blue in the first or second invention.

Since the structure is constructed such that the specific color is blue which has relatively low visibility, the visibility of unevenness in alignment can be decreased more.

According to a fourth invention, there is provided a method for manufacturing a color-filter substrate by applying an alignment-layer material on a plurality of color filters to form an alignment layer, the method comprising the steps of: applying the alignment-layer material along a preset alignment-layer application train such that the lateral front end of the train corresponds to the position of a color filter displaying a specific color; and applying the alignment-layer material along the following alignment-layer application train such that the lateral rear end of the train overlaps with the front end of the alignment layer applied to the preceding alignment-layer application train and the lateral front end of the train is located at a position corresponding to the color filter displaying a specific color.

Since the structure is constructed such that the overlap width of the overlapped portion is placed at a position corresponding to the color filter displaying a specific color, manufacture is facilitated and atomization is promoted.

A fifth invention is characterized in that the overlap width of the overlapped portion is set within the color filter displaying a specific color in the fourth invention.

Since the structure is constructed such that the overlap width of the overlapped portion is set within the color filter displaying a specific color, unevenness in alignment is more difficult to view.

A sixth invention is characterized in that the alignment-layer material is applied onto the color filters with a droplet discharge head in the forth or fifth invention.

Since the structure is constructed such that the alignment-layer material is applied with a droplet discharge head, the thickness of the alignment layer is constant, thus providing a stable quality.

A seventh invention is characterized in that the alignment-layer material is applied onto the color filters by flexography in the fourth or fifth invention.

Since the structure is constructed such that the alignment-layer material is applied by flexography, the time for manufacture can be decreased.

An eighth invention is characterized in that the specific color is blue in the fourth to seventh inventions.

Since the structure is constructed such that the specific color is blue which has relatively low visibility, the visibility of unevenness in alignment can be further decreased.

A ninth invention is characterized by comprising a table for placing a substrate having a plurality of color filters, a droplet discharge head opposed to the substrate and capable of relative movement in two-dimensional directions along the substrate, and a controller for controlling the two-dimensional relative movement of the table and the droplet discharge head, wherein an alignment-layer material discharged from nozzles provided to the droplet discharge head is applied along a preset alignment-layer application train by the relative movement of the substrate and the droplet discharge head such that the lateral front end of the train is located at a position corresponding to a color filter displaying a specific color; and the alignment-layer material is applied along the following alignment-layer application train such that the lateral rear end of the train is overlapped with the front end of the alignment layer applied to the preceding alignment-layer application train and the lateral front end is located at a position corresponding to the color filter displaying a specific color.

Since the structure is constructed such that the overlapped portion of the alignment layer is set to a position corresponding to a color filter displaying a specific color in manufacturing a color-filter substrate, manufacture is facilitated and atomization is promoted.

A tenth invention is characterized in that the specific color is blue in the ninth invention.

Since the structure is constructed such that the specific color is blue which has relatively low visibility, the visibility of unevenness in alignment can be further decreased.

According to the present invention, even when an alignment-layer material is applied several times, streak unevenness in alignment generated at the boundary thereof is difficult to see from the exterior, thus improving the quality of products.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front view of a color-filter substrate according to an embodiment of the present invention;

FIG. **2** is a cross-sectional view of the same, taken along line II-II of FIG. **1**;

FIG. **3** is a perspective view of the state in which an alignment-layer material is applied onto a color filter with a droplet discharge head;

FIG. **4** is an enlarged cross-sectional view of an essential part of the same, showing the state in which an alignment-layer material is applied on the color filter;

FIG. **5** is a plan view of the arrangement of color filters disposed on the color-filter substrate;

FIG. **6** is a plan view of the arrangement of color filters disposed on the color-filter substrate according to another embodiment;

FIG. **7** is a cross-sectional view of a liquid crystal device according to the embodiment;

FIG. **8** is a flowchart of a method for manufacturing the liquid crystal device.

## DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

An embodiment of the present invention will be described hereinbelow with reference to the drawings. FIGS. **1** to **7** show an embodiment of the invention. FIG. **1** is a front view of a color-filter substrate. FIG. **2** is a cross-sectional view of the same, taken along line II-II of FIG. **1**.

Numeral **1** in the drawings denotes a color-filter substrate. The color-filter substrate **1** is provided to opposing substrates of, for example, a liquid crystal device. The color-filter substrate **1** has a plurality of color filters R, B, and G which are colored in the three primary colors of light, red (R), blue (B), and green (G), respectively, in a specified pattern and also has an alignment-layer application area **2** thereon.

An alignment-layer material is applied to the alignment-layer application area **2** with a droplet discharge head **3** to form an alignment layer **4**. The alignment-layer material applied on the color-filter substrate **1** and the alignment layer **4** formed by the alignment-layer material dried and solidified are shown in the same shape on the drawings. Accordingly, numeral to be given to the alignment-layer material is omitted hereinafter for convenience.

Referring to FIG. **3**, the droplet discharge head **3** which applies an alignment-layer material to the surface of the color-filter substrate **1** has one or multiple trains of nozzles **3***a*. An alignment-layer material held in an ink tank (not shown) is supplied to each nozzle **3***a* through a supply port **3***b*.

For the alignment-layer material, the same as that used in the general flexography, such as polyimide, is used. The viscosity and the discharge amount of one droplet are determined in consideration of a spread when applied to the color-filter substrate **1**. Specifically, as shown in FIG. **4**(*a*), the viscosity of the alignment-layer material and the discharge amount of one droplet of the nozzle **3***a* are set by experiment etc. so that the alignment-layer material applied to the color-filter substrate **1** is not dispersed on the color-filter substrate **1** but can be dried and solidified at a preset thickness.

A table (not shown) for placing the color-filter substrate **1** and the droplet discharge head **3** can make a relative movement in two dimensional directions (X, Y) with a controller (not shown). The alignment-layer material discharged from the nozzles **3***a* of the droplet discharge head **3** is applied to the entire alignment-layer application area **2** of the color-filter substrate **1** by the relative movement of the table and the droplet discharge head **3**.

In this case, when the effective discharge width WI of the nozzles **3***a* of the droplet discharge head **3** is smaller than the X-direction effective width W**2** of the alignment-layer application area **2** of the color-filter substrate **1**, as shown in FIG. **1**, the droplet discharge head **3** is reciprocated along preset multiple alignment-layer application trains to apply the alignment-layer material onto the entire alignment-layer application area **2**.

More specifically, one of the table and the droplet discharge head **3** placed above the color-filter substrate **1** placed on the table, opposed thereto with a predetermined space therebetween, is moved in the direction of arrow Y relative to the color-filter substrate **1**, and the first alignment-layer application train of the color-filter substrate **1** is scanned with the droplet discharge head **3**. The droplet discharge head **3** is then moved a specified pitch in the direction of arrow X relative to the color-filter substrate **1** by the relative movement of the

table and the droplet discharge head **3**, thereby scanning the second alignment-layer application train.

The entire alignment-layer application area **2** on the color-filter substrate **1** is scanned by repeating that process, during which the alignment-layer material discharged from the nozzles **3***a* of the droplet discharge head **3** is applied onto the color-filter substrate **1**, thereby forming the alignment layer **4** on the entire alignment-layer application area **2**, as shown in FIG. **2**.

When the alignment-layer material is applied to a preceding alignment-layer application train and then to the following alignment-layer application train with the droplet discharge head **3**, the alignment-layer material applied to the preceding alignment-layer application train has been dried and solidified to form a alignment-layer train **4***a* or on the way to forming the alignment-layer train **4***a*. Accordingly, in order to eliminate the boundary with the front end (hereinafter, referred to as a lateral front end) L**1** in the direction of movement along the X-direction of the alignment-layer train **4***a* formed in the preceding alignment-layer application train, as shown in FIG. **4***b*, when the alignment-layer material is applied to the following alignment-layer application train, the rear end (hereinafter, referred to as a lateral rear end) L**2** in the direction of movement along the X-direction of the alignment-layer material applied to the following alignment-layer application train is overlapped with the lateral front end L**1** of the alignment-layer train **4***a* applied to the preceding alignment-layer application train, thereby forming an overlapped portion **4***c* with an overlap width W**3**.

As a result, the overlapped portion **4***c* (refer to FIG. **4**(*b*)) is produced between the lateral front end L**1** of the alignment-layer train **4***a* formed in the preceding alignment-layer application train and the lateral rear end L**2** of the alignment-layer material formed in the following alignment-layer application train. The overlapped portion **4***c* is different in thickness from the alignment layer of the other parts, tending to affect the pre-tilt angle of liquid crystal, which can be viewed as streak unevenness in alignment from the exterior.

Therefore, the embodiment is constructed such that when an alignment-layer material is applied onto the color-filter substrate **1** with the droplet discharge head **3**, the relative movement of the table and the droplet discharge head **3** is set so that the overlapped portion **4***c* is produced at a portion corresponding to a specific color arrangement of the three primary colors (R, B, and G) which construct a color filter to be used for a color liquid crystal device. The specific color is preferably blue (B). Blue (B) is known to be generally lower in visibility than the other two colors (red and green) and difficult to view as luminance difference even if streak unevenness in alignment occurs owing to the variation in the thickness of the alignment layer **4**.

Accordingly, for example, when the color filters R, B, and G are arranged such that the same colors R, B, and G are arranged in respective columns, as shown in FIG. **5**, the relative movement of the table and the droplet discharge head **3** in the direction of the two dimensions (X, Y) is set so that the overlapped portion **4***c* shown in FIG. **4**(*b*) is formed on a portion corresponding to the train of the color filter B. In that case, as shown in FIG. **6**, when the color filters R, B, and G are arranged to be displaced one by one, the color-filter substrate **1** is tilted so that the overlapped portion **4***c* is formed along the color filter B.

This embodiment is constructed such that when the table and the droplet discharge head **3** are reciprocated to scan the color-filter substrate **1**, the overlapped portion **4***c* (refer to FIG. **4***b*) formed of the alignment-layer train **4***a* formed on the preceding alignment-layer application train and the alignment-layer train **4***b* formed on the following alignment-layer application train passes through a part corresponding to the color filter B which displays blue of the lowest visibility and lowest luminance difference of the color filters R, B, and G. Accordingly, streak unevenness in alignment is difficult to see from the exterior, thus improving the quality of products.

The operation of the embodiment will now be described. The color-filter substrate **1** is first placed on the table with a specified alignment. The color filters R, B, and G provided on the color-filter substrate **1** are then arranged such that the same display colors are aligned along the Y-direction which is the reciprocating scanning direction of the droplet discharge head **3** (refer to FIGS. **6** and **7**).

The droplet discharge head **3** is then moved relatively in the Y-direction along a preset coordinate to apply an alignment-layer material discharged from the nozzles **3***a* of the droplet discharge head **3** onto the first alignment-layer application train of the color-filter substrate **1**, in which case the lateral front end L**1** of the alignment-layer material is set to the position of the color filter B, as shown in FIGS. **4** and **5**.

After completion of the application of the alignment-layer material to the first alignment-layer application train of the color-filter substrate **1**, the droplet discharge head **3** is moved in the X-direction to apply the alignment-layer material to the following alignment-layer application train. The stroke of the droplet discharge head **3** in the X-direction for the second and following alignment-layer application trains is set so that the lateral rear end L**2** of the alignment-layer material discharged from the nozzles **3***a* is overlapped with or in contact with the lateral front end L**1** of the alignment-layer train **4***a* formed by the preceding application. The effective discharge width W**1** of the second and following nozzles **3***a* is set so that the lateral front end L**1** is located at the position of the color filter B by controlling the number of discharges of the nozzles **3***a*.

Accordingly, the effective discharge width W**1**, which is set so that the ends L**2** and L**1** of the alignment-layer material form the overlapped portion **4***c* as shown in FIG. **4**(*b*), is set to a value obtained by adding the overlap width W**3** of the overlapped portion **4***c* to a value approximately integer times the interval of pixels, with the arrangement of the color filters R, B, and G as one unit.

The overlap width W**3** of the overlapped portion **4***c* varies and so is not constant under the influence of the deflections at relative reciprocating scanning of the table and the droplet discharge head **3**, the accuracy error of the effective discharge width W**1** of the nozzles **3***a*, etc. Therefore, the effective discharge width W**1** is set in consideration of the variation factors by experiment etc. so that the overlap width W**3** of the overlapped portion **4***c* is set within the width of the color filter B at the maximum, and such that the ends L**1** and L**2** come into contact with each other at the minimum.

Accordingly, the alignment-layer material can be applied to the entire alignment-layer application area **2** of the color-filter substrate **1** by reciprocating the droplet discharge head **3** at a specified pitch in the X-direction to scan the color-filter substrate **1**. As shown in FIGS. **5** and **6**, the overlapped portion **4***c* (refer to FIG. **4***b*) of the alignment layer **4** is produced at a position corresponding to the color filter B which displays color with the lowest visibility and lowest luminance difference of the color filters R, B, and G disposed on the color-filter substrate **1**.

Consequently, streak unevenness in alignment generated by the overlapped portion **4***c* of the alignment layer **4** is difficult to see from the exterior, thus improving the quality of products.

It is to be understood that the present invention is not limited to the foregoing embodiment but it is also possible to

form the alignment-layer trains **4***a* and **4***b* on the color-filter substrate **1** by flexography and repeat it to form the alignment layer **4** on the entire alignment-layer application area **2** of the color-filter substrate **1**.

## First Embodiment

An embodiment of a liquid crystal device **11** which includes the color-filter substrate **1** according to the embodiment will next be described. The liquid crystal device **11** according to the embodiment includes an opposing substrate **10** and a device substrate **20** opposed to each other. The substrates **10** and **20** are bonded together via a sealing material **30** and have a liquid-crystal sealed area **35** therein. The liquid-crystal sealed area **35** contains liquid crystal (not shown). A light source (not shown) is disposed on the outer surface of the opposing substrate **10**.

The opposing substrate **10** includes a plurality of color filters **55** (R, G, and B) colored in red (R), blue (B), and green (G), respectively, in the area on a transparent substrate **101**, such as a glass substrate, which corresponds to the intersection of a first electrode pattern **40** and a second electrode pattern **50**. In this embodiment, the opposing substrate **10** corresponds to the color-filter substrate **1** of this embodiment.

The color filters **55** (R, B, and G) are aligned in a specified pattern on the transparent substrate **101** (refer to FIG. **5** or **6**). The first electrode pattern **40** and the alignment layer **4** are formed in order on the surface of the color filters **55** (R, B, and G). Both of the first electrode pattern **40** and the second electrode pattern **50** are made of a transparent conducting layer, typified by indium tin oxide (ITO). A light shielding layer **16** is formed at the boundary of the color filters **55** (R, B, and G).

The second electrode pattern **50**, an overcoat layer **29**, and the alignment layer **4** are formed in order on a transparent substrate **201**, such as a glass substrate, which constructs the device substrate **20**.

The alignment layer **4** is formed on the color filters **55** (R, B, and G) and the overcoat layer **29** by the droplet discharge method according to the embodiment.

The alignment layer **4** formed by the droplet discharge method of this embodiment has the overlapped portion **4***c* at which the ends L**1** and L**2** of the adjacent alignment-layer train **4***a* and **4***b* are overlapped with each other, at a position corresponding to the color filter **55**(B).

Blue which is displayed by the color filter **55**(B) has lower visibility and lower luminance difference than colors (R and G) displayed with the other color filters **55** (R and G). Accordingly, when the overlapped portion **4***c* is disposed at a position corresponding to the color filter **55**(B), streak unevenness in alignment generated by the overlapped portion **4***c* is difficult to see from the exterior, thus improving the quality of products.

Referring now to the flowchart of FIG. **8**, a method for manufacturing the liquid crystal device **11** according to the embodiment will be described. In manufacturing the liquid crystal device **11**, the electrode patterns **40** and **50** are formed with a semiconductor process, with the opposing substrate **10** and the device substrate **20** in the state of large substrates (not shown) from which a large number of substrates can be taken.

More specifically, a large substrate (not shown) is subjected to step ST**11** of forming the light shielding layer **16**, step ST**12** of forming the color filters **55**, step S**13** of forming the electrode pattern **40**, step ST**14** of forming the alignment layer **4**, rubbing step ST**15**, and step ST**16** of applying the sealing material **30**, in the state of a large substrate from which a large number of transparent substrates **101** can be taken.

Then, a large substrate (not shown) is subjected to step ST**21** of forming the electrode pattern **50**, step ST**22** of forming the overcoat layer **29**, step ST**23** of forming the alignment layer **4**, rubbing step ST**24**, and step ST**25** of spraying a gap material, in the state of a large substrate from which a large number of transparent substrates **201** can be taken.

In bonding step ST**31**, both the large substrates (not shown) before divided to multiple opposing substrates **10** and device substrates **20** are bonded together to form a large panel structure and then it is cut to strip panel structures in first breaking step ST**32**.

In liquid-crystal charging and sealing step ST**33**, after the liquid-crystal sealed area **35** (refer to FIG. **7**) formed in the strip panel structure is filled with liquid crystal and then sealed. Subsequently, in second breaking step ST**34**, the strip panel structure is cut into the liquid crystal devices **11** and then, in mounting step ST**35**, a flexible substrate etc. are mounted to each liquid crystal device **11**.

In step ST**14** of forming the alignment layer **4**, the alignment-layer trains **4***a* and **4***b* are formed on every train by the droplet discharge method to form the alignment layer **4** on the entire alignment-layer application area **2** finally. The overlapped portion **4***c* formed at the adjacent ends L**1** and L**2** is formed on the color filter **55**(B), so that streak unevenness in alignment generated by the overlapped portion **4***c* is difficult to see from the exterior, thus improving the quality of the products.

Although the embodiment has been described for the alignment layer **4** formed on the opposing substrate **10**, the alignment layer **4** formed on the device substrate **20** has also the same structure. Specifically, in step ST**23** of forming the alignment layer **4** on the transparent substrate **201** of the device substrate **20**, the overlapped portion **4***c* of the alignment-layer trains **4***a* and **4***b* is formed at a position corresponding to the color filter **55**(B) (the position directly below the color filter **55**(B) shown in FIG. **7**), as in step ST**14** of forming the alignment layer **4** on the opposing substrate **10**. Since the overlapped portion **4***c* of the alignment-layer trains **4***a* and **4***b* is formed directly below the color filter **55**(B), also the streak unevenness in alignment generated by the overlapped portion **4***c* is difficult to see from the exterior.

What is claimed is:

**1**. An apparatus for manufacturing a color-filter substrate, comprising:

a table for placing a substrate having a plurality of color filters;

a droplet discharge head opposed to the substrate and capable of relative movement in two-dimensional directions along the substrate; and

a controller specifically programmed to control the two-dimensional relative movement of the table and the droplet discharge head so that:

a lateral front end of a first application of the alignment-layer material discharged from nozzles provided to the droplet discharge head is located at a position corresponding to a color filter of a specific color; and

a lateral rear end of a second application of the alignment-layer material discharged from the nozzles provided to the droplet discharge head overlaps with the lateral front end of the first application of the alignment-layer material.

**2**. The apparatus for manufacturing a color-filter substrate according to claim **1**, wherein the specific color is blue.

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|---|---|---|---|
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摘要(译)

使得难以观察在取向层的边界处产生的条纹的条纹不均匀性，即使当将取向层材料多次施加到滤色器基板上以形成取向层时也是如此。当在具有滤色器排出头3的表面上将具有滤色器（R，G和B）的滤色器基板1施加到对准层材料上以形成对准层列4a时，横向前端L1为列车4a形成在显示蓝色的滤色器（B）上。然后，当将取向层材料施加到随后的取向层施加系列以形成取向层列4b时，列4b的横向后端L2与前面的取向层列的横向前端L1重叠。在图4a中形成重叠部分4c。由于重叠部分4c形成在显示具有三原色光的最低可见度的蓝色的滤色器（B）上，因此难以从外部观察在边界处产生的条纹不均匀。