US 20200152713A1

(19) United States
(12) Patent Application Publication (10) Pub. No.: US 2020/0152713 A1
YIM et al. (43) Pub. Date: May 14, 2020

(54) **DISPLAY PANEL AND ORGANIC LIGHT EMITTING DISPLAY DEVICE INCLUDING THE SAME**

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(21) Appl. No.: **16/599,591**

(22) Filed: **Oct. 11, 2019**

(30) **Foreign Application Priority Data**

Nov. 12, 2018 (KR) 10-2018-0137892

Publication Classification

(51) **Int. Cl.**
H01L 27/32 (2006.01)
H01L 51/52 (2006.01)

(52) **U.S. Cl.**
CPC *H01L 27/3218* (2013.01); *H01L 51/5206* (2013.01)

(57) **ABSTRACT**

A display panel includes first pixels each including a first organic light emitting element which outputs red color light, second pixels each including a second organic light emitting element which outputs green color light, and third pixels each including a third organic light emitting element which outputs blue color light. The first organic light emitting elements are arranged in point symmetry with respect to the second organic light emitting element, the third organic light emitting elements are arranged in point symmetry with respect to the second organic light emitting element, an anode of the first organic light emitting element is spaced apart from an anode of the second organic light emitting element by a first distance, and the anode of the second organic light emitting element is spaced apart from an anode of the third organic light emitting element by a second distance which is shorter than the first distance.

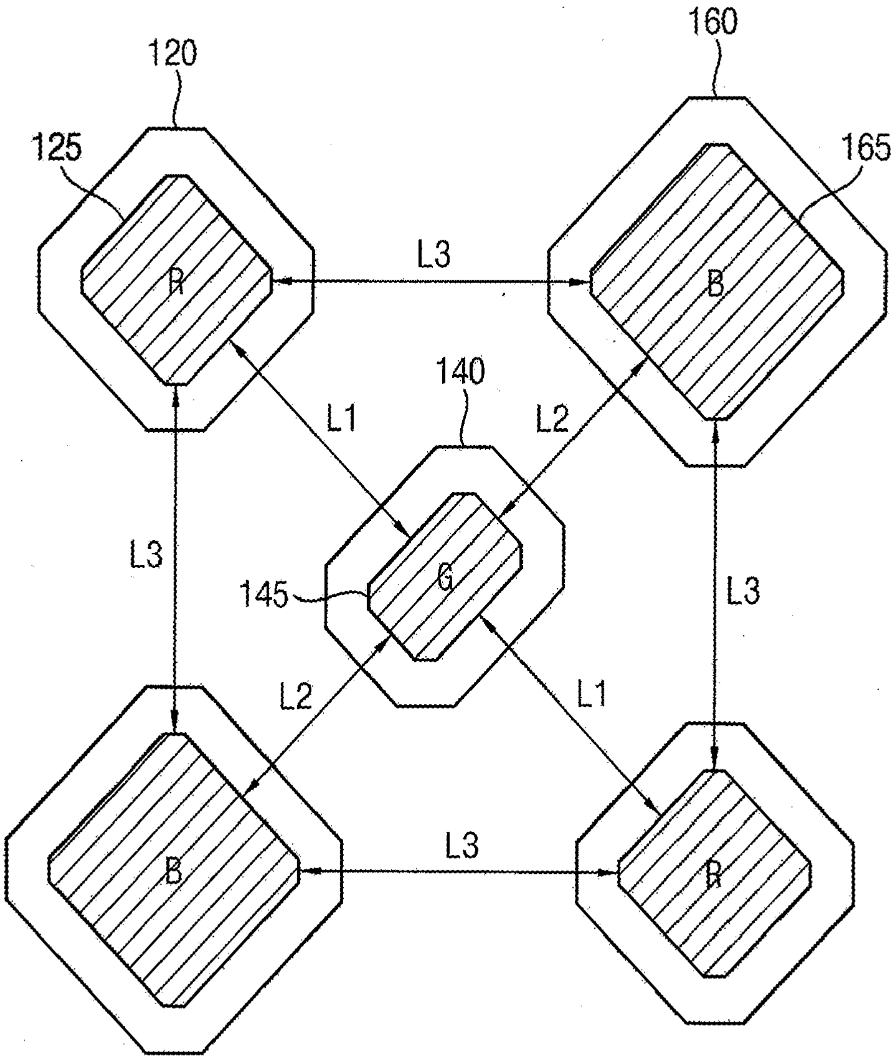


FIG. 1

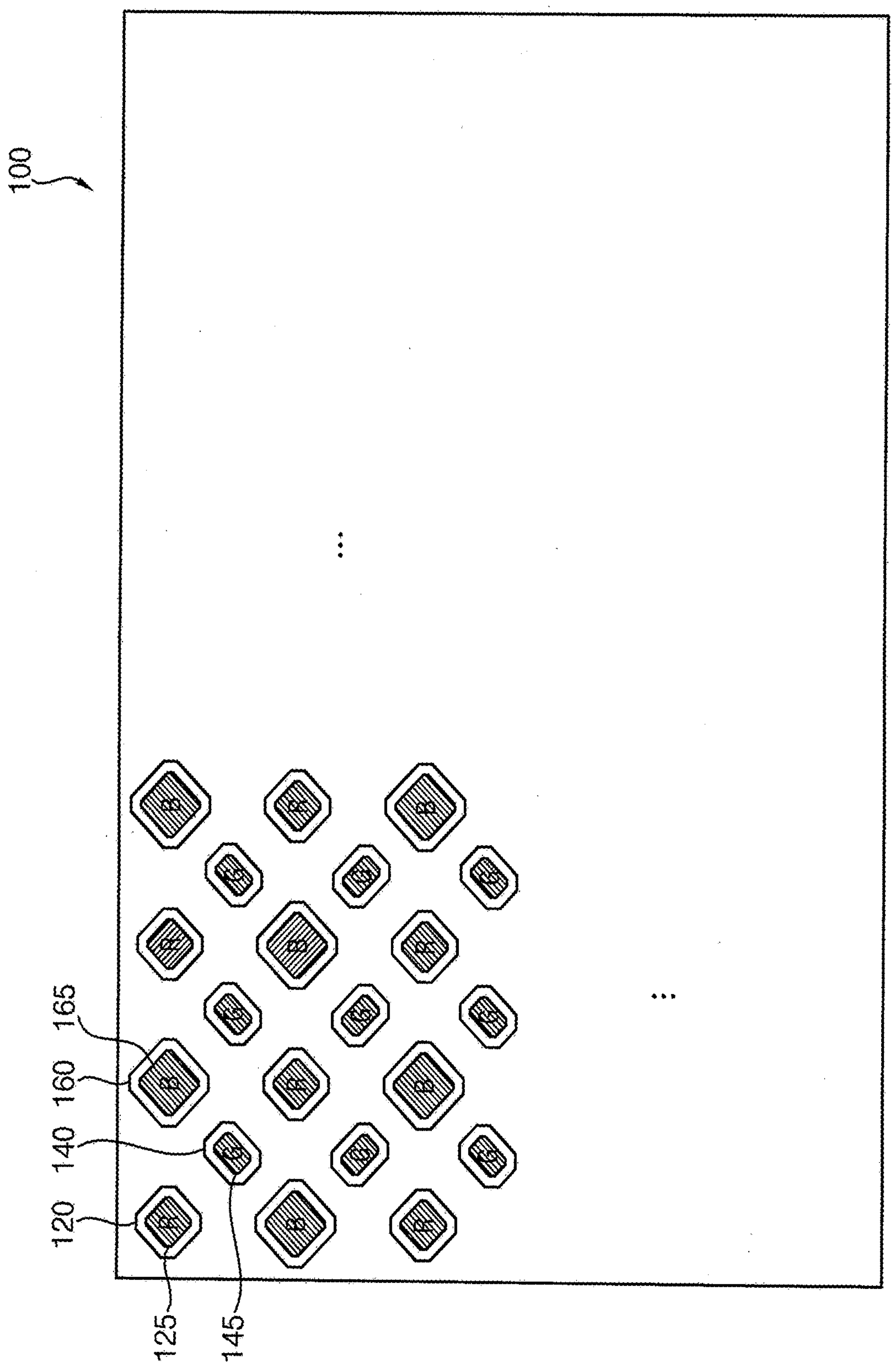


FIG. 2

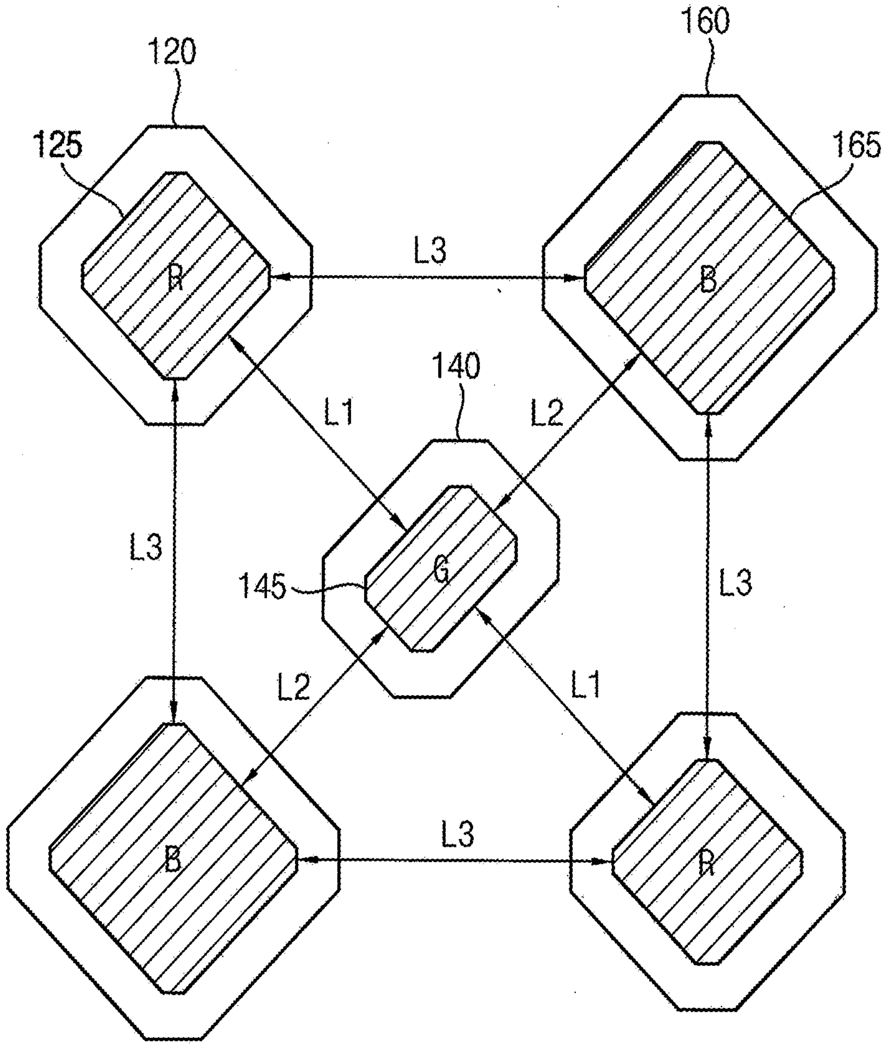


FIG. 3
(PRIOR ART)

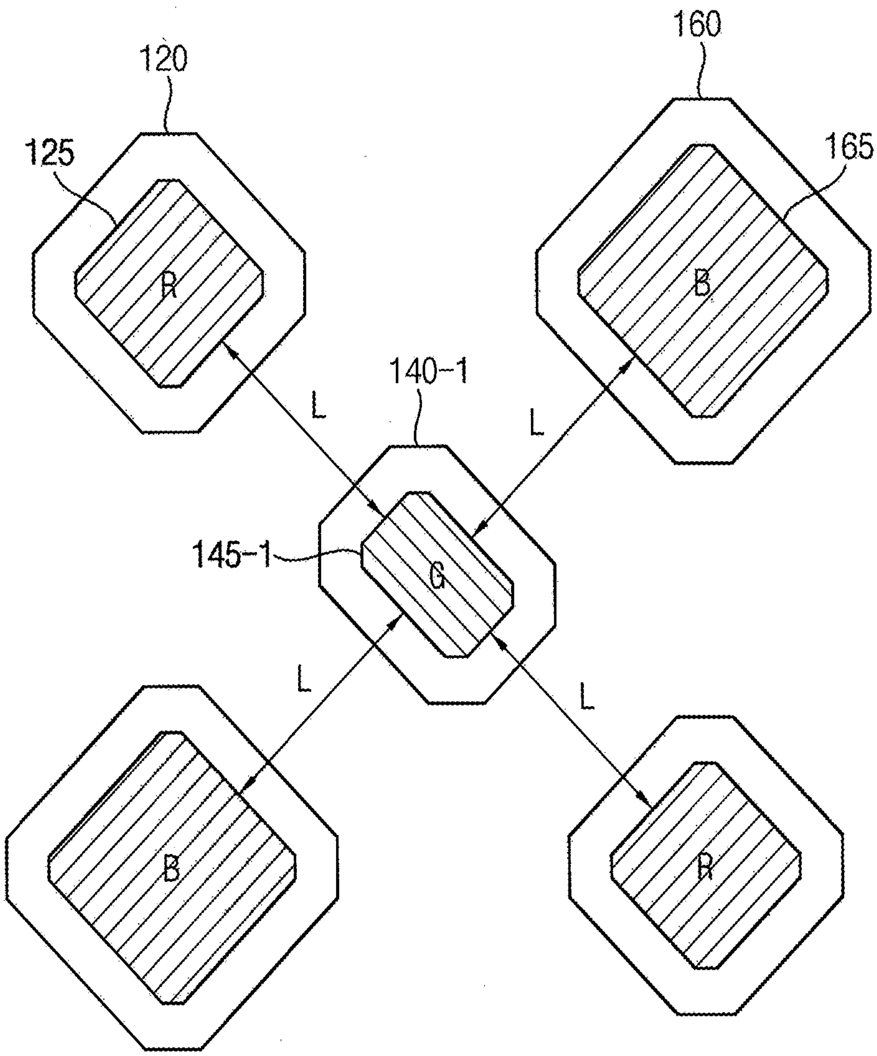


FIG. 4
(PRIOR ART)

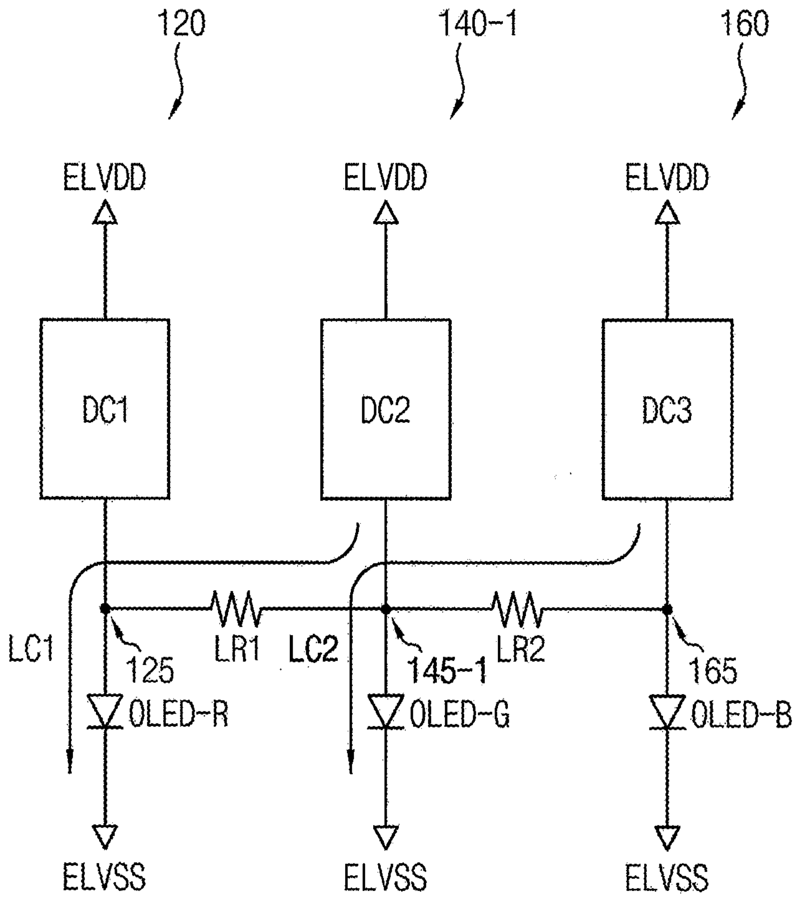


FIG. 5
(PRIOR ART)

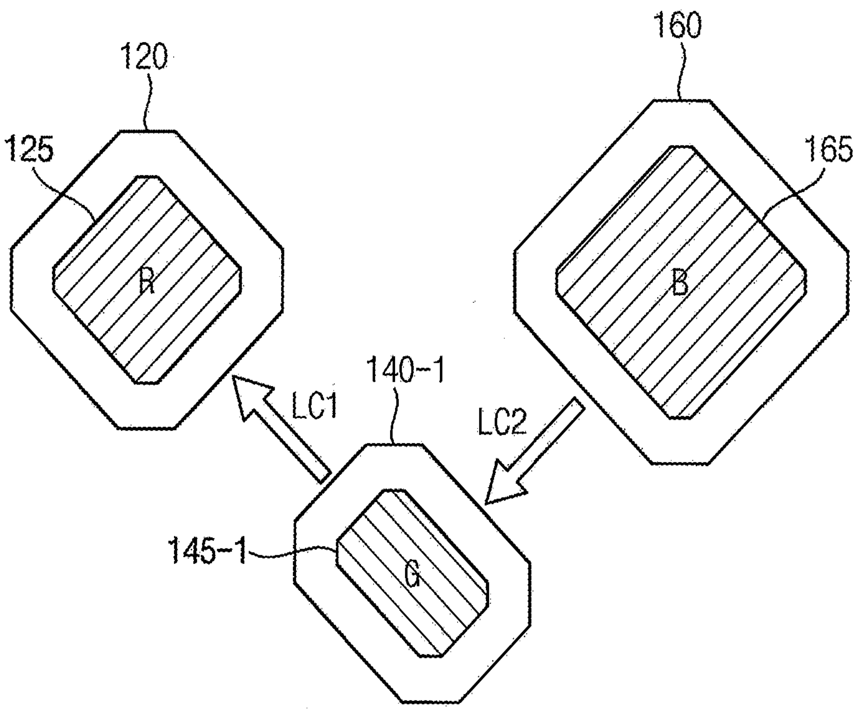


FIG. 6

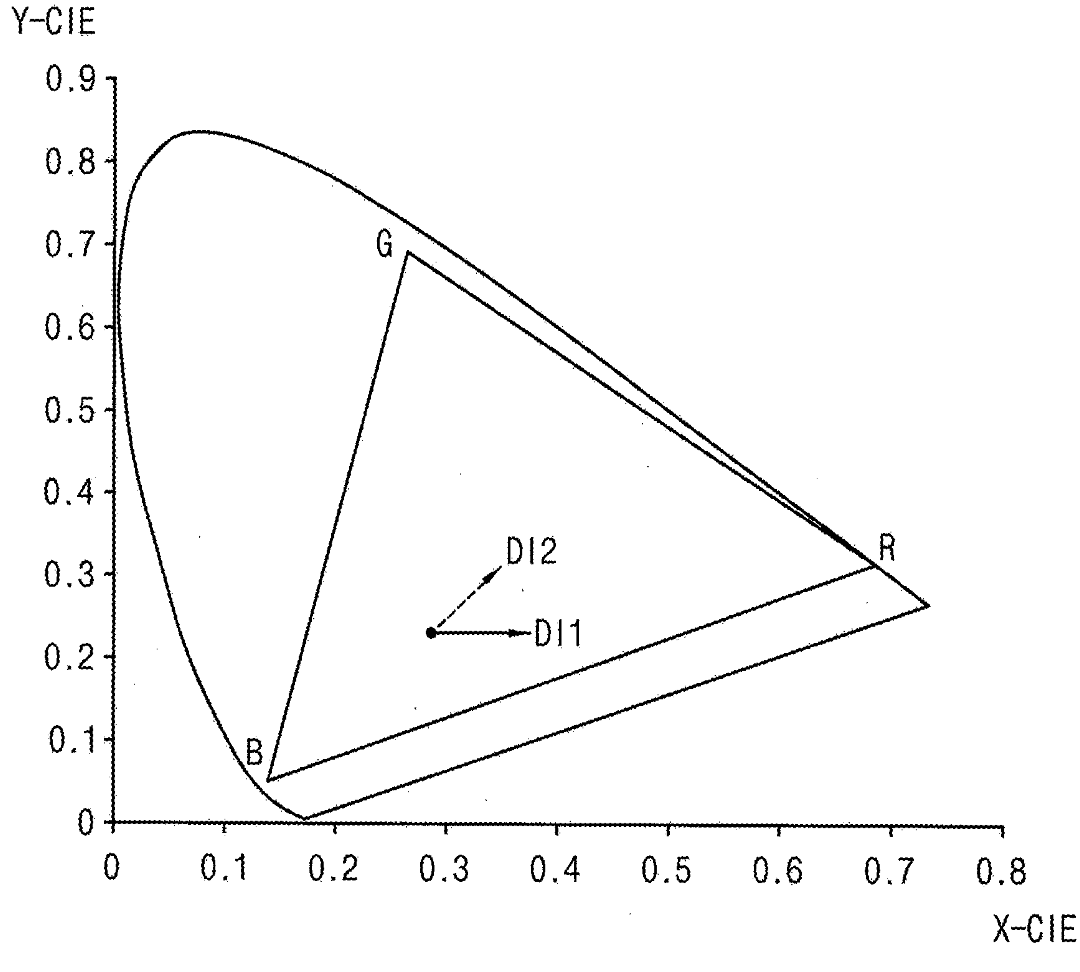

Y-CIE
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
G
R
B
DI2
DI1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
X-CIE

FIG. 7

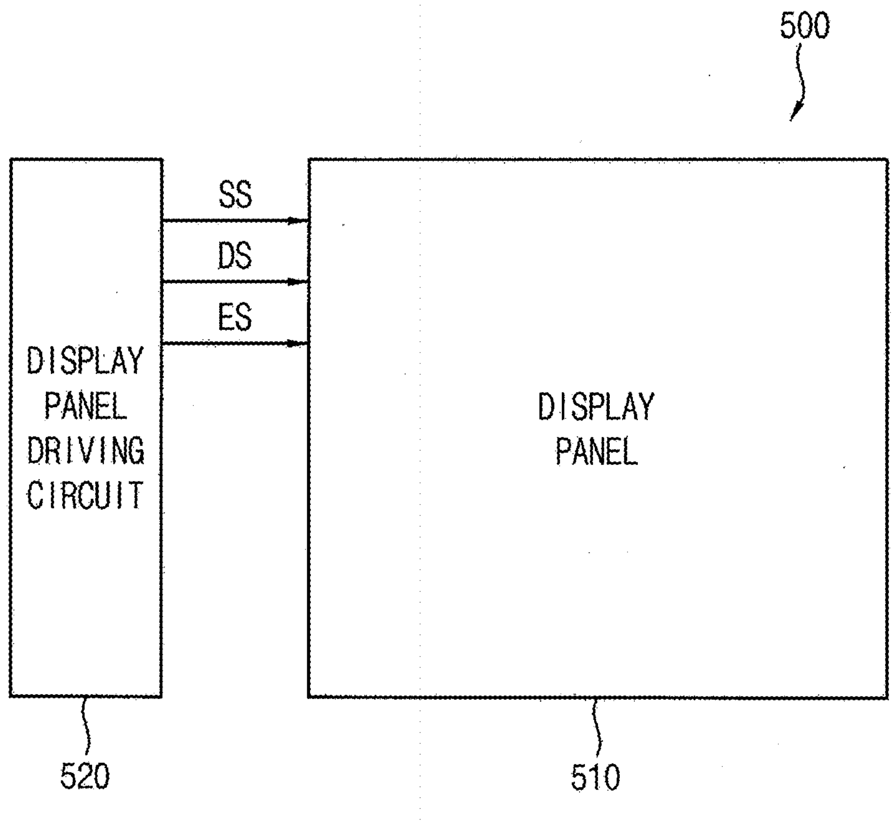

500
SS
DS
ES
DISPLAY PANEL DRIVING CIRCUIT
DISPLAY PANEL
520
510

FIG. 8

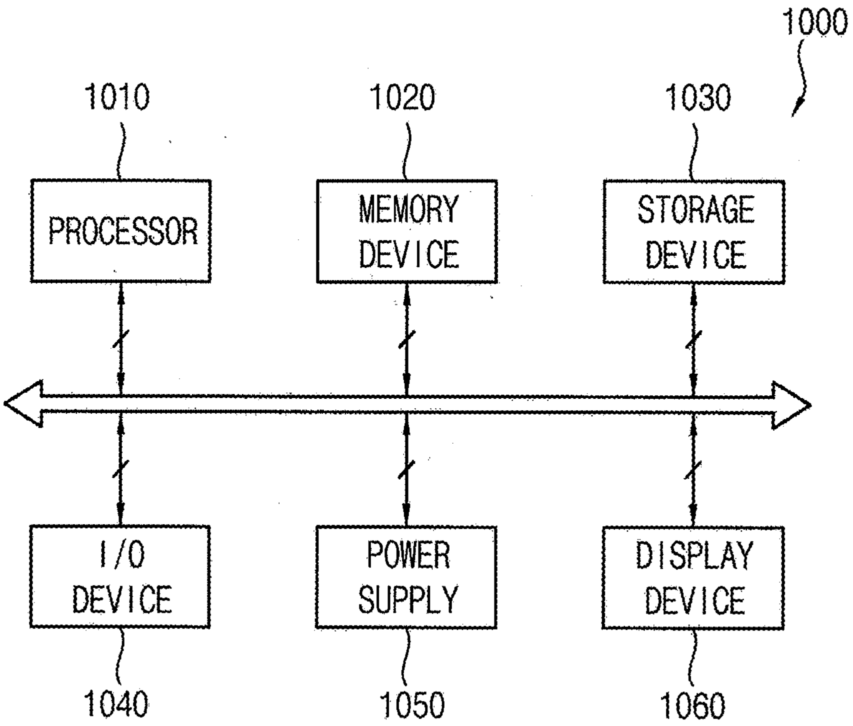
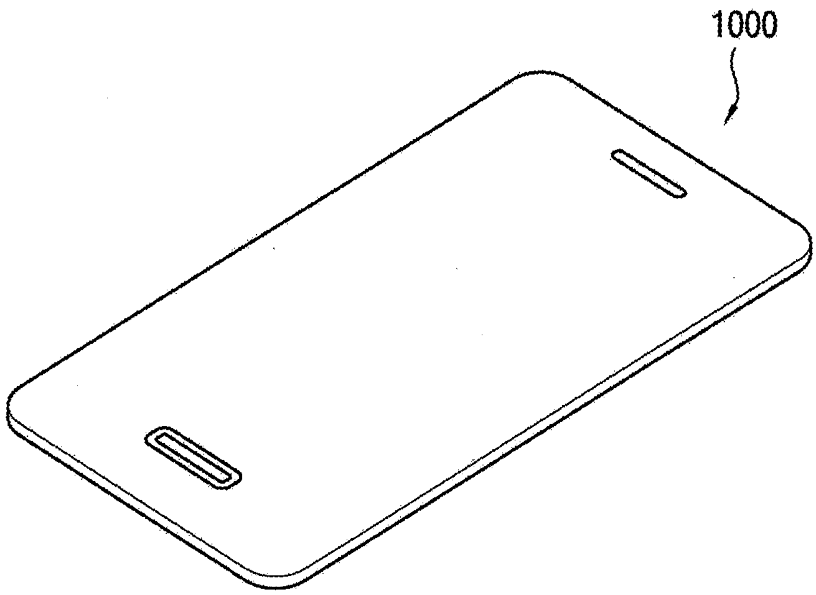

1000
1010
1020
1030
PROCESSOR
MEMORY DEVICE
STORAGE DEVICE
I/O DEVICE
POWER SUPPLY
DISPLAY DEVICE
1040
1050
1060

FIG. 9


1000

DISPLAY PANEL AND ORGANIC LIGHT EMITTING DISPLAY DEVICE INCLUDING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims priority to Korean Patent Application No. 10-2018-0137892, filed on Nov. 12, 2018, and all the benefits accruing therefrom under 35 U.S.C. § 119, the content of which in its entirety is herein incorporated by reference.

BACKGROUND

1. Technical Field

[0002] Exemplary embodiments relate to a display device. More particularly, exemplary embodiments of the inventive concept relate to a display panel including a plurality of pixels each including an organic light emitting element (e.g., an organic light emitting diode) and an organic light emitting display device including the display panel.

2. Description of the Related Art

[0003] Generally, a display panel of an organic light emitting display device may include first pixels each including a first organic light emitting element that outputs a red color light, second pixels each including a second organic light emitting element that outputs a green color light, and third pixels each including a third organic light emitting element that outputs a blue color light.

SUMMARY

[0004] Because material-characteristics of the first through third organic light emitting elements are different from each other, driving voltages applied to the first through third pixels to implement the same grayscale may be also different. For example, when the first through third pixels implement the same grayscale, the driving voltage applied to the second pixel may be higher than the driving voltage applied to the first pixel, and the driving voltage applied to the third pixel may be higher than the driving voltage applied to the second pixel. Thus, a lateral leakage current may flow between adjacent pixels due to differences of the driving voltages applied to the first through third pixels. For example, since the driving voltages applied to the first through third pixels are relatively low when a low-grayscale is implemented, resistances of the first through third organic light emitting elements included therein may be relatively high, and thus an effect of relatively reducing lateral resistances (or lateral resistors) existing between adjacent pixels may occur. As a result, the lateral leakage current may flow through the lateral resistances existing between adjacent pixels. In other words, the lateral leakage current may flow from the third pixel that outputs the blue color light into the second pixel that outputs the green color light, and the lateral leakage current may flow from the second pixel that outputs the green color light into the first pixel that outputs the red color light. Here, a light emission of the first pixel that outputs the red color light may be greatly affected by the lateral leakage current while a light emission of the second pixel that outputs the green color light is not greatly affected by the lateral leakage current. As a result, when a low-grayscale is implemented, the first pixel that outputs the red color light may be over-emitted by the lateral leakage current, and thus a low-grayscale color shift phenomenon in which an image becomes reddish may occur.

[0005] Some exemplary embodiments provide a display panel including first through third pixels that are arranged to prevent (or reduce) a low-grayscale color shift phenomenon in which an image becomes reddish when a low-grayscale is implemented, where each pixel includes an organic light emitting element.

[0006] Some exemplary embodiments provide an organic light emitting display device including the display panel above.

[0007] According to exemplary embodiments, a display panel includes a plurality of first pixels, where each of the plurality of first pixels includes a first organic light emitting element which outputs a red color light, a plurality of second pixels, where each of the plurality of second pixels includes a second organic light emitting element which outputs a green color light, and a plurality of third pixels, where each of the plurality of first pixels includes a third organic light emitting element which outputs a blue color light. Here, the first organic light emitting elements are arranged in point symmetry with respect to the second organic light emitting element, the third organic light emitting elements are arranged in point symmetry with respect to the second organic light emitting element, an anode of the first organic light emitting element is spaced apart from an anode of the second organic light emitting element by a first distance, the anode of the second organic light emitting element is spaced apart from an anode of the third organic light emitting element by a second distance, and the first distance is longer than the second distance.

[0008] In exemplary embodiments, the anode of the third organic light emitting element may be spaced apart from the anode of the first organic light emitting element by a third distance, and the third distance is longer than the first distance.

[0009] In exemplary embodiments, one side of the anode of the second organic light emitting element may be parallel with at least one side of the anode of the first organic light emitting element, and another side of the anode of the second organic light emitting element may be parallel with at least one side of the anode of the third organic light emitting element.

[0010] In exemplary embodiments, the anode of the second organic light emitting element may have an octagonal shape, and each of the anode of the first organic light emitting element and the anode of the third organic light emitting element may have a polygonal shape.

[0011] In exemplary embodiments, a major axis of the anode of the second organic light emitting element may extend in a direction toward the anode of the third organic light emitting element, and a minor axis of the anode of the second organic light emitting element may extend in a direction toward the anode of the first organic light emitting element.

[0012] In exemplary embodiments, an area of the anode of the first organic light emitting element may be different from an area of the anode of the third organic light emitting element.

[0013] In exemplary embodiments, the area of the anode of the first organic light emitting element may be smaller than the area of the anode of the third organic light emitting element.

[0014] In exemplary embodiments, an area of the anode of the second organic light emitting element may be smaller than the area of the anode of the first organic light emitting element.

[0015] In exemplary embodiments, an area of the anode of the first organic light emitting element may be equal to an area of the anode of the third organic light emitting element.

[0016] In exemplary embodiments, an area of the anode of the second organic light emitting element may be smaller than the area of the anode of the first organic light emitting element and the area of the anode of the third organic light emitting element.

[0017] According to exemplary embodiments, an organic light emitting display device includes a display panel which includes a plurality of first pixels each including a first organic light emitting element which outputs a red color light, a plurality of second pixels each including a second organic light emitting element which outputs a green color light, and a plurality of third pixels each including a third organic light emitting element which outputs a blue color light, and a display panel driving circuit which drives the display panel. Here, the display panel has a pixel arrangement structure in which the first organic light emitting elements are arranged in point symmetry with respect to the second organic light emitting element, the third organic light emitting elements are arranged in point symmetry with respect to the second organic light emitting element, an anode of the first organic light emitting element is spaced apart from an anode of the second organic light emitting element by a first distance, the anode of the second organic light emitting element is spaced apart from an anode of the third organic light emitting element by a second distance, and the first distance is longer than the second distance.

[0018] In exemplary embodiments, the anode of the third organic light emitting element may be spaced apart from the anode of the first organic light emitting element by a third distance, and the third distance is longer than the first distance.

[0019] In exemplary embodiments, one side of the anode of the second organic light emitting element may be parallel with at least one side of the anode of the first organic light emitting element, and another side of the anode of the second organic light emitting element may be parallel with at least one side of the anode of the third organic light emitting element.

[0020] In exemplary embodiments, the anode of the second organic light emitting element may have an octagonal shape, and each of the anode of the first organic light emitting element and the anode of the third organic light emitting element may have a polygonal shape.

[0021] In exemplary embodiments, a major axis of the anode of the second organic light emitting element may extend in a direction toward the anode of the third organic light emitting element, and a minor axis of the anode of the second organic light emitting element may extend in a direction toward the anode of the first organic light emitting element.

[0022] In exemplary embodiments, an area of the anode of the first organic light emitting element may be different from an area of the anode of the third organic light emitting element.

[0023] In exemplary embodiments, the area of the anode of the first organic light emitting element may be smaller than the area of the anode of the third organic light emitting element.

[0024] In exemplary embodiments, an area of the anode of the second organic light emitting element may be smaller than the area of the anode of the first organic light emitting element.

[0025] In exemplary embodiments, an area of the anode of the first organic light emitting element may be equal to an area of the anode of the third organic light emitting element.

[0026] In exemplary embodiments, an area of the anode of the second organic light emitting element may be smaller than the area of the anode of the first organic light emitting element and the area of the anode of the third organic light emitting element.

[0027] Therefore, a display panel according to exemplary embodiments may include first pixels each including a first organic light emitting element that outputs a red color light, second pixels each including a second organic light emitting element that outputs a green color light, and third pixels each including a third organic light emitting element that outputs a blue color light. Here, the display panel has a pixel arrangement structure in which the first organic light emitting elements are arranged (or placed) in point symmetry with respect to the second organic light emitting element, the third organic light emitting elements are arranged in point symmetry with respect to the second organic light emitting element, an anode of the first organic light emitting element is spaced apart from an anode of the second organic light emitting element by a first distance, and the anode of the second organic light emitting element is spaced apart from an anode of the third organic light emitting element by a second distance, where the first distance is longer than the second distance. Thus, the display panel may reduce a lateral leakage current flowing from the second pixel that outputs the green color light into the first pixel that outputs the red color light by relatively increasing a lateral resistance existing between the second pixel that outputs the green color light and the first pixel that outputs the red color light. As a result, as compared to a conventional display panel, the display panel may prevent (or reduce) a low-grayscale color shift phenomenon in which an image becomes reddish when a low-grayscale is implemented.

[0028] In addition, an organic light emitting display device including the display panel according to exemplary embodiments may provide a high-quality image to a viewer (or user).

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] Illustrative, non-limiting exemplary embodiments will be more clearly understood from the following detailed description in conjunction with the accompanying drawings.

[0030] FIG. **1** is a diagram illustrating an exemplary embodiment of a display panel according to the invention.

[0031] FIG. **2** is a diagram illustrating an example in which first through third pixels are arranged in the display panel of FIG. **1**.

[0032] FIG. **3** is a diagram illustrating an example in which first through third pixels are arranged in a conventional display panel.

[0033] FIGS. **4** and **5** are diagrams for describing that a lateral leakage current occurs between a first pixel and a second pixel in a conventional display panel.

[0034] FIG. **6** is a diagram for describing that a low-grayscale color shift phenomenon is prevented (or reduced) in the display panel of FIG. **1**.

[0035] FIG. **7** is a block diagram illustrating an exemplary embodiment of an organic light emitting display device according to the invention.

[0036] FIG. **8** is a block diagram illustrating an exemplary embodiment of an electronic device according to the invention.

[0037] FIG. **9** is a diagram illustrating an example in which the electronic device of FIG. **8** is implemented as a smart phone.

DETAILED DESCRIPTION

[0038] Hereinafter, embodiments of the inventive concept will be explained in detail with reference to the accompanying drawings.

[0039] It will be understood that, although the terms "first," "second," "third" etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, layer or section from another element, component, region, layer or section. Thus, "a first element," "component," "region," "layer" or "section" discussed below could be termed a second element, component, region, layer or section without departing from the teachings herein.

[0040] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting. As used herein, the singular forms "a," "an," and "the" are intended to include the plural forms, including "at least one," unless the content clearly indicates otherwise. "At least one" is not to be construed as limiting "a" or "an." "Or" means "and/or." As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items. It will be further understood that the terms "comprises" and/or "comprising," or "includes" and/or "including" when used in this specification, specify the presence of stated features, regions, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, regions, integers, steps, operations, elements, components, and/or groups thereof.

[0041] FIG. **1** is a diagram illustrating an exemplary embodiment of a display panel according to the invention, FIG. **2** is a diagram illustrating an example in which first through third pixels are arranged in the display panel of FIG. **1**, and FIG. **3** is a diagram illustrating an example in which first through third pixels are arranged in a conventional display panel.

[0042] Referring to FIGS. **1** to **3**, the display panel **100** may include first pixels **120** each including a first organic light emitting element (e.g., an organic light emitting diode) that outputs a red color light, second pixels **140** each including a second organic light emitting element that outputs a green color light, and third pixels **160** each including a third organic light emitting element that outputs a blue color light. The display panel **100** may display an image based on the red color light output from the first pixels **120**, the green color light output from the second pixels **140**, and the blue color light output from the third pixels **160**.

[0043] In the display panel **100**, the first pixels **120** each including the first organic light emitting element that outputs the red color light, the second pixels **140** each including the second organic light emitting element that outputs the green color light, and the third pixels **160** each including the third organic light emitting element that outputs the blue color light may be arranged adjacent to each other. Here, the first pixels **120** are arranged (or disposed) in point symmetry with respect to the second pixel **140**, and the third pixels **160** are arranged in point symmetry with respect to the second pixel **140**. That is, the first organic light emitting elements of the first pixels **120** are arranged in point symmetry with respect to the second organic light emitting element of the second pixel **140**, and the third organic light emitting elements of the third pixels **160** are arranged in point symmetry with respect to the second organic light emitting element of the second pixel **140**. For example, two first pixels **120** and two third pixels **160** may be arranged to surround one second pixel **140**, two first pixels **120** may face each other with one second pixel **140** as a center between them, and two third pixels **160** may face each other with one second pixel **140** as a center between them. In an exemplary embodiment, an anode **145** of the second organic light emitting element of the second pixel **140** may have an octagonal shape, an anode **125** of the first organic light emitting element of the first pixel **120** may have a polygonal shape (e.g., a tetragonal shape, a hexagon shape, an octagonal shape, etc.), and an anode **165** of the third organic light emitting element of the third pixel **160** may have a polygonal shape. Because material-characteristic of the first organic light emitting element of the first pixel **120**, material-characteristic of the second organic light emitting element of the second pixel **140**, and material-characteristic of the third organic light emitting element of the third pixel **160** are different from each other, a driving voltage applied to the first pixel **120**, a driving voltage applied to the second pixel **140**, and a driving voltage applied to the third pixel **160** to implement the same grayscale may be also different. For example, when the first through third pixels **120**, **140**, and **160** implement the same grayscale, the driving voltage applied to the third pixel **160** that outputs the blue color light may be the highest, and the driving voltage applied to the first pixel **120** that outputs the red color light may be the lowest.

[0044] For this reason, a lateral leakage current may flow from the third pixel **160** that outputs the blue color light into the second pixel **140** that outputs the green color light or into the first pixel **120** that outputs the red color light, and a lateral leakage current may flow from the second pixel **140** that outputs the green color light into the first pixel **120** that outputs the red color light. Here, the lateral leakage current may affect an image when especially a low-grayscale is implemented (i.e., when the driving voltages applied to the first through third pixels **120**, **140**, and **160** are relatively low) more than when a high-grayscale is implemented (i.e., when the driving voltages applied to the first through third pixels **120**, **140**, and **160** are relatively high). Generally, the lateral leakage current flowing from the third pixel **160** into the second pixel **140** may not generate a big problem because a light emission of the second pixel **140** that outputs the green color light is not greatly affected by the lateral leakage current. On the other hand, the lateral leakage current flowing from the second pixel **140** into the first pixel **120** may generate a big problem because a light emission of the first pixel **120** that outputs the red color light is greatly affected by the lateral leakage current (i.e., since a light emission efficiency of the first pixel **120** that outputs the red color light may be relatively high). Thus, when a low-grayscale is implemented, the first pixel **120** may be over-emitted by the lateral leakage current flowing from the second pixel **140** into the first pixel **120**, and thus a low-grayscale color shift phenomenon in which an image becomes reddish may occur. Although the lateral leakage current also flows from the third pixel **160** into the first pixel **120**, the lateral leakage current flowing from the second pixel **140** into the first pixel **120** rather than the lateral leakage current flowing from the third pixel **160** into the first pixel **120** generates a bigger problem because a distance (i.e., third distance L**3**) between the third pixel **160** and the first pixel **120** is longer than a distance (i.e., first distance L**1**) between the second pixel **140** and the first pixel **120**. As used herein, the term "distance" between two pixels or between two anodes refers to the distance between the closest sides of the anodes of the two pixels. In addition, although the first pixel **120** is over-emitted by the lateral leakage current flowing from the second pixel **140** into the first pixel **120** when a high-grayscale is implemented, a color shift phenomenon is more conspicuous when the low-grayscale is implemented than when the high-grayscale is implemented because an amount of the additional light emission of the first pixel **120** due to the lateral leakage current is negligible as compared to an amount of a total light emission of the first pixel **120** when the high-grayscale is implemented.

[0045] In some exemplary embodiments, one side of the anode **145** of the second organic light emitting element of the second pixel **140** may be parallel with at least one side of the anode **125** of the first organic light emitting element of the first pixel **120**, and another side of the anode **145** of the second organic light emitting element of the second pixel **140** may be parallel with at least one side of the anode **165** of the third organic light emitting element of the third pixel **160**. In an exemplary embodiment, an area of the anode **125** of the first organic light emitting element of the first pixel **120** may be different from an area of the anode **165** of the third organic light emitting element of the third pixel **160**. For example, as illustrated in FIG. **2**, the area of the anode **125** of the first organic light emitting element of the first pixel **120** may be smaller than the area of the anode **165** of the third organic light emitting element of the third pixel **160**. Here, an area of the anode **145** of the second organic light emitting element of the second pixel **140** may be smaller than the area of the anode **125** of the first organic light emitting element of the first pixel **120** and the area of the anode **165** of the third organic light emitting element of the third pixel **160**. In another exemplary embodiment, the area of the anode **125** of the first organic light emitting element of the first pixel **120** may be equal to the area of the anode **165** of the third organic light emitting element of the third pixel **160**. Here, the area of the anode **145** of the second organic light emitting element of the second pixel **140** may be smaller than the area of the anode **125** of the first organic light emitting element of the first pixel **120** and the area of the anode **165** of the third organic light emitting element of the third pixel **160**. As illustrated in FIG. **2**, the anode **125** of the first organic light emitting element of the first pixel **120** may be spaced apart from the anode **145** of the second organic light emitting element of the second pixel **140** by a first distance L**1**, the anode **145** of the second organic light emitting element of the second pixel **140** may be spaced apart from the anode **165** of the third organic light emitting element of the third pixel **160** by a second distance L**2**, and the anode **165** of the third organic light emitting element of the third pixel **160** may be spaced apart from the anode **125** of the first organic light emitting element of the first pixel **120** by a third distance L**3**. Here, the first distance L**1** is longer than the second distance L**2**, and the third distance L**3** is longer than the first distance L**1** and the second distance L**2**. To this end, a major axis (i.e., longitudinal axis) of the anode **145** of the second organic light emitting element of the second pixel **140** may extend in a direction (i.e., L**2** direction in FIG. **2**) toward the anode **165** of the third organic light emitting element of the third pixel **160**, and a minor axis (i.e., latitudinal axis) of the anode **145** of the second organic light emitting element of the second pixel **140** may extend in a direction (i.e., L**1** direction in FIG. **2**) toward the anode **125** of the first organic light emitting element of the first pixel **120**.

[0046] On the other hand, in a conventional display panel as shown in FIG. **3**, a distance L between the anode **125** of the first organic light emitting element of the first pixel **120** and the anode **145-1** of the second organic light emitting element of the second pixel **140-1** is equal to the distance L between the anode **165** of the third organic light emitting element of the third pixel **160** and the anode **145-1** of the second organic light emitting element of the second pixel **140-1**. That is, the first distance L**1** between the anode **125** of the first organic light emitting element of the first pixel **120** and the anode **145** of the second organic light emitting element of the second pixel **140** in the display panel **100** of the exemplary embodiment according to the invention may be relatively longer than the distance L between the anode **165** of the third organic light emitting element of the third pixel **160** and the anode **145-1** of the second organic light emitting element of the second pixel **140-1** in the conventional display panel if the other conditions are the same. Here, a major axis (i.e., longitudinal axis) of the anode **145-1** of the second organic light emitting element of the second pixel **140-1** may extend in a direction from the anode **145-1** toward the anode **125** of the first organic light emitting element of the first pixel **120**, and a minor axis (i.e., latitudinal axis) of the anode **145-1** of the second organic light emitting element of the second pixel **140-1** may extend in a direction from the anode **145-1** toward the anode **165** of the third organic light emitting element of the third pixel **160**. Thus, if the other conditions of the display panel **100** are the same as those of the conventional display panel, the lateral resistance existing between the first pixel **120** and the second pixel **140** in the exemplary embodiment according to the invention may be relatively higher than the lateral resistance existing between the first pixel **120** and the second pixel **140-1** in the conventional display panel, and thus the first lateral leakage current flowing from the second pixel **140** into the first pixel **120** may be relatively reduced in the display panel **100** compared with the conventional display panel. As a result, as compared to the conventional display panel, an amount of the additional light emission of the first pixel **120** due to the first lateral leakage current flowing from the second pixel **140** into the first pixel **120** especially when a low-grayscale is implemented, may be reduced, and thus the low-grayscale color-shift phenomenon in which an image becomes reddish may be prevented (or reduced) in the display panel **100**. On the other hand, if the other conditions of the display panel **100** are the same as those of the conventional display panel, the second distance L**2** between the anode **165** of the third organic light emitting element of the third pixel **160** and the anode **145** of the second organic light emitting element of the second pixel **140** may be relatively shorter in the display panel **100** according to the invention rather than the distance L between the anode **165** of the third organic light emitting element of the third pixel **160** and the anode **145-1** of the second organic light emitting element of the second pixel **140-1** in the conventional display panel. Hence, the second lateral resistance existing between the third pixel **160** and the second pixel **140** may be relatively low, and thus the first lateral leakage current flowing from the third pixel **160** into the second pixel **140** may be relatively increased in the display panel **100**, compared with the conventional display panel. However, as described above, because the light emission of the second pixel **140** that outputs the green color light is not greatly affected by the lateral leakage current, an amount of the additional light emission of the second pixel **140** due to the second lateral leakage current flowing from the third pixel **160** into the second pixel **140** may be negligible.

[0047] In brief, the display panel **100** according to the exemplary embodiments includes the first pixels **120** each including the first organic light emitting element that outputs the red color light, the second pixels **140** each including the second organic light emitting element that outputs the green color light, and the third pixels **160** each including the third organic light emitting element that outputs the blue color light. Here, the display panel **100** has a pixel arrangement structure in which the first organic light emitting elements of the first pixels **120** are arranged in point symmetry with respect to the second organic light emitting element of the second pixel **140**, the third organic light emitting elements of the third pixels **160** are arranged in point symmetry with respect to the second organic light emitting element of the second pixel **140**, the anode **125** of the first organic light emitting element of the first pixel **120** is spaced apart from the anode **145** of the second organic light emitting element of the second pixel **140** by the first distance L**1**, and the anode **145** of the second organic light emitting element of the second pixel **140** is spaced apart from the anode **165** of the third organic light emitting element of the third pixel **160** by the second distance L**2**, where the first distance L**1** is longer than the second distance L**2**. Thus, the display panel **100** may reduce the first lateral leakage current flowing from the second pixel **140** that outputs the green color light into the first pixel **120** that outputs the red color light by relatively increasing the first lateral resistance existing between the second pixel **140** that outputs the green color light and the first pixel **120** that outputs the red color light. As a result, as compared to the conventional display panel, the display panel **100** may prevent (or reduce) the low-grayscale color-shift phenomenon in which an image becomes reddish when a low-grayscale is implemented. Therefore, an organic light emitting display device including the display panel **100** may provide a high-quality image to a viewer (or user).

[0048] FIGS. **4** and **5** are diagrams for describing that a lateral leakage current occurs between a first pixel and a second pixel in a conventional display panel, and FIG. **6** is a diagram for describing that a low-grayscale color shift phenomenon is prevented (or reduced) in the display panel of FIG. **1**. The internal structures of the pixels shown in FIG. **4** can also be applied to the display panel **100** according to the invention.

[0049] Referring to FIGS. **4** to **6**, the first pixel **120** may include a first organic light emitting element driving circuit DC**1** and a first organic light emitting element OLED-R, the second pixel **140-1** may include a second organic light emitting element driving circuit DC**2** and a second organic light emitting element OLED-G, and the third pixel **160** may include a third organic light emitting element driving circuit DC**3** and a third organic light emitting element OLED-B. A first power voltage ELVDD and a second power voltage ELVSS supplies the power to the first to third pixels **120** to **160**. Here, the first organic light emitting element driving circuit DC**1**, the second organic light emitting element driving circuit DC**2**, and the third organic light emitting element driving circuit DC**3** may have the same structure. For example, each of the first through third organic light emitting element driving circuits DC**1**, DC**2**, and DC**3** may include a switching transistor, a driving transistor, a storage capacitor, etc.

[0050] As illustrated in FIGS. **4** and **5**, in the conventional display panel, the first pixel **120** that outputs the red color light, the second pixel **140-1** that outputs the green color light, and the third pixel **160** that outputs the blue color light may be arranged adjacent to each other. Here, the first organic light emitting element driving circuit DC**1** may control the first organic light emitting element OLED-R to emit the red color light, the second organic light emitting element driving circuit DC**2** may control the second organic light emitting element OLED-G to emit the green color light, and the third organic light emitting element driving circuit DC**3** may control the third organic light emitting element OLED-B to emit the blue color light. Specifically, the first organic light emitting element OLED-R may output the red color light in response to a driving current supplied from the first organic light emitting element driving circuit DC**1** in the first pixel **120**, the second organic light emitting element OLED-G may output the green color light in response to a driving current supplied from the second organic light emitting element driving circuit DC**2** in the second pixel **140-1**, and the third organic light emitting element OLED-B may output the blue color light in response to a driving current supplied from the third organic light emitting element driving circuit DC**3** in the third pixel **160**. As described above, since the first through third pixels **120**, **140-1**, and **160** are adjacent to each other, first and second lateral resistances LR**1** and LR**2** may exist among the first through third pixels **120**, **140-1**, and **160**. That is, the first lateral resistance LR**1** is a resistance between the first pixel **120** and the second pixel **140-1**, and the second lateral resistance LR**2** is a resistance between the second pixel **140-1** and the third pixel **160**. In addition, the driving voltages applied to the first through third pixels **120**, **140-1**, and **160** to implement the same grayscale may be different from each other. Here, when the first through third pixels **120**, **140-1**, and **160** implement the same grayscale, the driving voltage applied to the third pixel **160** that outputs the blue color light may be the highest, the driving voltage applied to the second pixel **140-1** that outputs the green color light may be medium, and the driving voltage applied to the first pixel **120** that outputs the red color light may be the lowest. Thus, as illustrated in FIGS. **4** and **5**, a second lateral leakage current LC**2** may flow from the third pixel **160** into the second pixel **140-1** through the second lateral resistance LR**2** because a voltage of the anode **165** of the third organic light emitting element OLED-B of the third pixel **160** is higher than a voltage of the anode **145-1** of the second organic light emitting element OLED-G of the second pixel **140-1**. In addition, a first lateral leakage current LC**1** may flow from the second pixel **140-1** into the first pixel **120** through the first lateral resistance LR**1** because the voltage of the anode **145-1** of the second organic light emitting element OLED-G of the second pixel **140-1** is higher than a voltage of the anode **125** of the first organic light emitting element OLED-R of the first pixel **120**.

[0051] As described above, the second lateral leakage current LC**2** may flow from the third pixel **160** that outputs the blue color light into the second pixel **140-1** that outputs the green color light, and the first lateral leakage current LC**1** may flow from the second pixel **140-1** that outputs the green color light into the first pixel **120** that outputs the red color light. However, the second lateral leakage current LC**2** flowing from the third pixel **160** into the second pixel **140-1** may not generate a big problem because a light emission of the second pixel **140-1** that outputs the green color light is not greatly affected by the second lateral leakage current LC**2**. On the other hand, the first lateral leakage current LC**1** flowing from the second pixel **140-1** into the first pixel **120** may generate a big problem because a light emission of the first pixel **120** that outputs the red color light is greatly affected by the first lateral leakage current LC**1**. For example, as illustrated in FIG. **6**, when a low-grayscale is implemented, the first pixel **120** that outputs the red color light may be over-emitted by the first lateral leakage current LC**1** flowing from the second pixel **140-1** into the first pixel **120**, and thus a low-grayscale color-shift phenomenon in which an image becomes reddish may occur (i.e., indicated by a first color shift DI' on color coordinates). To prevent (or reduce) the low-grayscale color-shift phenomenon, the display panel **100** according to the invention may have a pixel arrangement structure in which the first distance L**1** between the anode **125** of the first organic light emitting element OLED-R of the first pixel **120** and the anode **145** of the second organic light emitting element OLED-G of the second pixel **140** is longer than the second distance L**2** between the anode **145** of the second organic light emitting element OLED-G of the second pixel **140** and the anode **165** of the third organic light emitting element OLED-B of the third pixel **160**. Thus, the display panel **100** may reduce the first lateral leakage current LC**1** flowing from the second pixel **140** that outputs the green color light into the first pixel **120** that outputs the red color light by increasing the first lateral resistance LR**1** existing between the first pixel **120** that outputs the red color light and the second pixel **140** that outputs the green color light. Here, although the second lateral resistance LR**2** existing between the third pixel **160** and the second pixel **140** is decreased (i.e., the second lateral leakage current LC**2** flowing from the third pixel **160** into the second pixel **140** is increased), as described above, an influence of the second lateral leakage current LC**2** on the second pixel **140** may be negligible. As a result, the low-grayscale color-shift phenomenon in which an image becomes reddish may be reduced (i.e., indicated by a second color shift DI**2** on color coordinates).

[0052] FIG. **7** is a block diagram illustrating an exemplary embodiment of an organic light emitting display device according to the invention.

[0053] Referring to FIG. **7**, the organic light emitting display device **500** may include a display panel **510** and a display panel driving circuit **520**.

[0054] The display panel **510** may include a plurality of pixels. Here, the pixels may include a plurality of first pixels each including a first organic light emitting element that outputs a red color light, a plurality of second pixels each including a second organic light emitting element that outputs a green color light, and a plurality of third pixels each including a third organic light emitting element that outputs a blue color light. Specifically, in the display panel **510**, the first organic light emitting elements of the first pixels are arranged in point symmetry with respect to the second organic light emitting element of the second pixel, the third organic light emitting elements of the third pixels are arranged in point symmetry with respect to the second organic light emitting element of the second pixel, an anode of the first organic light emitting element of the first pixel may be spaced apart from an anode of the second organic light emitting element of the second pixel by a first distance, the anode of the second organic light emitting element of the second pixel may be spaced apart from an anode of the third organic light emitting element of the third pixel by a second distance, the anode of the third organic light emitting element of the third pixel may be spaced apart from the anode of the first organic light emitting element of the first pixel by a third distance, the first distance is longer than the second distance, and the third distance may be longer than the first distance and the second distance. Here, one side of the anode of the second organic light emitting element of the second pixel may be parallel with at least one side of the anode of the first organic light emitting element of the first pixel, and another side of the anode of the second organic light emitting element of the second pixel may be parallel with at least one side of the anode of the third organic light emitting element of the third pixel.

[0055] In some exemplary embodiments, the anode of the second organic light emitting element of the second pixel may have an octagonal shape, and each of the anode of the first organic light emitting element of the first pixel and the anode of the third organic light emitting element of the third pixel may have a polygonal shape. Here, a major axis (i.e., longitudinal axis) of the anode of the second organic light emitting element of the second pixel may extend in a direction toward the anode of the third organic light emitting element of the third pixel, and a minor axis (i.e., latitudinal axis) of the anode of the second organic light emitting element of the second pixel may extend in a direction toward the anode of the first organic light emitting element of the first pixel. Thus, the first distance by which the anode of the first organic light emitting element of the first pixel is spaced apart from the anode of the second organic light emitting element of the second pixel is longer than the second distance by which the anode of the third organic light emitting element of the third pixel is spaced apart from the anode of the second organic light emitting element of the second pixel. Hence, the first lateral resistance existing between the first pixel that outputs the red color light and the second pixel that outputs the green color light may be higher (or greater) than the second lateral resistance existing between the second pixel that outputs the green color light and the third pixel that outputs the blue color light. That is, as compared to a conventional display panel, the first lateral resistance existing between the first pixel that outputs the red color light and the second pixel that outputs the green color light is relatively high, and thus a first lateral leakage current flowing from the second pixel that outputs the green color light into the first pixel that outputs the red color light when a low-grayscale is implemented may be reduced in the display panel **510**. As a result, as compared to the conventional display panel, a low-grayscale color shift phenomenon in which an image becomes reddish may be prevented (or reduced) in the display panel **510** according to the invention because an amount of additional light emission of the first pixel, which outputs the red color light, due to the first lateral leakage current flowing from the second pixel into the first pixel when a low-grayscale is implemented, is reduced in the display panel **510**. Therefore, the organic light emitting display device **500** may provide a high-quality image to a viewer.

[0056] In an exemplary embodiment, an area of the anode of the first organic light emitting element of the first pixel may be different from an area of the anode of the third organic light emitting element of the third pixel. For example, the area of the anode of the first organic light emitting element of the first pixel may be smaller than the area of the anode of the third organic light emitting element of the third pixel. Here, the area of the anode of the second organic light emitting element of the second pixel may be smaller than the area of the anode of the first organic light emitting element of the first pixel. In another exemplary embodiment, the area of the anode of the first organic light emitting element of the first pixel may be equal to the area of the anode of the third organic light emitting element of the third pixel. Here, the area of the anode of the second organic light emitting element of the second pixel may be smaller than the area of the anode of the first organic light emitting element of the first pixel and the area of the anode of the third organic light emitting element of the third pixel. Since these are described above with reference to FIGS. **1** to **3**, duplicated description related thereto will not be repeated. In exemplary embodiments, the display panel driving circuit **520** may drive the display panel **510**. For this operation, the display panel driving circuit **520** may include a scan driver, a data driver, a timing controller, etc. In some exemplary embodiments, the display panel driving circuit **520** may further include an emission control driver. The display panel **510** may be connected to the data driver via a plurality of data-lines. The display panel **510** may be connected to the scan driver via a plurality of scan-lines. The display panel **510** may be connected to the emission control driver via a plurality of emission control-lines. Specifically, the data driver may provide a data signal DS to the display panel **510** via the data-lines, the scan driver may provide a scan signal SS to the display panel **510** via the scan-lines, and the emission control driver may provide an emission control signal ES to the display panel **510** via the emission control-lines. The timing controller may control the scan driver, the data driver, the emission control driver, etc.

[0057] FIG. **8** is a block diagram illustrating an exemplary embodiment of an electronic device according to the invention, and FIG. **9** is a diagram illustrating an example in which the electronic device of FIG. **8** is implemented as a smart phone.

[0058] Referring to FIGS. **8** and **9**, the electronic device **1000** may include a processor **1010**, a memory device **1020**, a storage device **1030**, an input/output (I/O) device **1040**, a power supply **1050**, and an organic light emitting display device **1060**. Here, the organic light emitting display device **1060** may be the same with the organic light emitting display device **500** of FIG. **7**. In addition, the electronic device **1000** may further include a plurality of ports for communicating with a video card, a sound card, a memory card, a universal serial bus ("USB") device, other electronic devices, etc. In an exemplary embodiment, as illustrated in FIG. **9**, the electronic device **1000** may be implemented as a smart phone. However, the electronic device **1000** according to the invention is not limited thereto. For example, the electronic device **1000** may be implemented as a cellular phone, a video phone, a smart pad, a smart watch, a tablet PC, a car navigation system, a computer monitor, a laptop, a head mounted display ("MID") device, etc.

[0059] The processor **1010** may perform various computing functions. The processor **1010** may be a microprocessor, a central processing unit ("CPU"), an application processor ("AP"), etc. The processor **1010** may be coupled to other components via an address bus, a control bus, a data bus, etc. Further, the processor **1010** may be coupled to an extended bus such as a peripheral component interconnection ("PCI") bus. The memory device **1020** may store data for operations of the electronic device **1000**. For example, the memory device **1020** may include at least one non-volatile memory device such as an erasable programmable read-only memory ("EPROM") device, an electrically erasable programmable read-only memory ("EEPROM") device, a flash memory device, a phase change random access memory ("PRAM)" device, a resistance random access memory ("RRAM") device, a nano floating gate memory ("NFGM") device, a polymer random access memory ("PoRAM") device, a magnetic random access memory ("MRAM") device, a ferroelectric random access memory ("FRAM") device, etc and/or at least one volatile memory device such as a dynamic random access memory ("DRAM") device, a static random access memory ("SRAM") device, a mobile DRAM device, etc. The storage device **1030** may include a solid state drive ("SSD") device, a hard disk drive ("HDD") device, a CD-ROM device, etc. The I/O device **1040** may include an input device such as a keyboard, a keypad, a mouse device, a touch-pad, a touch-screen, etc, and an output device such as a printer, a speaker, etc. The power supply **1050** may provide power for operations of the electronic device **1000**.

[0060] The organic light emitting display device **1060** may be coupled to other components via the buses or other communication links. In some exemplary embodiments, the organic light emitting display device **1060** may be included in the I/O device **1040**. As described above, the organic light emitting display device **1060** may include a display panel that can prevent (or reduce) a low-grayscale color shift phenomenon in which an image becomes reddish when a low-grayscale is implemented and a display panel driving circuit that drives the display panel. For this operation, the display panel may include first pixels each including a first organic light emitting element that outputs a red color light, second pixels each including a second organic light emitting element that outputs a green color light, and third pixels each including a third organic light emitting element that outputs a blue color light. Here, the display panel are a pixel arrangement structure in which the first organic light emitting elements are arranged in point symmetry with respect to the second organic light emitting element, the third organic light emitting elements are arranged in point symmetry with respect to the second organic light emitting element, an anode of the first organic light emitting element is spaced apart from an anode of the second organic light emitting element by a first distance, and the anode of the second organic light emitting element is spaced apart from an anode of the third organic light emitting element by a second distance, where the first distance is longer than the second distance. Thus, the display panel may reduce a lateral leakage current flowing from the second pixel that outputs the green color light into the first pixel that outputs the red color light by relatively increasing a lateral resistance existing between the second pixel that outputs the green color light and the first pixel that outputs the red color light. As a result, the display panel may prevent (or reduce) the low-grayscale color shift phenomenon, and the organic light emitting display device **1060** including the display panel may provide a high-quality image to a viewer. Since these are described above, duplicated description related thereto will not be repeated.

[0061] The inventive concept may be applied to an organic light emitting display device and an electronic device including the organic light emitting display device. For example, the inventive concept may be applied to a cellular phone, a smart phone, a video phone, a smart pad, a smart watch, a tablet PC, a car navigation system, a television, a computer monitor, a laptop, a head mounted display (HMD) device, an MP3 player, etc.

[0062] The foregoing is illustrative of exemplary embodiments and is not to be construed as limiting thereof. Although a few exemplary embodiments have been described, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of the inventive concept. Accordingly, all such modifications are intended to be included within the scope of the inventive concept as defined in the claims. Therefore, it is to be understood that the foregoing is illustrative of various exemplary embodiments and is not to be construed as limited to the specific exemplary embodiments disclosed, and that modifications to the disclosed exemplary embodiments, as well as other exemplary embodiments, are intended to be included within the scope of the appended claims.

What is claimed is:

1. A display panel comprising:

a plurality of first pixels, wherein each of the plurality of first pixels includes a first organic light emitting element which outputs a red color light;

a plurality of second pixels, wherein each of the plurality of second pixels includes a second organic light emitting element which outputs a green color light; and

a plurality of third pixels, wherein each of the plurality of third pixels includes a third organic light emitting element which outputs a blue color light,

wherein the first organic light emitting elements are arranged in point symmetry with respect to the second organic light emitting element, the third organic light emitting elements are arranged in point symmetry with respect to the second organic light emitting element, an anode of the first organic light emitting element is spaced apart from an anode of the second organic light emitting element by a first distance, the anode of the second organic light emitting element is spaced apart from an anode of the third organic light emitting element by a second distance, and the first distance is longer than the second distance.

2. The display panel of claim **1**, wherein the anode of the third organic light emitting element is spaced apart from the anode of the first organic light emitting element by a third distance, and the third distance is longer than the first distance.

3. The display panel of claim **2**, wherein one side of the anode of the second organic light emitting element is parallel with at least one side of the anode of the first organic light emitting element, and another side of the anode of the second organic light emitting element is parallel with at least one side of the anode of the third organic light emitting element.

4. The display panel of claim **1**, wherein the anode of the second organic light emitting element has an octagonal shape, and each of the anode of the first organic light emitting element and the anode of the third organic light emitting element has a polygonal shape.

5. The display panel of claim **4**, wherein a major axis of the anode of the second organic light emitting element extends in a direction toward the anode of the third organic light emitting element, and a minor axis of the anode of the second organic light emitting element extends in a direction toward the anode of the first organic light emitting element.

6. The display panel of claim **1**, wherein an area of the anode of the first organic light emitting element is different from an area of the anode of the third organic light emitting element.

7. The display panel of claim **6**, wherein the area of the anode of the first organic light emitting element is smaller than the area of the anode of the third organic light emitting element.

8. The display panel of claim **7**, wherein an area of the anode of the second organic light emitting element is smaller than the area of the anode of the first organic light emitting element.

9. The display panel of claim **1**, wherein an area of the anode of the first organic light emitting element is equal to an area of the anode of the third organic light emitting element.

10. The display panel of claim **9**, wherein an area of the anode of the second organic light emitting element is smaller than the area of the anode of the first organic light emitting element and the area of the anode of the third organic light emitting element.

11. An organic light emitting display device comprising:

a display panel which includes a plurality of first pixels each including a first organic light emitting element which outputs a red color light, a plurality of second pixels each including a second organic light emitting element which outputs a green color light, and a plurality of third pixels each including a third organic light emitting element which outputs a blue color light; and

a display panel driving circuit which drives the display panel,

wherein the display panel has a pixel arrangement structure in which the first organic light emitting elements are arranged in point symmetry with respect to the second organic light emitting element, the third organic light emitting elements are arranged in point symmetry with respect to the second organic light emitting element, an anode of the first organic light emitting element is spaced apart from an anode of the second organic light emitting element by a first distance, the anode of the second organic light emitting element is spaced apart from an anode of the third organic light emitting element by a second distance, and the first distance is longer than the second distance.

12. The display device of claim **11**, wherein the anode of the third organic light emitting element is spaced apart from the anode of the first organic light emitting element by a third distance, and the third distance is longer than the first distance.

13. The display device of claim **12**, wherein one side of the anode of the second organic light emitting element is parallel with at least one side of the anode of the first organic light emitting element, and another side of the anode of the second organic light emitting element is parallel with at least one side of the anode of the third organic light emitting element.

14. The display device of claim **11**, wherein the anode of the second organic light emitting element has an octagonal shape, and each of the anode of the first organic light emitting element and the anode of the third organic light emitting element has a polygonal shape.

15. The display device of claim **14**, wherein a major axis of the anode of the second organic light emitting element extends in a direction toward the anode of the third organic light emitting element, and a minor axis of the anode of the second organic light emitting element extends in a direction toward the anode of the first organic light emitting element.

16. The display device of claim **11**, wherein an area of the anode of the first organic light emitting element is different from an area of the anode of the third organic light emitting element.

17. The display device of claim **16**, wherein the area of the anode of the first organic light emitting element is smaller than the area of the anode of the third organic light emitting element.

18. The display device of claim **17**, wherein an area of the anode of the second organic light emitting element is smaller than the area of the anode of the first organic light emitting element.

19. The display device of claim **11**, wherein an area of the anode of the first organic light emitting element is equal to an area of the anode of the third organic light emitting element.

20. The display device of claim **19**, wherein an area of the anode of the second organic light emitting element is smaller than the area of the anode of the first organic light emitting element and the area of the anode of the third organic light emitting element.

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专利名称(译)	显示面板和包括该显示面板的有机发光显示装置		
公开(公告)号	US20200152713A1	公开(公告)日	2020-05-14
申请号	US16/599591	申请日	2019-10-11
[标]申请(专利权)人(译)	三星显示有限公司		
申请(专利权)人(译)	三星DISPLAY CO.，LTD.		
当前申请(专利权)人(译)	三星DISPLAY CO.，LTD.		
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IPC分类号	H01L27/32 H01L51/52		
CPC分类号	H01L51/5206 H01L27/3218		
优先权	1020180137892 2018-11-12 KR		
外部链接	Espacenet USPTO		

摘要(译)

显示面板包括：第一像素，每个包括输出红色光的第一有机发光元件；第二像素，每个包括输出绿色光的第二有机发光元件；第三像素，每个像素包括输出蓝色的第三有机发光元件 彩色光。 第一有机发光元件相对于第二有机发光元件以点对称的方式布置，第三有机发光元件相对于第二有机发光元件以点对称的方式布置，第一有机发光元件的阳极 元件与第二有机发光元件的阳极隔开第一距离，并且第二有机发光元件的阳极与第三有机发光元件的阳极隔开第二距离，该第二距离比第二有机发光元件的阳极短。 第一距离。