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(54) **ELECTRO-OPTICAL DEVICE, OPTICAL UNIT, AND ELECTRONIC APPARATUS**

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(57) **ABSTRACT**

An electro-optical device, including: a substrate; a pixel electrode; a pixel switching element which is disposed between the substrate and the pixel electrode; a first light shielding film which is disposed between the pixel switching element and the pixel electrode, and extends in one direction among the first direction and the second direction; and a second light shielding film which is disposed between the pixel switching element and the pixel electrode, and extends in the other direction among the first direction and the second direction. A pixel opening portion is defined by an outer edge of the first light shielding film and an outer edge of the second light shielding film.

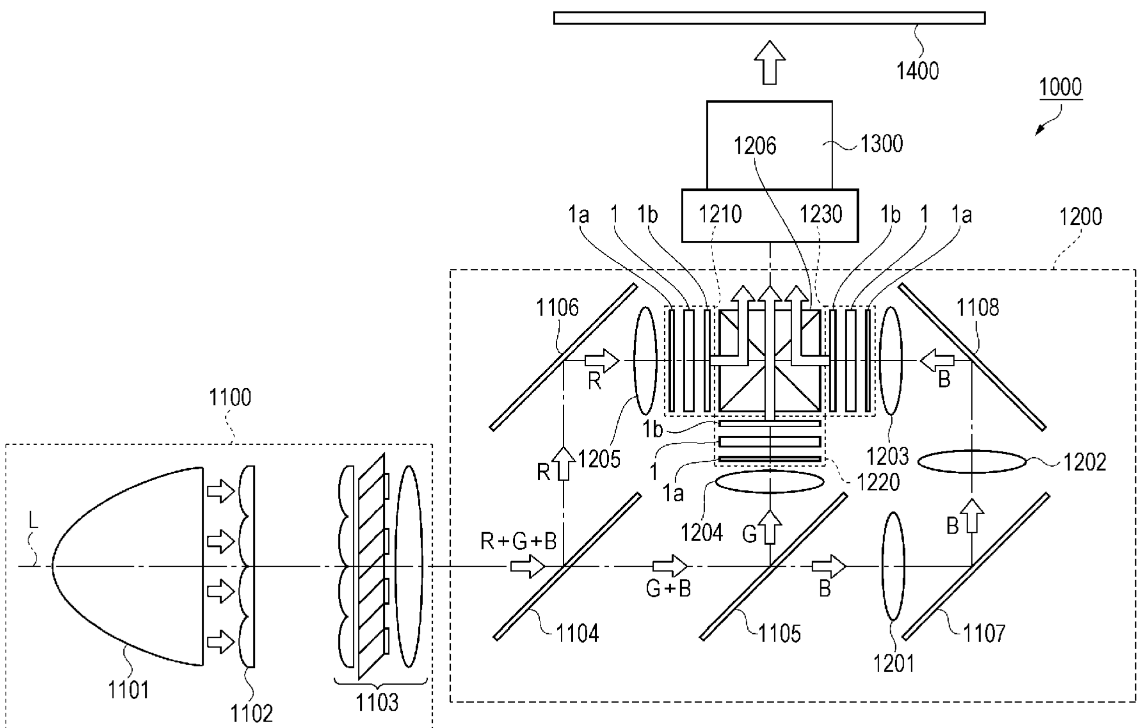
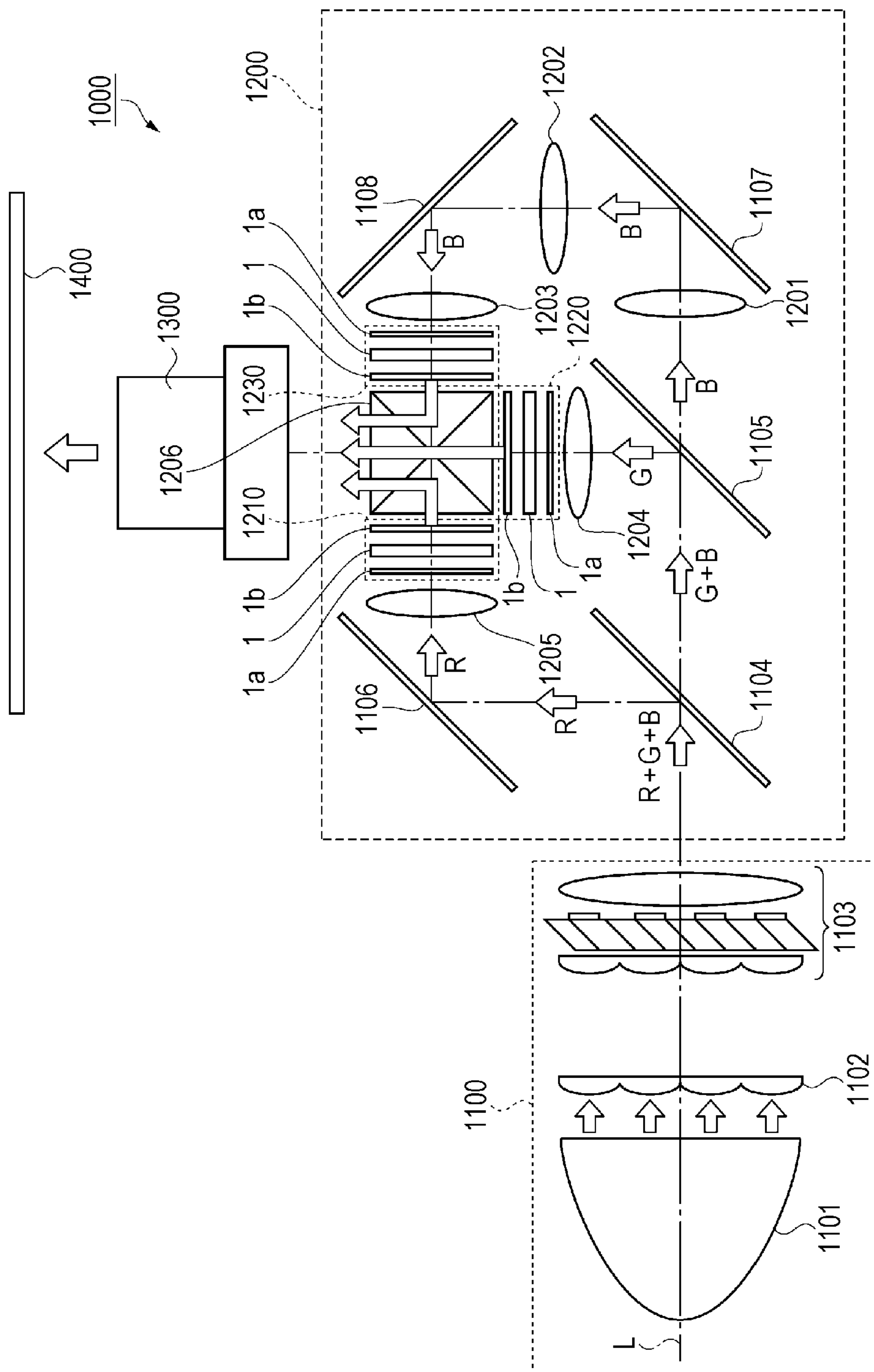


FIG. 1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1400
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1230
1206
1210
1200
1202
1108
1107
1a
1
1b
B
1203
1220
1201
1105
G
1204
G+B
1205
R
1106
1104
R+G+B
1100
1101
1102
1103
L

FIG. 2

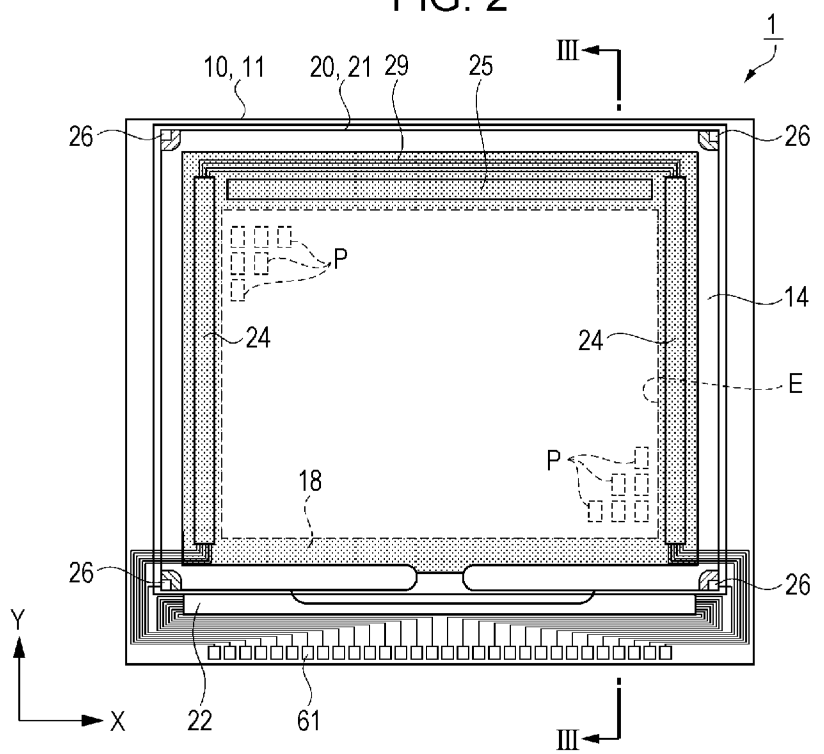
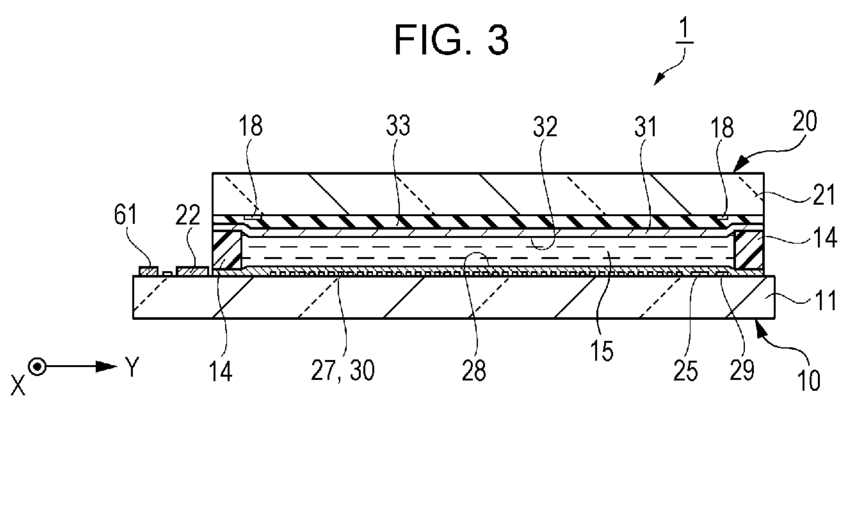

1
III
10, 11
20, 21
29
25
26
26
P
14
24
24
E
P
18
26
26
Y
X
22
61
III

FIG. 3


1
18
33
32
31
18
20
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61
22
14
11
14
27, 30
28
15
25
29
10
X
Y

FIG. 4

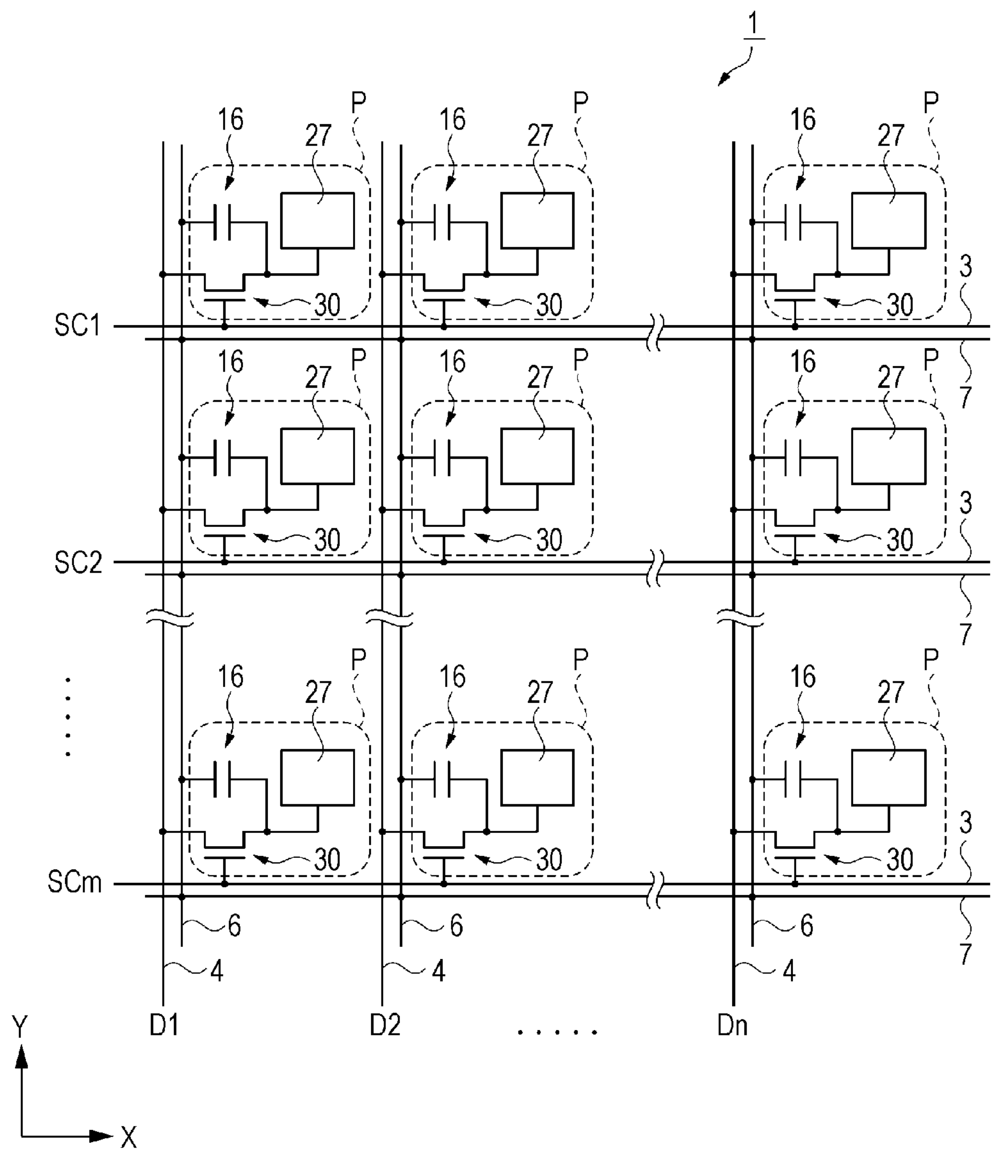
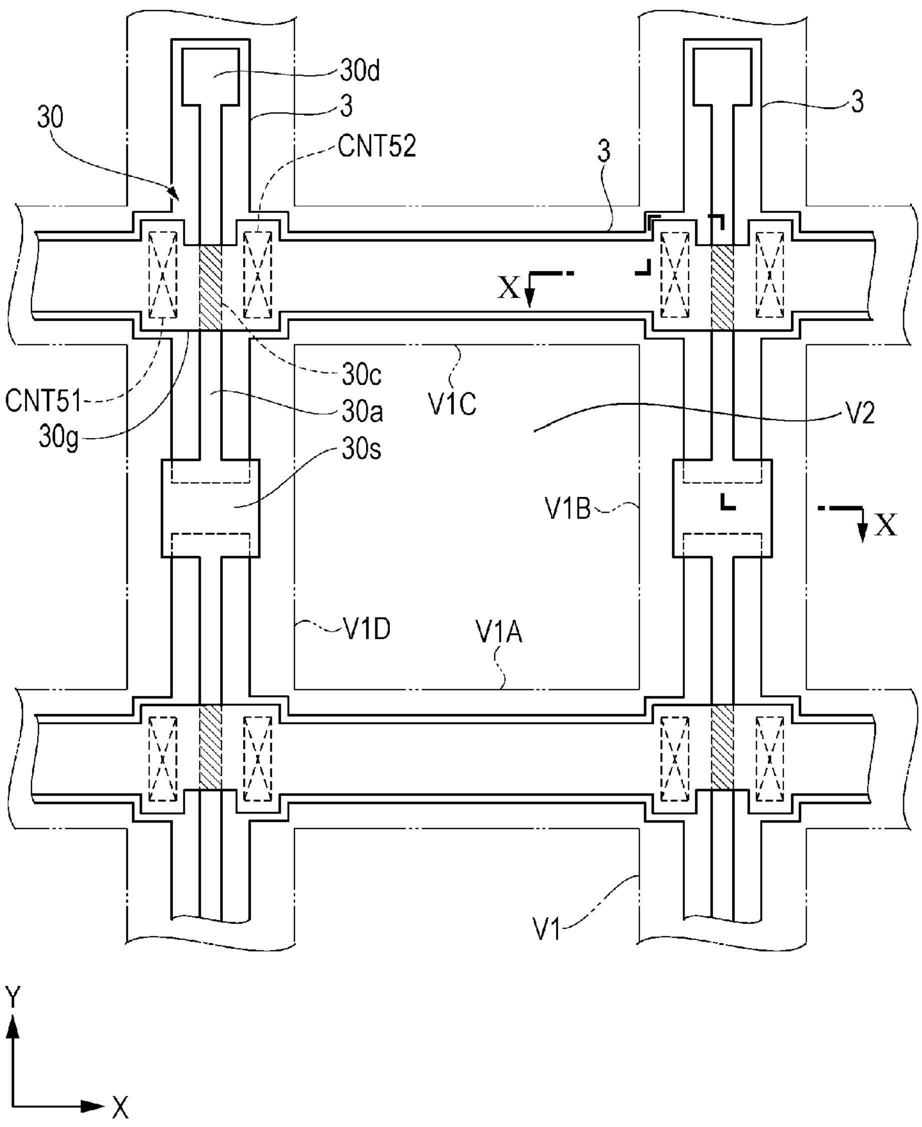
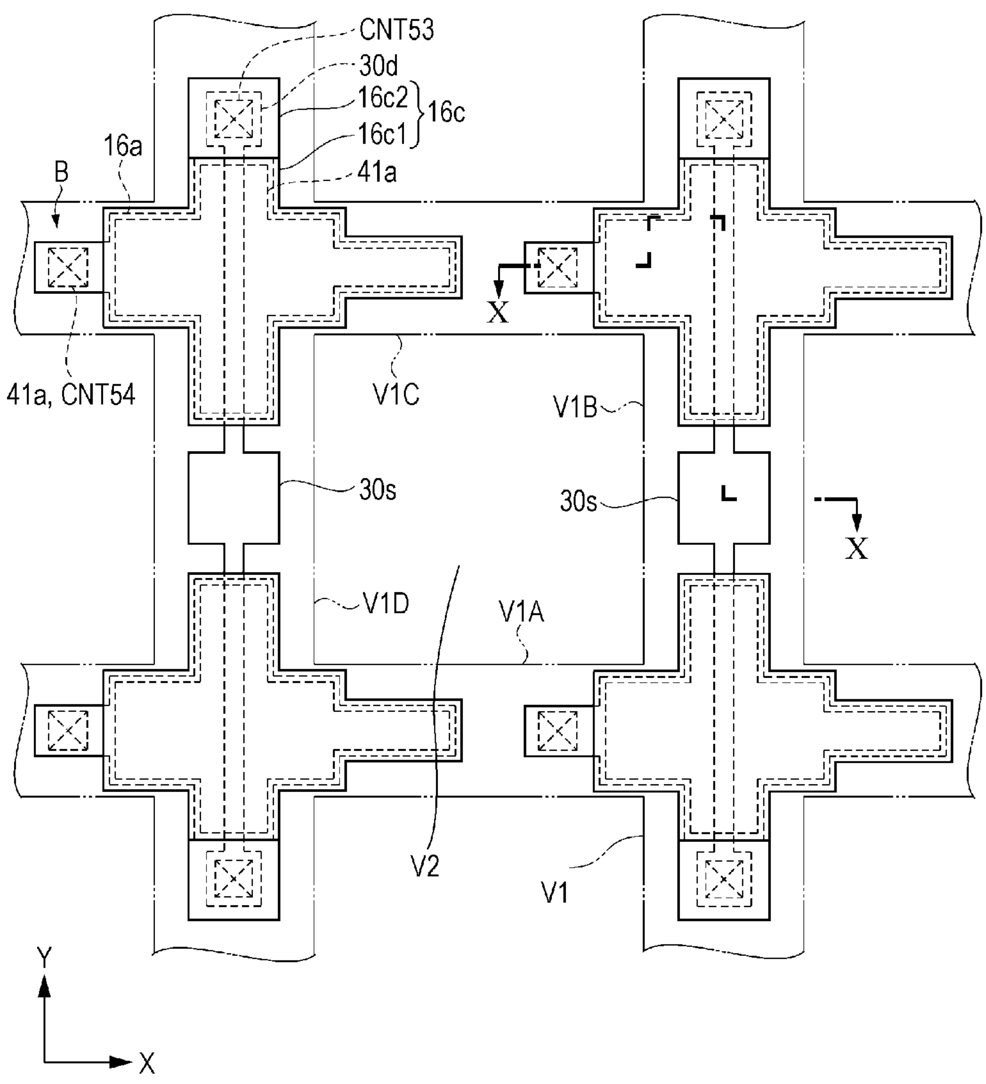


FIG. 5



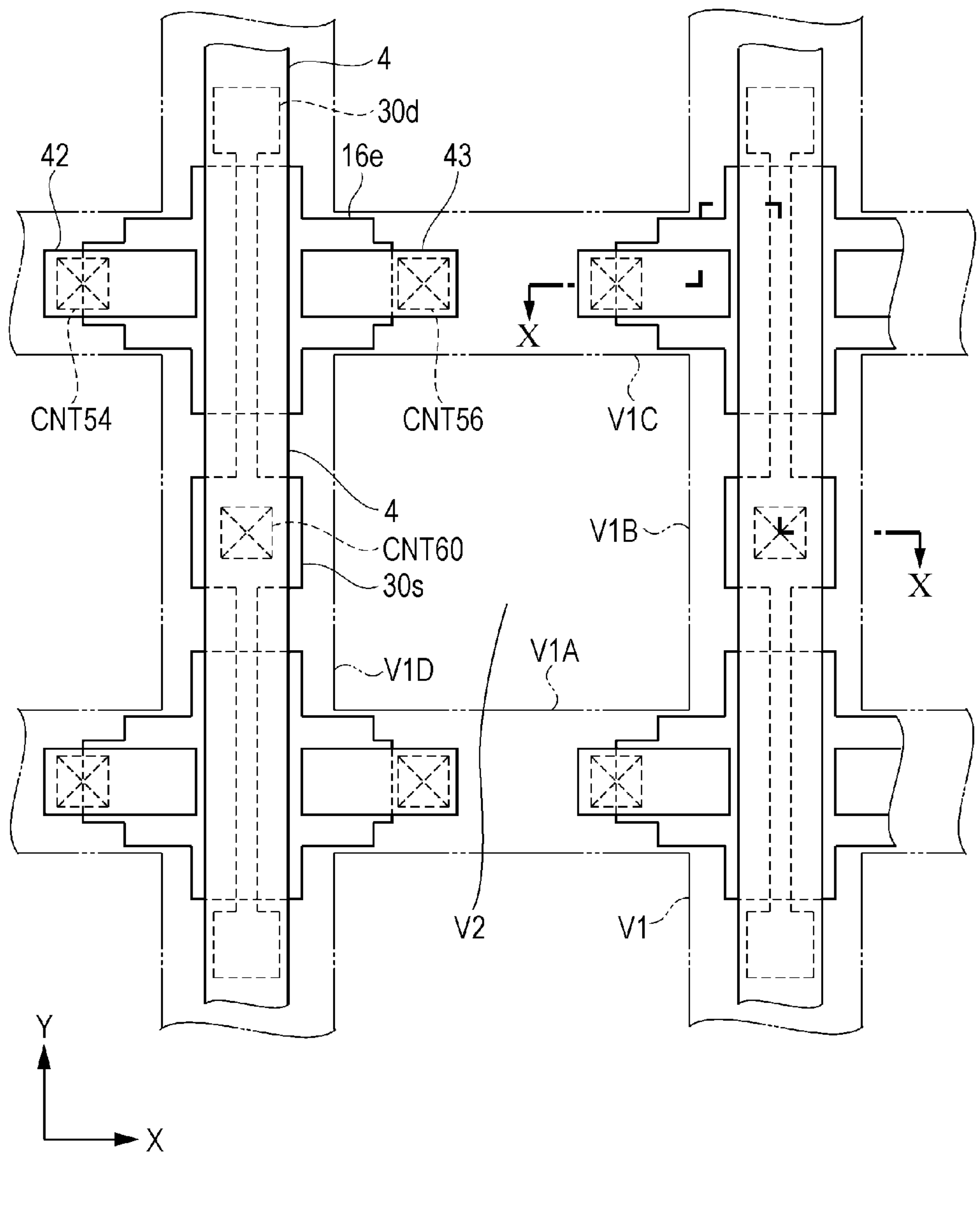
30d
3
30
CNT52
3
3
X
X
CNT51
30g
30c
30a
30s
V1C
V2
V1B
V1D
V1A
V1
Y
X

FIG. 6



CNT53
30d
16c2
16c
16c1
41a
16a
B
X
41a, CNT54
V1C
V1B
30s
30s
X
V1D
V1A
V2
V1
Y
X

FIG. 7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43
X
CNT54
CNT56
V1C
4
CNT60
30s
V1B
X
V1D
V1A
V2
V1
Y
X

FIG. 8

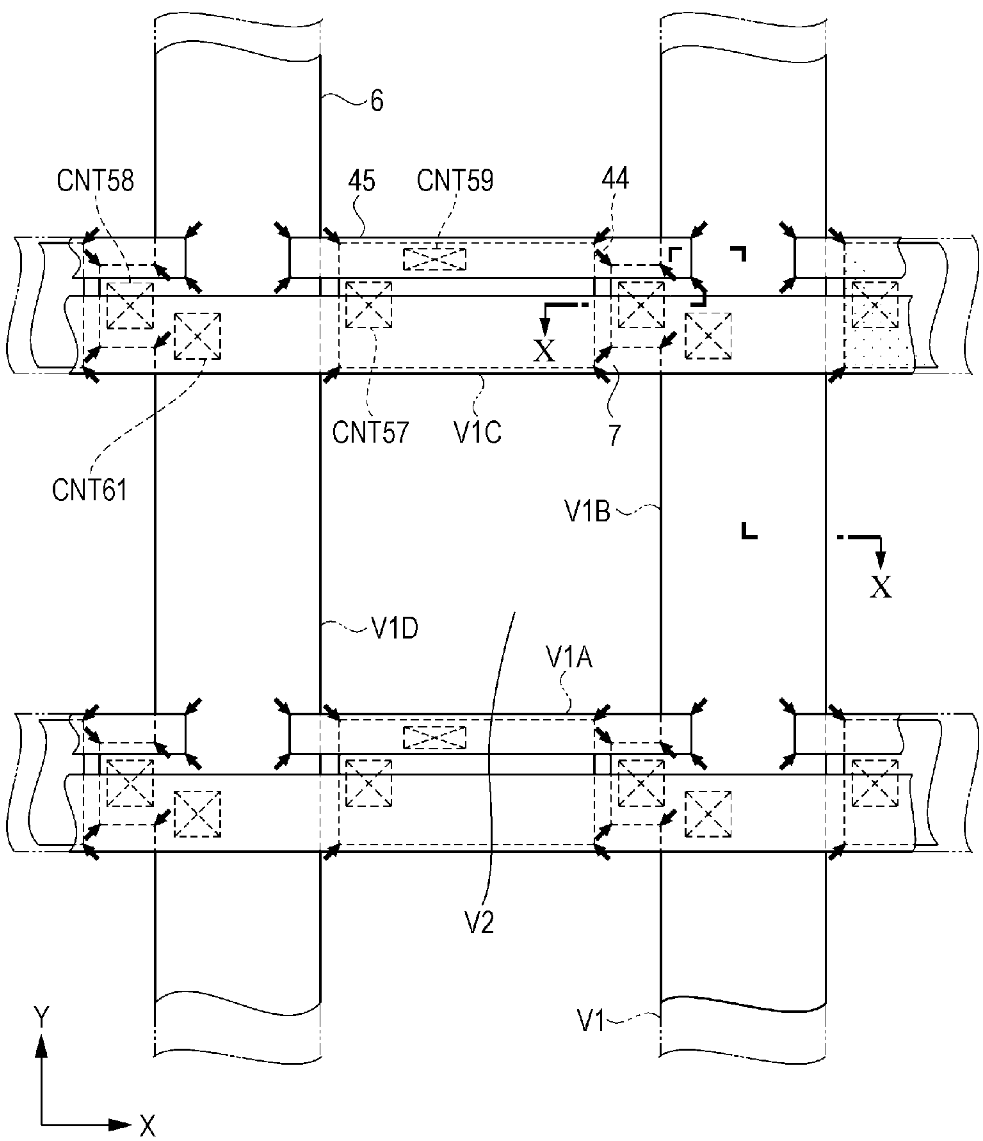


FIG. 9

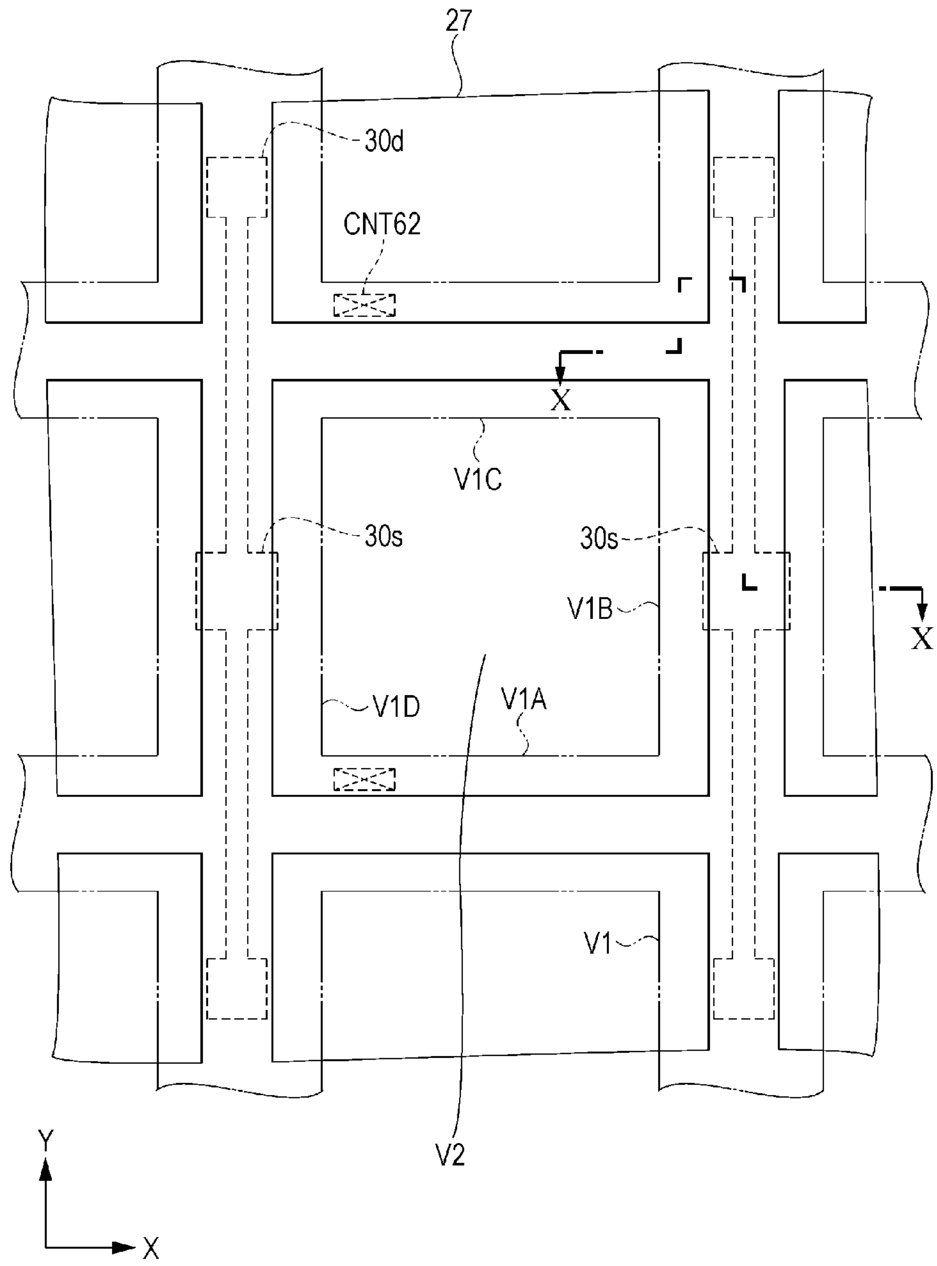
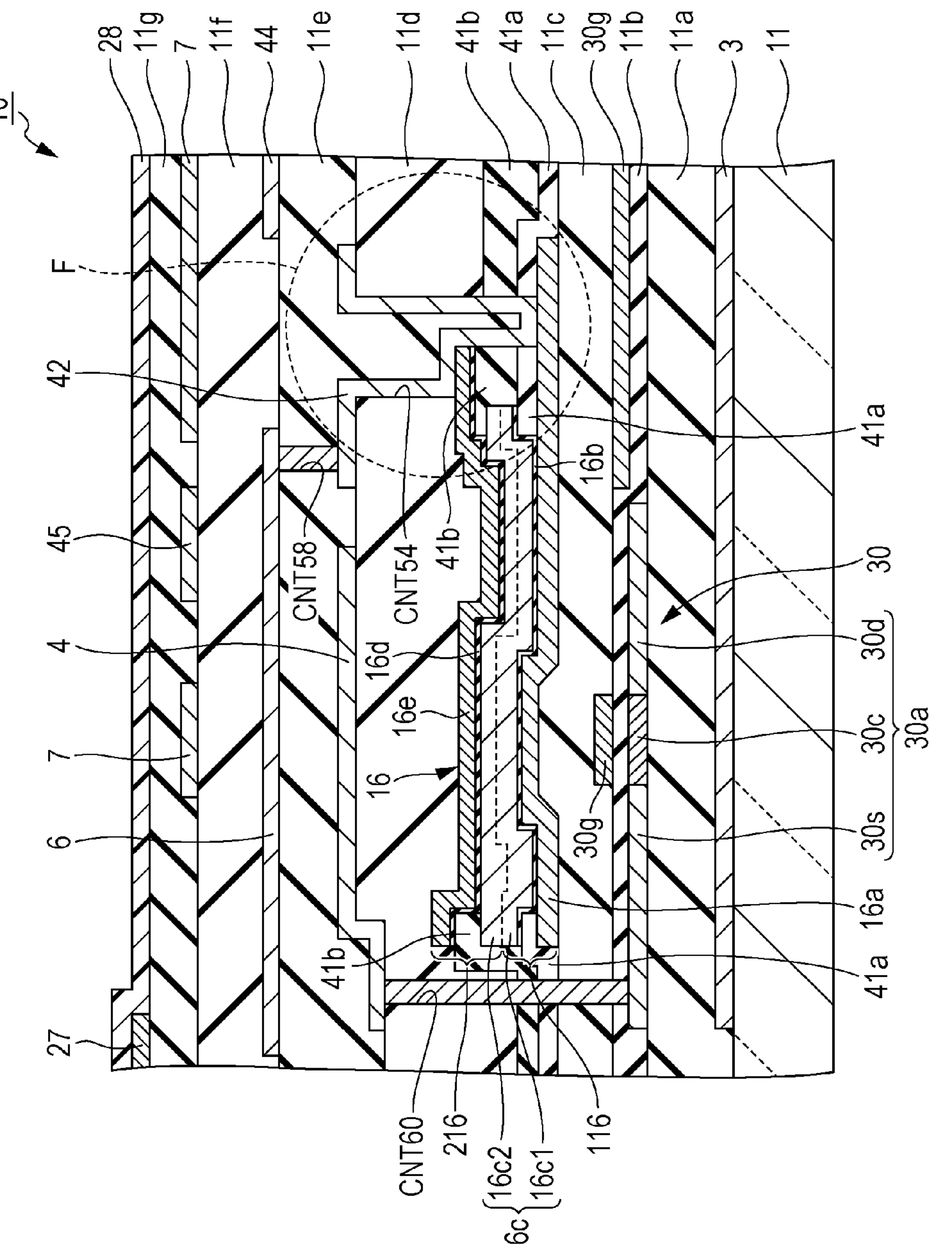


FIG. 10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11g
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44
11e
11d
41b
41a
11c
30g
11b
11a
3
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41a
16b
45
CNT58
CNT54
41b
30
4
16d
30d
16e
7
16
30c
30a
30g
6
30s
16a
41b
41a
27
CNT60
216
16c
16c2
16c1
116

ELECTRO-OPTICAL DEVICE, OPTICAL UNIT, AND ELECTRONIC APPARATUS

BACKGROUND

[0001] 1. Technical Field

[0002] The present invention relates to an electro-optical device, an optical unit and an electronic apparatus which have the electro-optical device mounted thereon.

[0003] 2. Related Art

[0004] An active driving type liquid crystal device, which is used as an optical modulating unit (light valve) of a liquid crystal projector, is an example of an electro-optical device. The active driving type liquid crystal device includes an element substrate which is provided with a thin film transistor (TFT), an opposing substrate which is provided with a common electrode, and a liquid crystal which is disposed between the element substrate and the opposing substrate. On a base member of the element substrate, a scanning line, the TFT, a signal line, a pixel electrode and the like, are provided in order. Furthermore, a pixel opening portion, which transmits light by a constituent element (light shielding film) having light shielding properties which is formed on the element substrate or the opposing substrate, is defined.

[0005] In the liquid crystal projector, a pair of polarizing elements which is disposed in a cross-nicol state, is disposed on a light-incidence side and a light-emitting side of the liquid crystal device. The light which is polarized by the polarizing elements disposed on the light-incidence side passes through the polarizing elements in the liquid crystal device (pixel opening portion) and on the light-emitting side, and becomes image light which displays a predetermined image.

[0006] In the liquid crystal projector in this configuration, the light shielding film which defines the pixel opening portion is configured of a light shielding material having light reflective properties, such as aluminum, and when an outer edge of the light shielding film is disposed in a direction which intersects a polarizing direction of the polarizing elements, light which is incident on the pixel opening portion and passes through the outer edge is polarized in a direction which is different from a direction in which the light is originally to be polarized, and a polarization state changes. Furthermore, reflected light which is reflected on an end surface of the outer edge of the light shielding film among rays of light which are incident on the pixel opening portion is polarized in a direction which is different from a direction in which the light is originally to be polarized, and the polarization state changes. Therefore, when the outer edge of the light shielding film is disposed in the direction which intersects the polarizing direction of the polarizing elements, the polarization state of a part of the light which is incident on the pixel opening portion changes, the light becomes leakage light, and display contrast deteriorates.

[0007] For this reason, in JP-A-2010-250005, negative influence (deterioration of display contrast) on display when the outer edge of the light shielding film is disposed in the direction which intersects the polarizing direction, is suppressed by covering the light shielding film having light reflective properties with the light shielding material having lower light reflectivity than that of the light shielding film, and by reducing reflection of the light on the end surface of the outer edge of the light shielding film.

[0008] In JP-A-2010-160308, the pixel opening portion is defined by the scanning line and the signal line which extend along the polarizing direction of the polarizing elements so that the outer edge of the light shielding film which defines the pixel opening portion is not disposed in the direction which intersects the polarizing direction of the polarizing elements.

[0009] In JP-A-2010-250005, there is a problem that it is difficult to completely suppress reflection of the light by the light shielding material having low light reflectivity, slight reflection of the light is generated, and it is difficult to completely suppress deterioration of display contrast.

[0010] In JP-A-2010-160308, the scanning line and the signal line which define the pixel opening portion are disposed nipping the TFT on the substrate. In other words, since two light shielding films which define the pixel opening portion are disposed to be apart from each other while nipping the TFT, for example, compared to a case where the two light shielding films which define the pixel opening portion are disposed to be close to each other, there is a problem that light shielding properties deteriorate, and light leakage is likely to be generated.

SUMMARY

[0011] The invention can be realized in the following forms or application examples.

Application Example 1

[0012] According to this application example, there is provided an electro-optical device which is disposed between a first polarizing element which polarizes light in a first direction, and a second polarizing element which polarizes the light in a second direction which intersects the first direction, including: a substrate; a pixel electrode; a pixel switching element which is disposed between the substrate and the pixel electrode; a first light shielding film which is disposed between the pixel switching element and the pixel electrode, and extends in one direction among the first direction and the second direction; and a second light shielding film which is disposed between the pixel switching element and the pixel electrode, and extends in the other direction among the first direction and the second direction. A pixel opening portion is defined by an outer edge of the first light shielding film and an outer edge of the second light shielding film.

[0013] In this case, the pixel opening portion is defined by the outer edge of the first light shielding film which extends in one direction among the first direction and the second direction, and the outer edge of the second light shielding film which extends in the other direction among the first direction and the second direction. The outer edge of the light shielding film which defines the pixel opening portion is disposed along the polarizing direction of the light which is polarized by the first polarizing element and the second polarizing element, and is not disposed in a direction which intersects the polarizing direction of the light. For this reason, a polarization state of the light which passes through the pixel opening portion does not change, and thus, it is possible to suppress deterioration (leakage light) of display contrast due to the change of the polarization state. In other words, it is possible to suppress generation of slight leakage of the light, which is a problem of the known technology (JP-A-2010-250005)

[0014] Two light shielding films (first light shielding film and second light shielding film) which define the pixel opening portion is disposed between the pixel switching element (TFT) and the pixel electrode. Compared to the known technology (JP-A-2010-160308) in which the two light shielding films are disposed to be apart from each other while nipping the pixel switching element (TFT), since the two light shielding films (first light shielding film and second light shielding film) are disposed to be close to each other, light shielding properties are improved, and a concern about generation of light leakage is reduced.

[0015] Therefore, in this case, it is possible to suppress deterioration of display contrast compared to the known technology, and to provide high display quality.

Application Example 2

[0016] According to this application example, there is provided an electro-optical device which is disposed between a first polarizing element which polarizes light in a first direction, and a second polarizing element which polarizes the light in a second direction which intersects the first direction, including: a substrate; a pixel electrode; a pixel switching element which is disposed between the substrate and the pixel electrode; a first light shielding film which is disposed between the pixel switching element and the pixel electrode, and extends in one direction among the first direction and the second direction; a second light shielding film which is disposed between the pixel switching element and the pixel electrode, and extends in the other direction among the first direction and the second direction; a first conducting film having light shielding properties which is provided on the same layer as the first light shielding film; and a second conducting film having light shielding properties which is provided on the same layer as the second light shielding film. A pixel opening portion is defined by an outer edge of the first light shielding film, an outer edge of the second light shielding film, and at least one outer edge of the first conducting film and the second conducting film.

[0017] In this case, the pixel opening portion is defined by the outer edge of the first light shielding film which extends in one direction among the first direction and the second direction, the outer edge of the second light shielding film which extends in the other direction among the first direction and the second direction, and at least one outer edge of the first conducting film and the second conducting film. The outer edge of the light shielding film which defines the pixel opening portion is disposed along the polarizing direction of the light which is polarized by the first polarizing element and the second polarizing element, and is not disposed in the direction which intersects the polarizing direction of the light. Furthermore, as at least one outer edge of the first conducting film and the second conducting film which defines the pixel opening portion is disposed along the polarizing direction of the light, the polarization state of the light which passes through the pixel opening portion does not change, and thus, it is possible to suppress deterioration (leakage light) of display contrast due to the change of the polarization state. In other words, it is possible to suppress generation of slight leakage of the light, which is a problem of the known technology (JP-A-2010-250005).

[0018] In this case, the light shielding films (first light shielding film, second light shielding film, first conducting film, and second conducting film) which define the pixel opening portion are disposed between the pixel switching element (TFT) and the pixel electrode. Compared to the known technology (JP-A-2010-160308) in which the light shielding films which define the pixel opening portion are disposed to be apart from each other while nipping the pixel switching element (TFT), since the light shielding films which define the pixel opening portion are disposed close to each other, light shielding properties are improved, and a concern about generation of light leakage is reduced.

[0019] Therefore, in this case, compared to the known technology, it is possible to suppress deterioration of display contrast, and to provide high display quality.

[0020] Furthermore, it is possible to enhance a degree of freedom of wiring as at least one of the first conducting film and the second conducting film is used in a relay electrode which electrically connects wirings disposed on a plurality of layers.

Application Example 3

[0021] In the electro-optical device according to the application example, it is preferable that a material which constitutes the first light shielding film and the second light shielding film be aluminum or a conductive material including aluminum.

[0022] In this case, aluminum or the conductive material including aluminum has excellent light shielding properties and less conductivity, compared to a conductive material having a high melting point, such as titanium nitride. Therefore, light shielding properties of the light shielding films (first light shielding film and second light shielding film) which define the pixel opening portion are improved, and thus, it is possible to reduce resistance of the light shielding films (first light shielding film and second light shielding film).

Application Example 4

[0023] In the electro-optical device according to the application example, it is preferable that a signal line be provided which extends in one direction among the first direction and the second direction between the pixel switching element and the pixel electrode. It is preferable that the first light shielding film be disposed on a layer between a layer on which the signal line is formed and a layer on which the pixel electrode is formed. It is preferable that the second light shielding film be disposed on a layer between the layer on which the first light shielding layer is formed and the layer on which the pixel electrode is formed.

[0024] In this case, the two light shielding films (first light shielding film and second light shielding film) are disposed between the layer on which the signal line is formed and the layer on which the pixel electrode is formed. Compared to the known technology (JP-A-2010-160308) in which the two light shielding films are disposed to be apart from each other while nipping the pixel switching element (TFT), since the two light shielding films (first light shielding film and second light shielding film) are disposed to be close to each other, light shielding properties are improved, and a concern about generation of light leakage is reduced.

[0025] Furthermore, the first light shielding film extends in the same direction as the signal line, and is disposed on a side closer to the signal line than the second light shielding film. As the first light shielding film is disposed to cover the signal line between the signal line and the pixel electrode, it is possible to reduce influence of an electric field of the signal line with respect to the pixel electrode.

Application Example 5

[0026] In the electro-optical device according to the application example, it is preferable that the first light shielding film and the second light shielding film be wirings to which a fixed potential is supplied.

[0027] In this case, when the first light shielding film and the second light shielding film are wirings to which the fixed potential is supplied, and the first light shielding film and the second light shielding film supply the fixed potential, influence of the electric field of the signal line with respect to the pixel electrode, that is, coupling between the signal line and the pixel electrode can be reduced. Therefore, it is possible to reduce potential variation of the pixel electrode due to the electric field of the signal line, and improve display quality.

Application Example 6

[0028] In the electro-optical device according to the application example, it is preferable that the outer edge of the first light shielding film and the outer edge of the second light shielding film which define the pixel opening portion be straight lines.

[0029] In this case, for example, when the outer edge of the light shielding film which defines the pixel opening portion has a part which is not a straight line, the outer edge of the part which is not a straight line is disposed in the direction which intersects the polarizing direction of the light, the polarization state of the light which passes through the pixel opening portion changes, and display contrast deteriorates. Since the outer edge of the light shielding film which defines the pixel opening portion is a straight line along the polarizing direction of the light, the polarization state of the light which passes through the pixel opening portion does not change, and thus, it is possible to suppress deterioration (leakage light) of display contrast due to the change of the polarization state of the light.

Application Example 7

[0030] According to this application example, there is provided an optical unit, including: a first polarizing element which polarizes light in a first direction; a second polarizing element which polarizes the light in a second direction which intersects the first direction; the electro-optical device according to above-described application examples which is disposed between the first polarizing element and the second polarizing element; and a light synthesizing optical system which synthesizes and emits the light which is emitted from the plurality of electro-optical devices.

[0031] In this case, compared to the known technology, the electro-optical device according to the above-described application example suppresses deterioration of display contrast, and provides high display quality. Therefore, the optical unit which includes the electro-optical device according to the above-described application example also provides high display quality.

Application Example 8

[0032] According to this application example, there is provided an electronic apparatus, including: the electro-optical device according to the above-described application example; and the optical unit according to the above-described application example.

[0033] In this case, compared to the known technology, the electro-optical device according to the above-described application example suppresses deterioration of display contrast, and provides high display quality. Furthermore, the optical unit which includes the electro-optical device according to the above-described application example also provides high display quality. Therefore, in the electronic apparatus which includes the electro-optical device according to the above-described application example and the optical unit according to the above-described application example, high display quality is provided.

[0034] For example, by employing the electro-optical device according to the above-described application example in the electronic apparatus, such as a projection type display apparatus, a projection type head-up display (HUD), a direct viewing type head-mounted display (HMD), an electronic book, a personal computer, a digital still camera, a liquid crystal television, a view finder type or a monitor direct viewing type video recorder, a car navigation system, an information terminal apparatus including a POS, and an electronic organizer, it is possible to realize high display quality.

[0035] For example, by employing the optical unit according to the above-described application example in the electronic apparatus, such as the projection type display apparatus, or the projection type head-up display (HUD), it is possible to realize high display quality.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] The invention will be described with reference to the accompanying drawings, wherein like numbers reference like elements.

[0037] FIG. **1** is a schematic view illustrating a configuration of a projection type display apparatus provided with a liquid crystal device.

[0038] FIG. **2** is a schematic plan view illustrating a configuration of the liquid crystal device.

[0039] FIG. **3** is a schematic cross-sectional view of the liquid crystal device along line III-III in FIG. **2**.

[0040] FIG. **4** is an equivalent circuit diagram illustrating an electric configuration of the liquid crystal device.

[0041] FIG. **5** is a schematic plan view illustrating a configuration of an element substrate.

[0042] FIG. **6** is a schematic plan view illustrating a configuration of the element substrate.

[0043] FIG. **7** is a schematic plan view illustrating a configuration of the element substrate.

[0044] FIG. **8** is a schematic plan view illustrating a configuration of the element substrate.

[0045] FIG. **9** is a schematic plan view illustrating a configuration of the element substrate.

[0046] FIG. **10** is a schematic cross-sectional view of the element substrate along line X-X in FIGS. **5** to **9**.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0047] Hereinafter, an embodiment of the invention will be described with reference to the drawings. The embodiment illustrates an aspect of the invention, the invention is not limited thereto, and the embodiment can be arbitrarily changed within a range of a technical concept of the invention. In addition, in each following drawing, in order to make each layer or each part have a certain size to be recognizable on the drawings, a scale of each layer or each part is different from a real scale.

Embodiment

Overview of Projection Type Display Apparatus

[0048] First, a projection type display apparatus which is an example of an “electronic apparatus” in the invention will be described with reference to FIG. **1**. FIG. **1** is a schematic view illustrating a configuration of the projection type display apparatus provided with a liquid crystal device according to the embodiment.

[0049] As illustrated in FIG. **1**, a projection type display apparatus **1000** is configured of a polarization lighting device **1100** which is disposed along a system optical axis L, an optical unit **1200**, and a projection optical system (projection lens **1300**).

[0050] The polarization lighting device **1100** is schematically configured of a lamp unit **1101** as a light source which is made of white light source, such as a ultrahigh pressure mercury lamp or a halogen lamp, an integrator lens **1102**, and a polarization conversion element **1103**.

[0051] The optical unit **1200** is provided with two dichroic mirrors **1104** and **1105** as light separating elements, three reflecting mirrors **1106**, **1107**, and **1108**, five relay lenses **1201**, **1202**, **1203**, **1204**, and **1205**, three transmission type liquid crystal light valves **1210**, **1220**, and **1230**, and a cross dichroic prism **1206**.

[0052] The dichroic mirror **1104** reflects red light (R), and makes green light (G) and blue light (B) transmit, among polarization luminous fluxes emitted from the polarization lighting device **1100**. The other dichroic mirror **1105** reflects the green light (G) which is transmitted by the dichroic mirror **1104** and makes the blue light (b) transmit.

[0053] The red light (R) which is reflected by the dichroic mirror **1104** is incident on the liquid crystal light valve **1210** via the relay lens **1205** after being reflected by the reflecting mirror **1106**. The green light (G) which is reflected by the dichroic mirror **1105** is incident on the liquid crystal light valve **1220** via the relay lens **1204**. The blue light (B) which is transmitted by the dichroic mirror **1105** is incident on the liquid crystal light valve **1230** via a light guiding system which is made of three relay lenses **1201**, **1202**, and **1203**, and two reflecting mirrors **1107** and **1108**.

[0054] The liquid crystal light valves **1210**, **1220**, and **1230** are respectively disposed to oppose incident surfaces of each color light of the cross dichroic prism **1206**. The color light which is incident on the liquid crystal light valves **1210**, **1220**, and **1230**, is modulated based on image information (image signal) and is emitted toward the cross dichroic prism **1206**.

[0055] The liquid crystal light valve **1210** is configured of a liquid crystal device **1**, and a pair of polarizing elements **1***a* and **1***b* which is disposed in a cross-nicol state on an incidence side and an emitting side of the color light (red light). The liquid crystal device **1** is disposed with a void (interval) between the polarizing element **1***a* which is disposed on the incidence side of the color light, and the polarizing element **1***b* which is disposed on the emitting side of the color light. Other liquid crystal light valves **1220** and **1230** also have a similar configuration.

[0056] In addition, the liquid crystal device **1** is an example of an "electro-optical device" in the invention. The polarizing element **1***a* is an example of a "first polarizing element" in the invention, and the polarizing element **1***b* is an example of a "second polarizing element" in the invention. A polarizing direction of the polarizing element **1***a* which is disposed on the incidence side of the color light is an example of a "first direction" in the invention. A polarizing direction of the polarizing element **1***b* which is disposed on the emitting side of the color light is an example of a "second direction" in the invention.

[0057] The cross dichroic prism **1206** has four rectangular prisms stuck thereto, and a dielectric multilayer film which reflects the red light and a dielectric multilayer film which reflects the blue light are formed in a cross shape on the inner surface thereof. The three rays of color light are synthesized by these dielectric multilayer films, and light which shows a color image is synthesized.

[0058] In addition, the cross dichroic prism **1206** is an example of a "light synthesizing optical system" in the invention.

[0059] The light (image light) which is synthesized by the cross dichroic prism **1206** is projected onto a screen **1400** by a projection lens **1300** which is a projection optical system, and the image is enlarged and displayed.

Overview of Liquid Crystal Device

[0060] Next, an overview of the liquid crystal device **1** as an optical modulating unit in the projection type display apparatus **1000** will be described.

[0061] FIG. **2** is a schematic plan view illustrating a configuration of the liquid crystal device. FIG. **3** is a schematic cross-sectional view of the liquid crystal device along line III-III in FIG. **2**. FIG. **4** is an equivalent circuit diagram illustrating an electric configuration of the liquid crystal device.

[0062] As illustrated in FIGS. **2** and **3**, the liquid crystal device **1** includes an element substrate **10** and an opposing substrate **20** which are disposed to oppose each other, and a liquid crystal layer **15** which is pinched by this pair of substrates. In a first base member **11** which is a base member that constitutes the element substrate **10**, and in a second base member **21** which is a base member that constitutes the opposing substrate **20**, a transparent substrate, such as a glass substrate or a quartz substrate, is used.

[0063] In addition, the first base member **11** is an example of the "substrate" in the invention.

[0064] In the above-described liquid crystal light valves **1210**, **1220**, and **1230** (refer to FIG. **1**), the polarizing element **1***a* which is disposed on the incidence side of the color light is disposed on the opposing substrate **20** side, and the polarizing element **1***b* which is disposed on the emitting side of the color light is disposed on the element substrate **10** side. In other words, the light (color light which is separated by the dichroic mirror **1104**) emitted from the polarization lighting device **1100** is incident on the opposing substrate **20** side, is modulated by a liquid crystal layer **15**, and is emitted from the element substrate **10** side.

[0065] The element substrate **10** is larger than the opposing substrate **20**. Both substrates are adhered to each other via a sealing material **14** which is disposed along an outer circumference of the opposing substrate **20**. A liquid crystal which has positive or negative dielectric anisotropy is sealed to a void between the element substrate **10** and the opposing substrate **20**, and the liquid crystal layer **15** is formed. The sealing material **14** uses an epoxy resin or the like which has thermosetting properties or ultraviolet curing properties as an adhesive. In the sealing material **14**, a spacer (not illustrated) for holding the interval between the element substrate **10** and the opposing substrate **20** constantly is mixed.

[0066] On the inner side of the sealing material **14**, a display region E, in which a plurality of pixels P is aligned, is provided. In addition to the plurality of pixels P which contributes to displaying, the display region E may include dummy pixels which are disposed to surround the plurality of pixels P.

[0067] Between the sealing material **14** which is along one-side portion of the element substrate **10** and the one-side portion, a signal line driving circuit **22** is provided. In addition, between the sealing material **14** along the other one-side portion which opposes the one-side portion and the display region E, an inspection circuit **25** is provided. Furthermore, between the sealing material **14** along the other two-side portions which are perpendicular to the one-side portion and oppose each other and the display region E, the scanning line driving circuit **24** is provided. Between the sealing material **14** along the other one-side portion which opposes the one-side portion and the inspection circuit **25**, a plurality of wirings **29** which links two scanning line driving circuits **24** to each other is provided.

[0068] On the opposing substrate **20**, on the inner side of the frame-shaped sealing material **14**, light shielding portions **18** (corner portion) having the same frame shape are provided. For example, the light shielding portion **18** is made of metal or metal oxide which has light shielding properties, and the inner side of the light shielding portion **18** is made of the display region E having the plurality of pixels P.

[0069] The wiring which links the signal line driving circuit **22** and the scanning line driving circuit **24** to each other is connected to a plurality of external connection terminals **61** which is aligned along the one-side portion.

[0070] Hereinafter, a direction along the one-side portion is considered as an X direction, and a direction along the other two-side portions which are perpendicular to the one-side portion and oppose each other is considered as a Y direction.

[0071] In addition, the X direction is the polarizing direction of the polarizing element **1***a* (refer to FIG. **1**) which is disposed on the incidence side of the color light, and is an example of a "first direction" in the invention. The Y direction is the polarizing direction of the polarizing element **1***b* (refer to FIG. **1**) which is disposed on the emitting side of the color light, and is an example of a "second direction" in the invention.

[0072] As illustrated in FIG. **3**, on a front surface on the liquid crystal layer **15** side of the first base member **11**, a pixel electrode **27** and a TFT **30** having light transmission properties which are provided in each pixel P, a signal wiring, and a first orientation film **28** which covers these members, are formed. In other words, the pixel electrode **27** and the TFT **30** are disposed in the display region E.

[0073] In addition, the TFT **30** is an example of the "pixel switching element" in the invention.

[0074] On a front surface on the liquid crystal layer **15** side of the second base member **21**, the light shielding portion **18**, a planarization layer **33** which is formed to cover the light shielding portion **18**, a common electrode **31** which is provided to cover the planarization layer **33**, and a second orientation film **32** which covers the common electrode **31**, are provided.

[0075] As illustrated in FIG. **2**, the light shielding portion **18** is provided at a position for surrounding the display region E, and being overlapped with the scanning line driving circuit **24** and the inspection circuit **25** in a plan view. Accordingly, a function of shielding the light which is incident on a peripheral circuit including the driving circuit from the opposing substrate **20** side, and preventing a malfunction of the peripheral circuit due to the light, is achieved. Furthermore, the light shielding portion **18** blocks unnecessary stray light not to be incident on the display region E, and realizes high contrast in the display of the display region E.

[0076] The planarization layer **33** is made of an inorganic material, such as silicon oxide, has light transmission properties, and is provided to cover the light shielding portion **18**.

[0077] The common electrode **31** is made of a transparent conducting film, such as indium tin oxide (ITO), covers the planarization layer **33**, and is electrically connected to the wiring on the element substrate **10** side by a vertical conduction portion **26** provided at four corners of the opposing substrate **20** as illustrated in FIG. **2**.

[0078] The first orientation film **28** which covers the pixel electrode **27** and the second orientation film **32** which covers the common electrode **31** are selected based on an optical design of the liquid crystal device **1**. Examples of the orientation films include an organic orientation film which is formed of an organic material, such as polyimide, and is substantially and horizontally orientation-processed with respect to a liquid crystal particle having positive dielectric anisotropy by rubbing the front surface, or an inorganic orientation film which is formed of an inorganic material, such as silicon oxide, by using a vapor growth method, and is substantially and vertically orientated with respect to the liquid crystal particle having negative dielectric anisotropy.

[0079] In addition, in the embodiment, the above-described inorganic orientation film is used as the first orientation film **28** and the second orientation film **32**.

[0080] The liquid crystal device **1** is a transmission type, and uses an optical design of a normally white mode which displays brightness when the pixels P are not driving, or a normally black mode which displays darkness when the pixels P are not driving. In addition, in the embodiment, the normally black mode is used.

[0081] As illustrated in FIG. **4**, the liquid crystal device **1** includes a plurality of scanning lines **3** and a plurality of signal lines **4** which are insulated from each other and intersect each other at least in the display region E, a first wiring **6** which is provided in an extending direction of the signal lines **4**, and a second wiring **7** which is provided in an extending direction of scanning lines **3**. A direction in which the scanning lines **3** and the second wiring **7** extend is the X direction, and a direction in which the signal lines **4** and the first wiring **6** extend is the Y direction.

[0082] In addition, the first wiring **6** is an example of a "first light shielding film" in the invention, and the second wiring **7** is an example of a "second light shielding film" in the invention.

[0083] In a region which is divided by the scanning line **3** and the signal line **4**, the pixel electrode **27**, the TFT **30**, and a capacitor element **16**, are provided, and these members constitute a pixel circuit of the pixels P.

[0084] The scanning line **3** is electrically connected to a gate of the TFT **30**, and the signal line **4** is electrically connected to a signal line side source-drain region (source region) of the TFT **30**. The pixel electrode **27** is electrically connected to the pixel electrode side source-drain region (drain region) of the TFT **30**.

[0085] The signal line **4** is connected to the signal line driving circuit **22** (refer to FIG. **2**), and supplies image signals D1, D2, . . . , and Dn which are supplied from the signal line driving circuit **22** to each pixel P. The scanning line **3** is connected to the scanning line driving circuit **24** (refer to FIG.

1), and supplies scanning signals SC**1**, SC**2**, . . . , and SCm which are supplied from the scanning line driving circuit **24** to each pixel P.

[0086] The image signals D**1** to Dn which are supplied from the signal line driving circuit **22** to the signal line **4** may be line-sequentially supplied in this order, and may be supplied to each group with respect to the plurality of signal lines **4** which are adjacent to each other. The scanning line driving circuit **24** line-sequentially supplies the scanning signals SC**1** to SCm at a predetermined timing like a pulse, with respect to the scanning line **3**.

[0087] The liquid crystal device **1** has a configuration in which the image signals D**1** to Dn which are supplied from the signal line **4** are written into the pixel electrode **27** at a timing when the TFT **30** which is a switching element is in an ON state for a certain period by inputting the scanning signals SC**1** to SCm. The image signals D**1** to Dn having a predetermined level which are written into the liquid crystal layer **15** via the pixel electrode **27** are held for a certain period between the pixel electrode **27** and the common electrode **31**.

[0088] The capacitor element **16** is provided between the pixel electrode side source-drain region of the TFT **30** and the first wiring **6**, and the same potential (LCCOM potential) as that of the common electrode **31** is supplied to the first wiring **6**. In other words, the capacitor element **16** is connected in parallel to a liquid crystal capacitor which is formed between the pixel electrode **27** and the common electrode **31**, and a leakage of the image signals D**1** to Dn which is held between the pixel electrode **27** and the common electrode **31** is suppressed.

[0089] The first wiring **6** and the second wiring **7** are electrically connected to each other at a part where both wirings intersect each other, and the fixed potential (LCCOM potential) is supplied. In other words, the first wiring **6** and the second wiring **7** are wirings to which the fixed potential is supplied.

[0090] The LCCOM potential is supplied to the common electrode **31**, the first wiring **6**, and the second wiring **7**. In other words, since the wiring to which the LCCOM potential is supplied is configured of the common electrode **31**, the first wiring **6**, and the second wiring **7**, for example, compared to a case where the wiring is configured only of the common electrode **31**, a time constant of the wiring to which the LCCOM potential is supplied becomes smaller, responsiveness of the wiring to which the LCCOM potential is supplied becomes more excellent, and writing-in properties are improved. As the wiring-in properties are improved, a crosstalk or the like is reduced, and display quality is improved.

Overview of Element Substrate (Configuration in a Plan View)

[0091] FIGS. **5** to **9** are schematic plan views illustrating a configuration of the element substrate. FIG. **10** is a schematic cross-sectional view of the element substrate along line X-X in FIGS. **5** to **9**.

[0092] FIG. **5** illustrates a state from the scanning line **3** to a gate electrode **30***g*. FIG. **6** illustrates a state from a first capacitor electrode **16***a* to a second capacitor electrode **16***c*. FIG. **7** illustrates a state from a third capacitor electrode **16***e* to the signal line **4**. FIG. **8** is a state from the first wiring **6** to the second wiring **7**. FIG. **9** illustrates a state of the pixel electrode **27**.

[0093] In FIGS. **5** to **9**, in order to make it easy to understand a position of forming of constituent elements of the element substrate **10**, a semiconductor layer **30***a* is illustrated.

[0094] Furthermore, FIGS. **5** to **9** illustrate a light shielding region V**1** by a two-dot chain line. Although this will be describe in detail later, the light shielding region V**1** is formed of the constituent elements (scanning line **3**, signal line **4**, first wiring **6**, second wiring **7**, and third capacitor electrode **16***e*) of the element substrate **10** which is configured of a conductive material having light shielding properties. In other words, a part where the constituent elements of the element substrate **10** which is configured of the conductive material having light shielding properties is overlapped in a plan view, is the light shielding region V**1**.

[0095] A region which is surrounded by the light shielding region V**1** is a light transmitting region V**2** which transmits the light. For this reason, the light transmitting region V**2** is defined by an outer edge V**1**A, an outer edge V**1**B, an outer edge V**1**C, and an outer edge V**1**D of the light shielding region V**1**.

[0096] In addition, the light transmitting region V**2** is an example of a "pixel opening portion" in the invention. Hereinafter, the outer edge V**1**A, the outer edge V**1**B, the outer edge V**1**C, and the outer edge V**1**D of the light shielding region V**1** is referred to as a side V**1**A, a side V**1**B, a side V**1**C, and a side V**1**D.

[0097] Hereinafter, a configuration of the element substrate **10** in a plan view will be described with reference to FIGS. **5** to **9**.

[0098] As illustrated in FIG. **5**, the scanning line **3** is provided to extend in the X direction. The scanning line **3** has an overhung part in the Y direction. The scanning line **3** is configured of the conductive material having light shielding properties, such as a metal simple substance including at least one of metals having a high melting point, for example, titanium, chrome, tungsten, tantalum, or molybdenum, a metal silicide, a polysilicide, a nitride, or a material in which these materials are layered, and makes up a part of the light shielding region V**1**.

[0099] Along the overhung part of the scanning line **3** in the Y direction, the semiconductor layer **30***a* is provided. The semiconductor layer **30***a* includes a signal line side source-drain region **30***s* (high concentration impurities region), a pixel electrode side source-drain region **30***d* (high concentration impurities region), and a channel region **30***c*. Although not illustrated in the drawing, the low concentration impurities region (LDD region) is formed between the signal line side source-drain region **30***s* and the channel region **30***c* and between the pixel electrode side source-drain region **30***d* and the channel region **30***c*.

[0100] The gate electrode **30***g* which extends in the X direction is provided to nip the semiconductor layer **30***a* and oppose the scanning line **3**. The gate electrode **30***g* is configured of, for example, a polycrystal silicon, and is provided to be overlapped with the scanning line **3** in a plan view. The semiconductor layer **30***a* of the part which is overlapped with the gate electrode **30***g* in a plan view is the channel region **30***c*.

[0101] The gate electrode **30***g* is electrically connected to the scanning line **3** via contact holes CNT**51** and CNT**52**. As the gate electrode **30***g* functions as a second scanning line, and as a redundant configuration is employed by the scanning line **3** and the gate electrode **30***g*, disconnection of wiring is prevented.

[0102] As the scanning line **3** is formed to be wider than the semiconductor layer **30***a*, light in a direction toward the opposing substrate **20** from the element substrate **10**, for example, reflected light of the light toward the element substrate **10** from the opposing substrate **20** is unlikely to be incident on the channel region **30***c* of the semiconductor layer **30***a*, and an optical malfunction of the TFT **30** is suppressed.

[0103] All of the scanning line **3**, the semiconductor layer **30***a*, and the gate electrode **30***g* which are described above are disposed on an inner side of the light shielding region V**1**, and all of a corner portion of the scanning line **3**, a corner portion of the semiconductor layer **30***a*, and a corner portion of the gate electrode **30***g* are hidden (covered) by the light shielding region V**1**.

[0104] As illustrated in FIG. **6**, at the part where the TFT **30** is formed, the island-shaped first capacitor electrode **16***a*, a first dielectric layer **16***b* (refer to FIG. **10**), and the island-shaped second capacitor electrode **16***c* (first conductive layer **16***c***1**, and second conductive layer **16***c***2**) are layered in order.

[0105] The first capacitor electrode **16***a* and the second capacitor electrode **16***c* are configured of, for example, a polycrystal silicon film.

[0106] An outer edge of the first capacitor electrode **16***a* is covered with a first insulating film CAPA**41***a* which is made of an etching stopper when the second capacitor electrode **16***c* is formed (refer to FIG. **10**). In FIG. **6**, an outer edge (outline) of the first insulating film CAPA**41***a* is illustrated by a dashed line, and a region which is surrounded by the dashed line is an opening region in which the first insulating film CAPA**41***a* is not formed.

[0107] At a part which is illustrated by an arrow which is given a reference numeral B, the first capacitor electrode **16***a* is overhung from the second capacitor electrode **16***c*. In the first capacitor electrode **16***a* of the overhung part, the opening region of the first insulating film CAPA**41***a* which is surrounded by the dashed line having a square shape is formed. The opening region of the first insulating film CAPA**41***a* is a contact hole CNT**54** (refer to FIG. **7**) which will be described later.

[0108] The second capacitor electrode **16***c* includes a two-layered structure which is made of the first conductive layer **16***c***1** and the second conductive layer **16***c***2** which are layered in order from the first base member **11** side (refer to FIG. **10**). The second conductive layer **16***c***2** in the second capacitor electrode **16***c* is overhung from the first conductive layer **16***c***1**, and is provided up to a region which is overlapped with the pixel electrode side source-drain region **30***d* of the semiconductor layer **30***a* in a plan view. In the region, the second conductive layer **16***c***2** is electrically connected to the pixel electrode side source-drain region **30***d* of the semiconductor layer **30***a* via a contact hole CNT**53**.

[0109] All of the first capacitor electrode **16***a* and the second capacitor electrode **16***c* (first conductive layer **16***c***1** and second conductive layer **16***c***2**) are disposed on the inner side of the light shielding region V**1**, and all of a corner portion of the first capacitor electrode **16***a* and a corner portion of the second capacitor electrode **16***c* are hidden (covered) by the light shielding region V**1**.

[0110] As illustrated in FIG. **7**, on the second capacitor electrode **16***c* (refer to FIG. **6**), a second dielectric layer **16***d* (refer to FIG. **10**) and the third capacitor electrode **16***e* are layered in order. The third capacitor electrode **16***e* is configured of, for example, the conductive material having light shielding properties, such as tungsten silicide, is provided in an island shape to be overlapped with the first capacitor electrode **16***a* in a substantial plan view, and makes up a part of the light shielding region V**1**.

[0111] Furthermore, on the third capacitor electrode **16***e*, the signal line **4** which extends in the Y direction is provided. The signal line **4** is configured of aluminum or the conductive material having light shielding properties including aluminum, and makes up a part of the light shielding region V**1**. The signal line **4** is provided to cover the semiconductor layer **30***a*, and is electrically connected to the signal line side source-drain region **30***s* of the semiconductor layer **30***a* via a contact hole CNT**60**.

[0112] Along the part which extends in the X direction of the light shielding region V**1**, a first relay electrode **42** and a second relay electrode **43** are respectively provided in an island shape. The first relay electrode **42** and the second relay electrode **43** are disposed nipping the signal line **4**, and are formed of the same material as that of the signal line **4**. In other words, the first relay electrode **42** and the second relay electrode **43** also make up a part of the light shielding region V**1**.

[0113] Furthermore, the contact hole CNT**54** which is partially overlapped with the first relay electrode **42** is provided, and a contact hole CNT**56** which is overlapped with the second relay electrode **43** is provided. The second relay electrode **43** is electrically connected to the second conductive layer **16***c***2** (second capacitor electrode **16***c*) via the contact hole CNT**56**.

[0114] The third capacitor electrode **16***e*, the signal line **4**, the first relay electrode **42**, and the second relay electrode **43** which are described above, are disposed on the inner side of the light shielding region V**1**, and all of a corner portion of the third capacitor electrode **16***e*, a corner portion of the first relay electrode **42**, and a corner portion of the second relay electrode **43** are hidden (covered) by the light shielding region V**1**.

[0115] As illustrated in FIG. **8**, the first wiring **6** is provided to cover the signal line **4** in the Y direction. The first wiring **6** includes an overhung part in the X direction, and is provided with a contact hole CNT**58** at the overhung part in the X direction. The first wiring **6** is electrically connected to the first relay electrode **42** via the contact hole CNT**58**.

[0116] Between the first wiring **6** and the adjacent first wiring **6**, an island-shaped third relay electrode **44** which is long in the X direction is provided. The third relay electrode **44** is electrically connected to the second relay electrode **43** via a contact hole CNT**57**.

[0117] The first wiring **6** and the third relay electrode **44** are provided on the same layer, is configured of aluminum or the conductive material having light shielding properties including aluminum, and makes up a part of the light shielding region V**1**. In other words, the first wiring **6** and the third relay electrode **44** are formed of the same material as each other in the same process.

[0118] In addition, the third relay electrode **44** is an example of a "first conducting film having light shielding properties" in the invention.

[0119] The second wiring **7** is provided along the X direction, and is provided with a contact hole CNT**61** at a part where the second wiring **7** and the first wiring **6** are overlapped with each other. The second wiring **7** is electrically connected to the first wiring **6** via the contact hole CNT**61**.

[0120] An island-shaped fourth relay electrode **45** which is long in the X direction is provided to oppose the second wiring **7**. A contact hole CNT**59** is provided at a part where the fourth relay electrode **45** and the third relay electrode **44** are overlapped with each other. The fourth relay electrode **45** is electrically connected to the third relay electrode **44** via the contact hole CNT**59**.

[0121] The second wiring **7** and the fourth relay electrode **45** are provided on the same layer, are configured of aluminum or the conductive material having light shielding properties including aluminum, and make up a part of the light shielding region V**1**. In other words, the second wiring **7** and the fourth relay electrode **45** are formed of the same material as each other in the same process.

[0122] In addition, the fourth relay electrode **45** is an example of a "second conducting film having light shielding properties" in the invention.

[0123] In addition, in the light shielding region V**1**, since a part which is not covered with the first wiring **6**, the second wiring **7**, the third relay electrode **44**, and the fourth relay electrode **45**, is covered (hidden) with other light shielding films (scanning line **3**, signal line **4**, and third capacitor electrode **16***e*), light leakage does not occur.

[0124] Furthermore, the first wiring **6**, the second wiring **7**, and the fourth relay electrode **45** forms an outer edge of the light shielding region V**1**. Specifically, an outer edge which is long in the X direction of the fourth relay electrode **45** is the side VIA which defines the light transmitting region V**2**. An outer edge along the Y direction of the first wiring **6** is the side V1B and the side V1D which define the light transmitting region V**2**. An outer edge along the X direction of the second wiring **7** is the side V1C which defines the light transmitting region V**2**.

[0125] Any of the sides V**1**A, V**1**B, V**1**C, and V**1**D of the light shielding region V**1**, which are formed of the first wiring **6**, the second wiring **7**, and the fourth relay electrode **45**, make a straight line, and are disposed along the X direction or the Y direction, that is, are disposed along the polarizing direction of the polarizing element **1***a* (refer to FIG. **1**) or the polarizing direction of the polarizing element **1***b* (refer to FIG. **1**).

[0126] The light transmitting region V**2** is defined by the outer edge (side V**1**B, side V**1**D) along the Y direction of the first wiring **6**, the outer edge (V**1**C) along the X direction of the second wiring **7**, and the outer edge (side V**1**A) which is long in the X direction of the fourth relay electrode **45**. In other words, the light transmitting region V**2** is defined by the sides V**1**A and V**1**C along the polarizing direction of the polarizing element **1***a* which is disposed on the incidence side of the color light, and by the sides V**1**B and V**1**D along the polarizing direction of the polarizing element **1***b* which is disposed on the emitting side of the color light. Therefore, the sides V**1**A, V**1**B, V**1**C, and V**1**D of the light shielding region V**1** which define the light transmitting region V**2** do not include a part which intersects both the polarizing direction of the polarizing element **1***a* and the polarizing direction of the polarizing element **1***b*.

[0127] If the sides of the light shielding region V**1** which define the light transmitting region V**2** include the part which intersects the polarizing direction of the polarizing element **1***a* and the polarizing direction of the polarizing element **1***b*, by the part which intersects the polarizing directions, a part of the light which transmits the light transmitting region V**2** is polarized in a direction which is different from a direction in which the light is originally to be polarized, the polarization state changes, and a defect of deterioration of display contrast due to the leakage light is generated.

[0128] In the embodiment, since the sides of the light shielding region V**1** which define the light transmitting region V**2** do not include the part which intersects the polarizing direction of the polarizing element **1***a* and the polarizing direction of the polarizing element **1***b*, the polarization state of the light which transmits the light transmitting region V**2** does not change, and a defect of deterioration of display contrast is suppressed.

[0129] In addition, a corner portion of the first wiring **6** which is illustrated by an arrow is covered (hidden) with the second wiring **7** and the fourth relay electrode **45**. Furthermore, a corner portion of the third relay electrode **44** which is illustrated by an arrow is covered (hidden) with the second wiring **7** and the fourth relay electrode **45**. Furthermore, a corner portion of the fourth relay electrode **45** which is illustrated by an arrow is covered (hidden) with the first wiring **6**.

[0130] The corner portion of the first wiring **6**, the corner portion of the third relay electrode **44**, and the corner portion of the fourth relay electrode **45** are formed by patterning by using a photolithography process method and a dry etching method which are known technologies, after forming a film by aluminum or the material including aluminum by a sputtering method which is a known technology. In the photolithography process method which is the known technology, it is difficult to form the corner portion in a rectangular shape and a round shape (roundness) is formed in the corner portion. Accordingly, the corner portion illustrated by the arrow has a round shape (roundness) without a rectangular shape. Therefore, the corner portion of the first wiring **6** illustrated by the arrow, the corner portion of the third relay electrode **44** illustrated by the arrow, and the corner portion of the fourth relay electrode **45** illustrated by the arrow, include the part which intersects the polarizing direction of the polarizing element **1***a* and the polarizing direction of the polarizing element **1***b*.

[0131] If the corner portion of the first wiring **6**, the corner portion of the third relay electrode **44**, and the corner portion of the fourth relay electrode **45** are not hidden by the light shielding film, the part which intersects the polarizing direction of the polarizing element **1***a* and the polarizing direction of the polarizing element **1***b* is exposed, and by the part which intersects the polarizing directions, a part of the light which transmits the light transmitting region V**2** is polarized in the direction which is different from the direction in which the light is originally to be polarized, the polarization state changes, and a defect of deterioration of display contrast due to the leakage light is generated.

[0132] In the embodiment, since all of the corner portion of the first wiring **6**, the corner portion of the third relay electrode **44**, and the corner portion of the fourth relay electrode **45** are hidden by the light shielding region V**1**, the polarization state of the light which transmits the light transmitting region V**2** does not change, and deterioration of display contrast is suppressed.

[0133] As described above, all of the corner portion of the scanning line **3**, the corner portion of the semiconductor layer **30***a*, and the corner portion of the gate electrode **30***g* are hidden by the light shielding region V**1** (refer to FIG. **5**). All of the corner portion of the first capacitor electrode **16***a* and the corner portion of the second capacitor electrode **16***c* are hidden by the light shielding region V**1** (refer to FIG. **6**). All of the corner portion of the third capacitor electrode **16***e*, the corner portion of the first relay electrode **42**, and the corner portion of the second relay electrode **43** are hidden by the light shielding region V**1** (refer to FIG. **7**). Therefore, when these corner portions are exposed, the polarization state of the light which transmits the light transmitting region V2 changes, and it is possible to suppress a defect of deterioration of display contrast.

[0134] As illustrated in FIG. **9**, the pixel electrode **27** is provided in an island shape to cover the light transmitting region V**2**. In other words, a circumferential edge portion of the pixel electrode **27** is provided to be overlapped with the light shielding region V**1** in a plan view. A contact hole CNT**62** is provided at a part where the pixel electrode **27** and the light shielding region V**1** (fourth relay electrode **45**) are overlapped with each other. The pixel electrode **27** is connected to the fourth relay electrode **45** via the contact hole CNT**62**.

[0135] In other words, the pixel electrode **27** is electrically connected to the pixel electrode side source-drain region **30***d* of the semiconductor layer **30***a* via the contact hole CNT**62**, the fourth relay electrode **45**, the contact hole CNT**59**, the third relay electrode **44**, the contact hole CNT**57**, the second relay electrode **43**, the contact hole CNT**56**, the second conductive layer **16***c***2** (second capacitor electrode **16***c*), and a contact hole CNT**53**.

Overview (Cross-Sectional Structure) of Element Substrate

[0136] Next, a cross-sectional structure of the element substrate **10** will be described with reference to FIG. **10**.

[0137] As illustrated in FIG. **10**, the scanning line **3** is provided on the first base member **11**. For example, an underlying insulating film **11***a* which is made of silicon oxide or the like is provided to cover the first base member **11** and the scanning line **3**. The island-shaped semiconductor layer **30***a* is provided on the underlying insulating film **11***a*.

[0138] The semiconductor layer **30***a* is made of, for example, a polycrystal silicon, and is formed of an LDD region (not illustrated) into which impurity ion is injected, the signal line side source-drain region **30***s*, the channel region **30***c*, the pixel electrode side source-drain region **30***d*, or the like.

[0139] A first interlayer insulating layer (gate insulating layer) **11***b* is formed to cover the semiconductor layer **30***a* and the underlying insulating film **11***a*. The first interlayer insulating layer **11***b* is configured of silicon oxide or the like. Furthermore, the gate electrode **30***g* is provided at a position where the gate electrode **30***g* nips the first interlayer insulating layer **11***b* and opposes the channel region **30***c* of the semiconductor layer **30***a*.

[0140] A second interlayer insulating layer **11***c* is provided to cover the gate electrode **30***g* and the first interlayer insulating layer **11***b*. The second interlayer insulating layer **11***c* is configured of the silicon oxide or the like. On the second interlayer insulating layer **11***c*, the first capacitor electrode **16***a*, the first dielectric layer **16***b*, and the first conductive layer **16***c***1** (second capacitor electrode **16***c*) are layered in order, and a first capacitor element **116** is formed.

[0141] Although this will be described later, the first capacitor electrode **16***a* is electrically connected to the first wiring **6**, and the LCCOM potential (fixed potential) is supplied.

[0142] The first dielectric layer **16***b* is configured of a single layer film which is made of silicon nitride or silicon oxide, and a multi-layer film which includes the single layer films. On the first dielectric layer **16***b*, the island-shaped first conductive layer **16***c***1** (second capacitor electrode **16***c*) is provided.

[0143] As described above, the second capacitor electrode **16***c* is configured of a two-layered polycrystal silicon film, and includes the first conductive layer **16***c***1** which is formed by patterning on the TFT **30** side, and the second conductive layer **16***c***2** which is formed by patterning on the pixel electrode **27** side. The second capacitor electrode **16***c* is electrically connected to the pixel electrode side source-drain region **30***d* of the semiconductor layer **30***a* via the contact hole CNT**53** (refer to FIG. **6**). Furthermore, the second capacitor electrode **16***c* is electrically connected to the pixel electrode **27** via the contact hole CNT**56** (refer to FIG. **7**), the second relay electrode **43**, the contact hole CNT**57** (refer to FIG. **8**), the third relay electrode **44**, and the contact hole CNT**59** (refer to FIG. **8**), the fourth relay electrode **45**, and the contact hole CNT**62** (refer to FIG. **9**). In other words, the second capacitor electrode **16***c* is a pixel potential side capacitor electrode which is electrically connected to the pixel electrode side source-drain region **30***d* of the semiconductor layer **30***a* and the pixel electrode **27**.

[0144] The first insulating film CAPA**41***a* is formed to cover a circumferential edge portion of the first capacitor electrode **16***a*, and a second insulating film CAPA**41***b* is formed to cover a circumferential edge portion of the second capacitor electrode **16***c*. In other words, the first insulating film CAPA**41***a* is formed between the first capacitor electrode **16***a* and the first dielectric layer **16***b* to cover the circumferential edge portion of the first capacitor electrode **16***a*. The second insulating film CAPA**41***b* is formed between the second conductive layer **16***c***2** and the second dielectric layer **16***d* to cover the circumferential edge portion of the second conductive layer **16***c***2**.

[0145] The first insulating film CAPA**41***a* prevents each electrical short between an end surface of the first capacitor electrode **16***a* and an end surface of the second capacitor electrode **16***c*, and is an etching stopper when forming the second capacitor electrode **16***c* by dry etching or the like. The second insulating film CAPA**41***b* prevents each electrical short between the end surface of the second capacitor electrode **16***c* and an end surface of the third capacitor electrode **16***e*, and is an etching stopper when forming the third capacitor electrode **16***e* by dry etching or the like. In addition, an opening portion of the first insulating film CAPA**41***a* provided on the first capacitor electrode **16***a* and an opening portion of the second insulating film CAPA**41***b* provided on the second capacitor electrode **16***c*, are overlapped with each other in a plan view, and have substantially the same shape.

[0146] On the second capacitor electrode **16***c*, the second dielectric layer **16***d* and the third capacitor electrode **16***e* are layered in order, and the second accommodation portion **216** is formed. Similarly to the first dielectric layer **16***b*, the second dielectric layer **16***d* is configured of a single layer film which is made of silicon oxide or silicon nitride, and a multi-layer film which includes the single layer films.

[0147] In a region F which is surrounded by a dashed line, the outer edge (end surface) of the first capacitor electrode **16***a* is overhung from the outer edge (end surface) of the second capacitor electrode **16***c*, and the outer edge (end surface) of the third capacitor electrode **16***e* is disposed between the outer edge (end surface) of the first capacitor electrode **16***a* and the outer edge (end surface) of the second capacitor electrode **16***c*. Furthermore, the contact hole CNT**54** which penetrates the first insulating film CAPA**41***a*, the second insulating film CAPA**41***b*, and the third interlayer insulating layer **11***d*, to expose a part of the first capacitor electrode **16***a* and a part of the third capacitor electrode **16***e*. In other words, the contact hole CNT**54** which exposes the first capacitor electrode **16***a* and the third capacitor electrode **16***e* is provided in the region F.

[0148] In addition, since the second insulating film CAPA**41***b* is disposed between the contact hole CNT**54** and the second capacitor electrode **16***c*, the second capacitor electrode **16***c* is electrically separated from the first capacitor electrode **16***a* and the third capacitor electrode **16***e*.

[0149] Furthermore, the contact hole CNT**54** is covered with the first relay electrode **42**. As a result, the first capacitor electrode **16***a* and the third capacitor electrode **16***e* are in contact with the first relay electrode **42** inside the contact hole CNT**54**, and are electrically connected to each other by the first relay electrode **42**.

[0150] As described above, since the first relay electrode **42** is electrically connected to the first wiring **6** via the contact hole CNT**58** (refer to FIG. **8**), the first capacitor electrode **16***a* and the third capacitor electrode **16***e* are electrically connected to the first wiring **6** via the contact hole CNT**54**, the first relay electrode **42**, and the contact hole CNT**58** (refer to FIG. **8**), and the same potential as that of the first wiring **6**, that is, the LCCOM potential (fixed potential) is supplied.

[0151] In other words, the first capacitor electrode **16***a* is a fixed potential side capacitor electrode in the first capacitor element **116**, and the third capacitor electrode **16***e* is a fixed potential side capacitor electrode in the second accommodation portion **216**.

[0152] In this manner, in the embodiment, by one contact hole (contact hole CNT**54**), the first capacitor electrode **16***a* and the third capacitor electrode **16***e* which are disposed on different layers are electrically connected to each other. As a result, the capacitor element **16** is configured of the first capacitor element **116** and the second accommodation portion **216** which are connected to each other in parallel, and can increase a capacity value per unit area in the pixel P. By increasing the capacity value of the capacitor element **16**, it is possible to improve potential holding properties of the pixel electrode **27**, and to improve display performance by improving contrast and reducing flickers.

[0153] A third interlayer insulating layer **11***d* is layered on the third capacitor electrode **16***e*. The third interlayer insulating layer **11***d* is configured of a film which includes any of silicon oxide, silicon nitride, or silicon oxynitride.

[0154] Furthermore, on the third interlayer insulating layer **11***d*, the signal line **4**, the first relay electrode **42** (refer to FIG. **7**), and the second relay electrode **43** are provided. The signal line **4** is electrically connected to the signal line side source-drain region **30***s* of the semiconductor layer **30***a*, via the contact hole CNT**60** which penetrates the third interlayer insulating layer **11***d*, the second insulating film CAPA**41***b*, the first insulating film CAPA**41***a*, the second interlayer insulating layer **11***c*, and the first interlayer insulating layer **11***b*.

[0155] A fourth interlayer insulating layer **11***e* is provided to cover the signal line **4**, the first relay electrode **42**, and the second relay electrode **43** (refer to FIG. **7**). The fourth interlayer insulating layer **11***e* is configured of a film which includes any of silicon oxide, silicon nitride, or silicon oxynitride.

[0156] On the fourth interlayer insulating layer **11***e*, the first wiring **6** or the third relay electrode **44** are provided. The first wiring **6** is overlapped with the signal line **4** in a plan view, and is formed to be wider than the signal line **4**.

[0157] A fifth interlayer insulating layer **11***f* is provided to cover the first wiring **6** or the third relay electrode **44**. The fifth interlayer insulating layer **11***f* is configured of a film which includes any of silicon oxide, silicon nitride, or silicon oxynitride.

[0158] On the fifth interlayer insulating layer **11***f*, the second wiring **7** and the fourth relay electrode **45** are provided.

[0159] A sixth interlayer insulating layer **11***g* is provided to cover the second wiring **7** and the fourth relay electrode **45**. The sixth interlayer insulating layer **11***g* is configured of a film which includes any of silicon oxide, silicon nitride, or silicon oxynitride.

[0160] On the sixth interlayer insulating layer **11***g*, the pixel electrode **27** which is made of the ITO film or the like is provided by patterning. Furthermore, the pixel electrode **27** is covered with the first orientation film **28**.

[0161] In this manner, the signal line **4** which extends in the Y direction is provided between the TFT **30** and the pixel electrode **27**, the first wiring **6** is disposed on a layer on a side close to the signal line **4** between the signal line **4** and the pixel electrode **27**, and the second wiring **7** is disposed on a layer on a side close to the pixel electrode **27** between the signal line **4** and the pixel electrode **27**.

[0162] In other words, since the first wiring **6** and the second wiring **7** to which the LCCOM potential (fixed potential) is supplied are provided between the pixel electrode **27** and the signal line **4**, influence of the electric field of the signal line **4**, that is, coupling between the signal line **4** and the pixel electrode **27** is reduced, and it is possible to improve display quality.

[0163] Furthermore, the first wiring **6** and the second wiring **7** are disposed nipping the fifth interlayer insulating layer **11***f*. Compared to the known technology (JP-A-2010-160308) in which the two light shielding films which form the light shielding region are disposed to be apart from each other nipping the TFT, since the two light shielding films (first light shielding film and second light shielding film) which form the light shielding region **V1** are disposed to be close to each other, light shielding properties of the light shielding region **V1** is improved, and a concern about generating of light leakage is reduced.

[0164] As described above, in the embodiment, it is possible to achieve the following effects.

[0165] (1) The wiring to which the LCCOM potential is supplied is configured of the common electrode **31**, the first wiring **6**, and the second wiring **7**, and further, the first wiring **6** and the second wiring **7** are configured of aluminum or a low resistance material (light shielding material) which includes aluminum. For this reason, the time constant of the wiring to which the LCCOM potential is supplied becomes smaller, responsiveness of the wiring becomes more excellent, writing-in properties are improved. As the wiring-in properties are improved, a crosstalk or the like is reduced, and display quality is improved.

[0166] (2) The sides **V1A**, **V1B**, **V1C**, and **V1D** of the light shielding region **V1** which define the light transmitting region **V2** are disposed along the polarizing direction of the polarizing element **1***a* and the polarizing direction of the polarizing element **1***b*, and do not include the part which intersects both the polarizing direction of the polarizing element **1***a* and the polarizing direction of the polarizing element **1***b*. For this reason, the polarization state of the light which transmits the light transmitting region **V2** does not change, and a defect of deterioration of display contrast is suppressed.

[0167] (3) All of the corner portion of the first wiring **6**, the corner portion of the third relay electrode **44**, the corner portion of the fourth relay electrode **45**, the corner portion of the scanning line **3**, the corner portion of the semiconductor layer **30***a*, the corner portion of the gate electrode **30***g*, the corner portion of the first capacitor electrode **16***a*, the corner portion of the second capacitor electrode **16***c*, the corner portion of the third capacitor electrode **16***e*, the corner portion of the first relay electrode **42**, and the corner portion of the second relay electrode **43** are hidden by the light shielding region V**1**. Therefore, when these corner portions are exposed, the polarization state of the light which transmits the light transmitting region V**2** changes, and it is possible to suppress a defect of deterioration of display contrast.

[0168] (4) Between the pixel electrode **27** and the signal line **4**, the first wiring **6** and the second wiring **7** to which the LCCOM potential (fixed potential) is supplied is provided. For this reason, influence of the electric field of the signal line **4**, that is, coupling between the signal line **4** and the pixel electrode **27** is reduced, and it is possible to improve display quality.

[0169] (5) Compared to the known technology (JP-A-2010-160308) in which the two light shielding films which form the light shielding region are disposed to be apart from each other nipping the TFT, the two light shielding films (first light shielding film and second light shielding film) which form the light shielding region V**1** are disposed to be close to each other. For this reason, light shielding properties of the light shielding region V**1** is improved, and a concern about light leakage is reduced.

[0170] The invention is not limited to the above-described embodiment, and can be appropriately changed without departing from an idea or a concept of the invention that can be read from the range of claims and the entire specification. A liquid crystal device in accordance with such a change, and an optical unit or an electronic apparatus which has the liquid crystal device mounted thereon, can also be included in the technical range of the invention.

[0171] Various modifications other than the above-described embodiment can be considered. Hereinafter, modification examples will be described.

Modification Example 1

[0172] At least one side among the sides V**1**A, V**1**B, V**1**C, and V**1**D of the light shielding region V**1** which define the light transmitting region V**2** may partially include a concave portion or a convex portion. The sides V**1**A, V**1**B, V**1**C, and V**1**D of the light shielding region V**1** which define the light transmitting region V**2** is included in the technical range in which the invention is employed when these sides can be considered as substantially straight lines.

Modification Example 2

[0173] The outer edges of the constituent elements (scanning line **3**, third capacitor electrode **16***e*, signal line **4**, first relay electrode **42**, second relay electrode **43**, third relay electrode **44**, and fourth relay electrode **45**) which are configured of the conductive material having light shielding properties may include a part which matches the sides V**1**A, V**1**B, V**1**C, and V**1**D of the light shielding region V**1**.

[0174] For example, when the outer edge of the third relay electrode **44** and the outer edge of the fourth relay electrode **45** match each other, both the outer edge of the third relay electrode **44** and the outer edge of the fourth relay electrode **45** are the side V**1**A which defines the light transmitting region V**2**. When the outer edge of the third relay electrode **44** and the outer edge of the second wiring **7** match each other, both the outer edge of the third relay electrode **44** and the outer edge of the second wiring **7** are the side V**1**C which defines the light transmitting region V**2**. In other words, the light transmitting region V**2** is defined by the first wiring **6**, the second wiring **7**, the third relay electrode **44**, and the fourth relay electrode **45**.

Modification Example 3

[0175] Any of the corner portion of the first wiring **6**, the corner portion of the third relay electrode **44**, the corner portion of the fourth relay electrode **45**, the corner portion of the scanning line **3**, the corner portion of the semiconductor layer **30***a*, the corner portion of the gate electrode **30***g*, the corner portion of the first capacitor electrode **16***a*, the corner portion of the second capacitor electrode **16***c*, the corner portion of the third capacitor electrode **16***e*, the corner portion of the first relay electrode **42**, and the corner portion of the second relay electrode **43** may be configured to be partially overhung from the light shielding region V**1**. When it is possible to consider that these corner portions are substantially hidden by the light shielding region V**1**, these corner portions are included in the technical range in which the invention is employed.

[0176] Furthermore, the constituent elements (gate electrode **30***g*, semiconductor layer **30***a*, first capacitor electrode **16***a*, and second capacitor electrode **16***c*), which are configured of polycrystal silicon, makes the light partially transmit and have less negative influence (deterioration of display contrast) when these constituent elements are disposed in the direction which intersects the polarizing directions of the polarizing elements **1***a* and **1***b*, compared to the constituent elements (scanning line **3**, third capacitor electrode **16***e*, signal line **4**, first relay electrode **42**, second relay electrode **43**, first wiring **6**, second wiring **7**, third relay electrode **44**, and fourth relay electrode **45**) which are configured of the conductive material having light shielding properties. Therefore, the constituent elements, such as the polycrystal silicon, which the light partially transmits, may have a part which is overhung from the light shielding region V**1**.

[0177] For example, the corner portions of the constituent elements (gate electrode **30***g*, semiconductor layer **30***a*, first capacitor electrode **16***a*, and second capacitor electrode **16***c*), such as the polycrystal silicon, which the light partially transmits, may be included in the technical range in which the invention is employed even when the corner portions are not substantially hidden by the light shielding region V**1**, if the constituent elements (scanning line **3**, third capacitor electrode **16***e*, signal line **4**, first relay electrode **42**, second relay electrode **43**, first wiring **6**, second wiring **7**, third relay electrode **44**, and fourth relay electrode **45**) which are configured of the conductive material having light shielding properties can be considered to be substantially hidden by the light shielding region V**1**.

Modification Example 4

[0178] The electronic apparatus in which the liquid crystal device **1** is employed is not limited to the projection type display apparatus **1000**. For example, other than the projection type display apparatus **1000**, it is possible to employ the liquid crystal device **1** in electronic apparatus, such as a projection type head-up display (HUD), a direct viewing type head-mounted display (HMD), an electronic book, a personal computer, a digital still camera, a liquid crystal television, a view finder type or a monitor direct viewing type video recorder, a car navigation system, an information terminal apparatus including a POS, and an electronic organizer.

Modification Example 5

[0179] The optical unit according to the invention may be configured to have the liquid crystal device as an optical modulating unit, and the light synthesizing optical system (cross dichroic prism) which synthesizes and emits the light which is emitted from the liquid crystal device, and for example, may have a configuration in which the dichroic mirrors **1104** and **1105**, the reflecting mirrors **1106**, **1107**, and **1108**, the relay lenses **1201**, **1202**, **1203**, **1204**, and **1205** in above-described embodiment, are omitted.

[0180] Furthermore, the optical unit according to the invention can be employed in the electronic apparatus, such as the projection type of head-up display (HUD) other than the projection type display apparatus.

[0181] The entire disclosure of Japanese Patent Application No. 2014-082546, filed Apr. 14, 2014 is expressly incorporated by reference herein.

What is claimed is:

1. An electro-optical device which is disposed between a first polarizing element which polarizes light in a first direction, and a second polarizing element which polarizes the light in a second direction which intersects the first direction, comprising:

a substrate;

a pixel electrode;

a pixel switching element which is disposed between the substrate and the pixel electrode;

a first light shielding film which is disposed between the pixel switching element and the pixel electrode, and extends in one direction among the first direction and the second direction; and

a second light shielding film which is disposed between the pixel switching element and the pixel electrode, and extends in the other direction among the first direction and the second direction,

wherein a pixel opening portion is defined by an outer edge of the first light shielding film and an outer edge of the second light shielding film.

2. An electro-optical device which is disposed between a first polarizing element which polarizes light in a first direction, and a second polarizing element which polarizes the light in a second direction which intersects the first direction, comprising:

a substrate;

a pixel electrode;

a pixel switching element which is disposed between the substrate and the pixel electrode;

a first light shielding film which is disposed between the pixel switching element and the pixel electrode, and extends in one direction among the first direction and the second direction;

a second light shielding film which is disposed between the pixel switching element and the pixel electrode, and extends in the other direction among the first direction and the second direction;

a first conducting film having light shielding properties which is provided on the same layer as the first light shielding film; and

a second conducting film having light shielding properties which is provided on the same layer as the second light shielding film,

wherein a pixel opening portion is defined by an outer edge of the first light shielding film, an outer edge of the second light shielding film, and at least one outer edge of the first conducting film and the second conducting film.

3. The electro-optical device according to claim **1**,

wherein a material which constitutes the first light shielding film and the second light shielding film is aluminum or a conductive material including aluminum.

4. The electro-optical device according to claim **1**,

wherein a signal line is provided which extends in one direction among the first direction and the second direction between the pixel switching element and the pixel electrode,

wherein the first light shielding film is disposed on a layer between a layer on which the signal line is formed and a layer on which the pixel electrode is formed, and

wherein the second light shielding film is disposed on a layer between the layer on which the first light shielding layer is formed and the layer on which the pixel electrode is formed.

5. The electro-optical device according to claim **1**,

wherein the first light shielding film and the second light shielding film are wirings to which a fixed potential is supplied.

6. The electro-optical device according to claim **1**,

wherein the outer edge of the first light shielding film and the outer edge of the second light shielding film which define the pixel opening portion are straight lines.

7. An optical unit, comprising:

a first polarizing element which polarizes light in a first direction;

a second polarizing element which polarizes the light in a second direction which intersects the first direction;

the electro-optical device according to claim **1** which is disposed between the first polarizing element and the second polarizing element; and

a light synthesizing optical system which synthesizes and emits the light which is emitted from the plurality of electro-optical devices.

8. An optical unit, comprising:

a first polarizing element which polarizes light in a first direction;

a second polarizing element which polarizes the light in a second direction which intersects the first direction;

the electro-optical device according to claim **2** which is disposed between the first polarizing element and the second polarizing element; and

a light synthesizing optical system which synthesizes and emits the light which is emitted from the plurality of electro-optical devices.

9. An optical unit, comprising:

a first polarizing element which polarizes light in a first direction;

a second polarizing element which polarizes the light in a second direction which intersects the first direction;

the electro-optical device according to claim **3** which is disposed between the first polarizing element and the second polarizing element; and a light synthesizing optical system which synthesizes and emits the light which is emitted from the plurality of electro-optical devices.

10. An optical unit, comprising:

a first polarizing element which polarizes light in a first direction;

a second polarizing element which polarizes the light in a second direction which intersects the first direction;

the electro-optical device according to claim **4** which is disposed between the first polarizing element and the second polarizing element; and

a light synthesizing optical system which synthesizes and emits the light which is emitted from the plurality of electro-optical devices.

11. An optical unit, comprising:

a first polarizing element which polarizes light in a first direction;

a second polarizing element which polarizes the light in a second direction which intersects the first direction;

the electro-optical device according to claim **5** which is disposed between the first polarizing element and the second polarizing element; and

a light synthesizing optical system which synthesizes and emits the light which is emitted from the plurality of electro-optical devices.

12. An optical unit, comprising:

a first polarizing element which polarizes light in a first direction;

a second polarizing element which polarizes the light in a second direction which intersects the first direction;

the electro-optical device according to claim **6** which is disposed between the first polarizing element and the second polarizing element; and

a light synthesizing optical system which synthesizes and emits the light which is emitted from the plurality of electro-optical devices.

13. An electronic apparatus, comprising:

the electro-optical device according to claim **1**.

14. An electronic apparatus, comprising:

the electro-optical device according to claim **2**.

15. An electronic apparatus, comprising:

the electro-optical device according to claim **3**.

16. An electronic apparatus, comprising:

the electro-optical device according to claim **4**.

17. An electronic apparatus, comprising:

the electro-optical device according to claim **5**.

18. An electronic apparatus, comprising:

the electro-optical device according to claim **6**.

19. An electronic apparatus, comprising:

the optical unit according to claim **7**.

20. An electronic apparatus, comprising:

the optical unit according to claim **8**.

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