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| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

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**FOREIGN PATENT DOCUMENTS**

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|---|---|---|---|---|---|
| | | CN 101009304 A | 08-01-2007 | Zhao et al. | Abstract |
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**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
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PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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/Elizabeth Gomez/
Elizabeth Gomez

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| Inventor(s) | : Sang-Shin Lee | Confirmation No. 4264 |
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| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| Grp./Div. | : 2691 | |
| Examiner | : Kwang-Su Yang | |
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Enclosed is FORM PTO/SB/08A/B listing a reference that is known to applicant. This filing is being made only to place the listed reference in the application file as described in 37 CFR § 1.97(i) as record only.

Respectfully submitted,
LEWIS ROCA ROTHGERBER CHRISTIE LLP

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## Pixel structure and organic EL component


**Inventor(s):** ZHAO QINGYAN XIAO [CN] ± (QINGYAN,XIAO ZHAO, ; ZHAO QINGYAN, ; XIAO XIACAI, ; WU GUANLONG, ; HUANG SHUHUI)

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**Classification:** **- international:** ***H01L23/522; H01L27/32; H05B33/10; H05B33/12***
**- cooperative:**

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## Abstract of CN101009304 (A)


The invention provides a pixel structure and organic electric exciting light discreteness, the pixel structure includes: base plate which includes film transistor; protecting layer which covers the base plate; the first electrode which is formed on the protecting layer and includes the first secondary electrode and the second secondary electrode, the first secondary electrode is electric connected with the film transistor; insulation layer covered part of the first electrode, the first secondary electrode and the second secondary electrode of the first electrode are separately defined as the first irradiance area and the second irradiance area; column object which is set on the insulation layer and surrounds the first irradiance area; the first organic irradiance layer which covers the first secondary electrode of the first electrode; the second organic irradiance layer which covers the second secondary electrode of the first electrode; the second electrode includes the first secondary electrode and the second secondary electrode, the first secondary electrode of the second electrode is formed on the first organic irradiance layer, and electric connected with the second secondary electrode of the first electrode to form series contacting area, the second secondary electrode of the second electrode is formed on the second organic irradiance layer.




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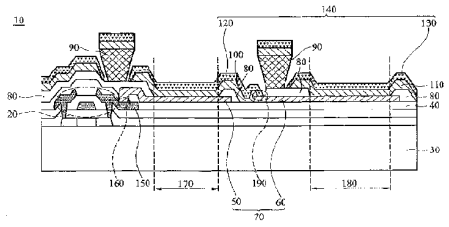
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权利要求书 4 页 说明书 7 页 附图 7 页

[54] 发明名称

# 像素结构及有机电激发光组件

[57] 摘要

本发明提供一种像素结构及有机电激发光组件，该像素结构包括：基板，包含薄膜晶体管；保护层，覆盖于基板上；第一电极，形成于保护层上，包含第一次电极与第二次电极，第一次电极与薄膜晶体管电连接；绝缘层，覆盖于第一电极的部分区域，第一电极露出的第一次电极与第二次电极分别定义为第一发光区与第二发光区；柱状物，设置于绝缘层上，包围第一发光区；第一有机发光层，覆盖于第一电极的第一次电极上；第二有机发光层，覆盖于第一电极的第二次电极上；及第二电极，包含第一次电极与第二次电极，第二电极的第一次电极形成于第一有机发光层上，并与第一电极的第二次电极电连接，以形成串联接触区，第二电极的第二次电极形成于第二有机发光层上。



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1. 一种像素结构，包括：

一基板，包含一薄膜晶体管；

一保护层，覆盖于该基板上；

一第一电极，形成于该保护层上，该第一电极包含一第一次电极与一第二次电极，其中该第一电极的第一次电极与该薄膜晶体管电连接；

一绝缘层，覆盖于该第一电极的部分区域，该第一电极的露出的第一次电极与该第一电极的露出的第二次电极分别定义为一第一发光区与一第二发光区；

一柱状物，设置于该绝缘层上，包围该第一发光区；

一第一有机发光层，覆盖于该第一电极的第一次电极上；

一第二有机发光层，覆盖于该第一电极的第二次电极上；以及

一第二电极，包含一第一次电极与一第二次电极，该第二电极的第一次电极形成于该第一有机发光层上，并与该第一电极的第二次电极电连接，以形成一串联接触区，该第二电极的第二次电极形成于该第二有机发光层上。

2. 如权利要求 1 所述的像素结构，其中该串联接触区位于该第一与第二发光区之间。

3. 如权利要求 1 所述的像素结构，其中该串联接触区位于该第一与第二发光区的外围。

4. 如权利要求 3 所述的像素结构，其中该像素结构还包括一金属线，该第一电极的第二次电极与该金属线电连接。

5. 如权利要求 4 所述的像素结构，其中该金属线位于该第一与第二发光区的外侧。

6. 如权利要求 1 所述的像素结构，其中该串联接触区位于该柱状物的投影区域内。

7. 如权利要求 6 所述的像素结构，其中该投影区域的宽度近似介于 3~10 微米之间。

8. 如权利要求 1 所述的像素结构，其中该第一电极的第一次电极、该第一有机发光层与该第二电极的第一次电极构成一第一发光组件，该第一电极



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的第二次电极、该第二有机发光层与该第二电极的第二次电极构成一第二发光组件，所述发光组件为下发光组件。

9. 如权利要求 8 所述的像素结构，其中该第一电极包含铟锡氧化物、铟锌氧化物或铝锌氧化物。

10. 如权利要求 8 所述的像素结构，其中该第二电极包含铝金属。

11. 如权利要求 1 所述的像素结构，其中该第一电极的第一次电极、该第一有机发光层与该第二电极的第一次电极构成一第一发光组件，该第一电极的第二次电极、该第二有机发光层与该第二电极的第二次电极构成一第二发光组件，所述发光组件为上发光组件。

12. 如权利要求 11 所述的像素结构，其中该第一电极包含铝金属。

13. 如权利要求 11 所述的像素结构，其中该第二电极包含铟锡氧化物、铟锌氧化物或铝锌氧化物。

14. 如权利要求 1 所述的像素结构，其中该绝缘层由氧化硅、氮化硅、氮氧化硅或光致抗蚀剂构成。

15. 如权利要求 1 所述的像素结构，其中该柱状物呈上宽下窄的倒梯形。

16. 如权利要求 1 所述的像素结构，其中该第一与第二发光区组成一像素单元。

17. 如权利要求 1 所述的像素结构，其中该第一与第二发光区的面积相等。

18. 如权利要求 1 所述的像素结构，其中该第一与第二发光区的总面积小于 1 平方厘米。

19. 一种像素结构，包括：

一基板，包含一薄膜晶体管；

一保护层，覆盖于该基板上；

一第一电极，形成于该保护层上，包含 N 个（N 为整数，且 N≥2）次电极，其中该第一电极的一第一次电极与该薄膜晶体管电连接；

一绝缘层，覆盖于该第一电极的部分区域，该第一电极的露出的所述 N 个次电极分别定义为一第一发光区至一第 N 发光区；

至少一柱状物，设置于该绝缘层上，分别包围该第一发光区至该第 N-1 发光区；



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一有机发光层，覆盖于该第一电极的所述发光区上；以及

一第二电极，包含N个（N为整数，且N≥2）次电极，所述N个次电极设置于该有机发光层上且分别对应于该第一电极的所述N个次电极，其中该第二电极的第一次电极至第N-1次电极分别与相邻发光区的该第一电极电连接并且形成至少一串联接触区。

20. 如权利要求19所述的像素结构，其中所述至少一串联接触区位于所述发光区之间。

21. 如权利要求19所述的像素结构，其中所述至少一串联接触区位于所述发光区的外围。

22. 如权利要求21所述的像素结构，其中该像素结构还包括至少一金属线，其设置于所述发光区的外侧，该第一电极的次电极与所述至少一金属线电连接。

23. 如权利要求19所述的像素结构，其中所述至少一串联接触区位于所述至少一柱状物的投影区域内。

24. 如权利要求23所述的像素结构，其中该投影区域的宽度近似介于3~10微米之间。

25. 如权利要求19所述的像素结构，其中所述至少一柱状物呈上宽下窄的倒梯形。

26. 权利要求19所述的像素结构，其中所述N个发光区组成一像素单元。

27. 如权利要求19所述的像素结构，其中所述N个发光区的面积实质上相等。

28. 一种有机电激发光组件，包括：

一基板；

多个第一像素、多个第二像素与多个第三像素，所述像素设置于该基板上，其中每一第一像素、第二像素与第三像素分别通过柱状物分割成N个次像素且所述N个次像素间电串联连接，并且所述第一像素、第二像素与第三像素的柱状物之间形成一空隙；以及

一电极，形成于所述第一像素、第二像素与第三像素上，其中位于所述第N个次像素上的电极通过该空隙彼此电连接。



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29. 如权利要求 28 所述的有机电激发光组件，其中所述第一像素为红色像素、所述第二像素为绿色像素以及所述第三像素为蓝色像素。

30. 如权利要求 28 所述的有机电激发光组件，其中所述第一像素、第二像素与第三像素间的柱状物之间的空隙介于 1 微米至 50 微米之间。

31. 如权利要求 28 所述的有机电激发光组件，其中位于所述第 N 个次像素上的电极为共同电极。



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# 像素结构及有机电激发光组件

## 技术领域

本发明涉及一种串联式的发光组件结构，尤其涉及一种像素结构及有机电激发光组件。

## 背景技术

目前，有源式有机电激发光二极管（OLED）面板的全彩显示是由RGB（红绿蓝）次像素所组成，而每一次像素是由一组薄膜晶体管电路连接一有机电激发光二极管组件所构成。由于有机电激发光二极管属于一种电流驱动的薄膜组件，因此，已有的有源驱动结构会有如下缺点，例如高耗能、微粒敏感性过高、多暗点或不适用于非晶硅薄膜晶体管背板等。

为解决前述问题，例如面板次像素结构利用有源驱动电路（至少2T1C）结构来驱动两个或两个以上的串联式有机电激发光二极管。

然而，传统上利用荫罩（shadow mask）来制造串联式有机电激发光二极管，仅适合于大尺寸的照明应用上，在制造面板上的微小次像素时并不适用。另外，已有技术是将较大尺寸的有机电激发光二极管或模块串联起来以作为照明光源或是文字显示上的应用。

## 发明内容

本发明的目的在于提供一种像素结构及有机电激发光组件，其可在薄膜晶体管背板上制造出微小尺寸的串联式有机电激发光二极管，以应用在有源式有机电激发光二极管面板中的次像素上。

本发明的像素结构包括：一基板，包含一薄膜晶体管；一保护层，覆盖于该基板上；一第一电极，形成于该保护层上，该第一电极包含一第一次电极与一第二次电极，其中该第一电极的第一次电极与该薄膜晶体管电连接；一绝缘层，覆盖于该第一电极的部分区域，该第一电极露出的第一次电极与第二次电极分别定义为一第一发光区与一第二发光区；一柱状物（pillar），



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设置于该绝缘层上，包围该第一发光区；一第一有机发光层，覆盖于该第一电极的第一次电极上；一第二有机发光层，覆盖于该第一电极的第二次电极上；以及一第二电极，包含一第一次电极与一第二次电极，该第二电极的第一次电极形成于该第一有机发光层上，并与该第一电极的第二次电极电连接，以形成一串联接触区，该第二电极的第二次电极形成于该第二有机发光层上。

本发明的像素结构包括：一基板，包含一薄膜晶体管；一保护层，覆盖于该基板上；一第一电极，形成于该保护层上，包含 N 个（N 为整数，且 N≥2）次电极，其中该第一电极的一第一次电极与该薄膜晶体管电连接；一绝缘层，覆盖于该第一电极的部分区域，该第一电极露出的该 N 个次电极分别定义为一第一发光区至一第 N 发光区；至少一柱状物，设置于该绝缘层上，分别包围该第一发光区至该第 N-1 发光区；一有机发光层，覆盖于该第一电极的所述发光区上；以及一第二电极，包含 N 个（N 为整数，且 N≥2）次电极，设置于该有机发光层上且分别对应于该第一电极的该 N 个次电极，其中该第二电极的第一次电极至第 N-1 次电极分别与相邻发光区的该第一电极电连接并且形成至少一串联接触区。

本发明的有机电激发光组件包括：一基板；多个第一像素、多个第二像素与多个第三像素，设置于该基板上，其中每一第一像素、第二像素与第三像素分别通过柱状物分割成 N 个次像素且该 N 个次像素间电串联连接，并且所述第一像素、第二像素与第三像素间的柱状物之间形成一空隙；以及一电极，形成于所述第一像素、第二像素与第三像素上，其中位于所述第 N 个次像素上的电极通过该空隙彼此电连接。

本发明的有益技术效果在于：由于面板次像素结构中的有机电激发光二极管是由两个或两个以上（N 为整数，且 N≥2）的串联有机电激发光二极管组成，因此，所需的驱动电流可降低为原先的 N 分之一，故本发明具有降低薄膜晶体管耗能、减少暗点、提高生产合格率、并较已有技术更适合应用在非晶硅薄膜晶体管上、有利于大尺寸面板制造等优点，同时可因面板升温较小而延长有机电激发光二极管的操作寿命。

为让本发明的上述目的、特征及优点能更明显易懂，下文特举一较佳实施例，并配合附图，作详细说明如下。



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## 附图说明

图 1 为本发明像素结构一实施例的剖面示意图。

图 2A 为本发明像素结构一实施例的示意性俯视图。

图 2B 为图 2A 沿 2B-2B 剖面线所得的剖面示意图。

图 3 为本发明像素结构另一实施例的剖面示意图。

图 4A 为本发明像素结构另一实施例的示意性俯视图。

图 4B 为图 4A 沿 4B-4B 剖面线所得的剖面示意图。

图 5 为本发明有机电激发光组件一实施例的示意性俯视图。

其中，附图标记说明如下：

| | | |
|---|---|---|
| 10、10'像素结构 | 20 薄膜晶体管 | 30 基板 |
| 40 保护层 | 50、120 第一次电极 | 60、130、210 第二次电极 |
| 70 第一电极 | 80 绝缘层 | 90 柱状物 |
| 100 第一有机发光层 | 110 第二有机发光层 | 100'有机发光层 |
| 140、140'第二电极 | 150 源/漏极 | |
| 160 第一电极的第一次电极与薄膜晶体管电连接 | | |
| 170 第一发光区 | 180 第二发光区 | 170'发光区 |
| 190 串联接触区 | 200 像素单元 | 220 金属线 |
| 1 基板 | 2 第一像素 | 3 第二像素 |
| 4 第三像素 | 5 柱状物 | 6 次像素 |
| 7 空隙 | 8 电极 | |

## 具体实施方式

本发明提供一种像素结构，包括一基板、一保护层、一第一电极、一绝缘层、至少一柱状物、一有机发光层以及一第二电极。基板包含一薄膜晶体管；保护层覆盖于基板上；第一电极形成于保护层上，且包含 N 个（N 为整数，且 N≥2）次电极，其中第一电极的一第一次电极与薄膜晶体管电连接；绝缘层覆盖于第一电极的部分区域，且第一电极露出的 N 个次电极分别定义为一第一发光区、第二发光区至一第 N 发光区；柱状物设置于绝缘层上，并且分别包围第一发光区、第二发光区至第 N-1 发光区；有机发光层覆盖于第



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一电极的发光区上；第二电极包含 N 个（N 为整数，且 N≥2）次电极，设置于有机发光层上且分别对应于第一电极的 N 个次电极，其中第二电极的第一次电极至第 N-1 次电极分别与相邻发光区的第一电极电连接并且形成至少一串联接触区（例如第二电极的第一次电极与第一电极的第二次电极电连接，以形成一串联接触区）。

请参阅图 1 及图 2A、图 2B，其分别以剖面图及示意性俯视图说明本发明 N=2 时的像素结构。

请参阅图 1，此为像素结构 10 的剖面示意图。像素结构 10 包括一包含一薄膜晶体管 20 的基板 30、一保护层 40、一包含一第一次电极 50 与一第二次电极 60 的第一电极 70、一绝缘层 80、一柱状物 90、一第一有机发光层 100、一第二有机发光层 110 以及一包含一第一次电极 120 与一第二次电极 130 的第二电极 140。第一电极 70 的第一次电极 50 与第二次电极 60 彼此不相连接。

保护层 40 覆盖于基板 30 上，第一电极 70 形成于保护层 40 上，绝缘层 80 覆盖于第一电极 70 的部分区域，柱状物 90 设置于绝缘层 80 上，第一有机发光层 100 覆盖于第一电极 70 的第一次电极 50 上，第二有机发光层 110 覆盖于第一电极 70 的第二次电极 60 上，第二电极 140 的第一次电极 120 形成于第一有机发光层 100 上，以及第二电极 140 的第二次电极 130 形成于第二有机发光层 110 上。

上述结构中，第一电极 70 的第一次电极 50 与薄膜晶体管 20 的源/漏极 150 电连接 160。第一电极 70 中，未被绝缘层 80 覆盖的第一次电极 50 定义为一第一发光区 170，未被绝缘层 80 覆盖的第二次电极 60 定义为一第二发光区 180，而两发光区共同组成一像素单元。柱状物 90 包围第一发光区 170。第二电极 140 的第一次电极 120 与第一电极 70 的第二次电极 60 电连接，形成一串联接触区 190。串联接触区 190 位于第一发光区 170 与第二发光区 180 之间，且位于柱状物 90 的投影区域内。

薄膜晶体管 20 例如为一非晶硅（amorphours silicone）或多晶硅（poly-crsystalline silicone）薄膜晶体管。保护层 40 可由无机材料或有机材料构成。第一电极 70 可由铟锡氧化物（indium tin oxide, ITO）、铟锌氧化物（indium zinc oxide, IZO）或铝锌氧化物（aluminum zinc oxide, AZO）构成。



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绝缘层 80 可由氧化硅、氮化硅、氮氧化硅或光致抗蚀剂构成。第一发光区 170 与第二发光区 180 的面积近似相等，通常其总面积大约小于 1 平方厘米。柱状物 90 例如可为一上宽下窄的倒梯形，其投影区域的宽度大体介于 3~10 微米之间。第二电极 140 可由例如铝金属构成，其第二次电极 130 彼此间电连接而成为一共同电极（common electrode）。上述第一电极 70 的第一次电极 50、第一有机发光层 100 与第二电极 140 的第一次电极 120 构成一第一下发光（bottom-emission）组件。第一电极 70 的第二次电极 60、第二有机发光层 110 与第二电极 140 的第二次电极 130 构成一第二下发光组件。若上述第一电极 70 与第二电极 140 的材料作适当的改变，则可构成上发光（top-emission）组件。

请参阅图 2A、图 2B，图 2A 为图 1 所示的像素结构中，第一有机发光层 100、第二有机发光层 110 及第二电极 140 尚未形成前的示意性俯视图，而图 2B 则为图 2A 沿 2B-2B 剖面线所得的剖面示意图。如上所述，由第一电极 70 中未被绝缘层 80 覆盖的第一次电极 50 定义出的第一发光区 170 与未被绝缘层 80 覆盖的第二次电极 60 定义出的第二发光区 180 共同组成一像素单元 200，且柱状物 90 包围第一发光区 170。图 2A 中，位于第一发光区 170 与第二发光区 180 之间、邻接柱状物 90 的第二次电极区域 210 作为后续第二电极的第一次电极与第一电极 70 的第二次电极 60 两者间的串联接触区 190。由此，从图 1 中可更清楚地看出，后续形成的串联接触区 190 位于第一发光区 170 与第二发光区 180 之间且在柱状物 90 的投影区域内。

图 1 为下发光组件的实施例，若第一电极改用不透光的材料，如铝金属，第二电极改用透光的材料，如铟锡氧化物、铟锌氧化物或铝锌氧化物等材料，有机发光层材料经适当的调整，则可制造出上发光组件，其具有较大开口率的优点。

本发明可做进一步的延伸，将面板次像素结构中的第一电极分割成 N（N 为整数，且 N≥2）等份，再将绝缘层覆盖于部分的第一电极或其边缘上，在绝缘层上，再制造出柱状物，以使后续形成的第二电极能被其分开，且与柱状物底下的第一电极相互导通，形成一微小的串联式有机电激发光组件，作为面板的（次）像素。

本发明的目的是在薄膜晶体管背板上制造出微小尺寸的串联式有机电



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激发光二极管，以应用在有源式有机电激发光二极管面板中的次像素上。由于面板次像素结构中的有机电激发光二极管是由两个或两个以上(N为整数，且 N≥2）的串联有机电激发光二极管组成，因此，所需的驱动电流可降低为原先的N分之一，故本发明具有降低薄膜晶体管耗能、减少暗点、提高生产合格率、并较已有技术更适合应用在非晶硅薄膜晶体管上、有利于大尺寸面板制造等优点，同时可因面板升温较小而延长有机电激发光二极管的操作寿命。

请参阅图3及图4A、图4B，其分别以剖面图及示意性俯视图说明本发明N=2时的另一像素结构。

请参阅图3，此为像素结构10'的剖面示意图。由于像素结构10'与图1中所示的像素结构10具有相似的结构，故在下面仅详细说明其与图1的不同之处，相近似或相同的内容在此不再赘述。像素结构10'包括一具有一金属线（bus line）220的基板30、一包含一第一次电极50与一第二次电极60的第一电极70、一绝缘层80、一柱状物90、一有机发光层100'以及一第二电极140'。第一电极70的第一次电极50与第二次电极60彼此不相连接。

绝缘层80覆盖于第一电极70的部分区域，柱状物90设置于绝缘层80上，有机发光层100'覆盖于第一电极70的第一次电极50上，以及第二电极140'形成于有机发光层100'上。

上述结构中，第一电极70的第二次电极60与金属线220电连接，以降低其电阻。第一电极70中，未被绝缘层80覆盖的第一次电极50定义为一发光区（对应于前述实施例中的第一发光区）170'。柱状物90包围发光区170'。第二电极140'与第一电极70的第二次电极60电连接，形成一串联接触区190。串联接触区190位于发光区170'外围，且位于柱状物90的投影区域内。金属线220位于发光区170'外侧。

第一电极70可由铟锡氧化物、铟锌氧化物或铝锌氧化物构成。绝缘层80可由氧化硅、氮化硅、氮氧化硅或光致抗蚀剂构成。柱状物90例如为一上宽下窄的倒梯形，其投影区域的宽度大体介于3~10微米之间。第二电极140'可由铝金属构成。金属线220可在制造薄膜晶体管的栅极金属层时同时制造形成，以传输信号，驱动像素电路。

请参阅图4A、图4B，图4A为图3所示的像素结构中，有机发光层100'



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及第二电极 140'尚未形成前的示意性俯视图，而图 4B 则为图 4A 沿 4B-4B 剖面线所得的剖面示意图。如上所述，柱状物 90 包围发光区 170'。图 4A 中，位于发光区 170'外围、邻接柱状物 90 的第二次电极区域 210 是作为后续第二电极与第一电极 70 的第二次电极 60 两者间的串联接触区。由此，可更清楚地看出，后续形成的串联接触区位于发光区 170'外围，以及柱状物 90 的投影区域内，且与金属线 220 电连接。

图 3 为下发光组件的实施例，若第一电极改用不透光的材料，如铝金属，第二电极改用透光的材料，如铟锡氧化物、铟锌氧化物或铝锌氧化物等材料，有机发光层材料经适当的调整，则可制造出上发光组件，其具有较大开口率的优点。

请参阅图 5，其以一示意性俯视图说明本发明的一种有机电激发光组件。

有机电激发光组件包括：一基板 1；多个第一像素 2、多个第二像素 3 与多个第三像素 4，其设置于基板 1 上，其中每一第一像素 2、第二像素 3 与第三像素 4 分别通过柱状物 5 分割成 N 个次像素 6 且 N 个次像素 6 间彼此电串联连接，并且第一像素 2、第二像素 3 与第三像素 4 间的柱状物 5 之间形成一空隙 7；以及一电极 8，形成于第一像素 2、第二像素 3 与第三像素 4 上，其中位于第 N 个次像素 6 上的电极 8 通过空隙 7 彼此电连接。

第一像素 2 为红色像素、第二像素 3 为绿色像素以及第三像素 4 为蓝色像素。第一像素 2、第二像素 3 与第三像素 4 间的柱状物 5 之间的空隙 7 实质上介于 1 微米至 50 微米之间。位于第 N 个次像素 6 上的电极 8 为共同电极。

以上所述仅为本发明的优选实施例，然其并非用以限定本发明的保护范围，任何本领域的技术人员，在不脱离本发明的精神和范围内，可作更动与润饰。因此，本发明的权利保护范围应以后附的权利要求书所界定的范围为准。



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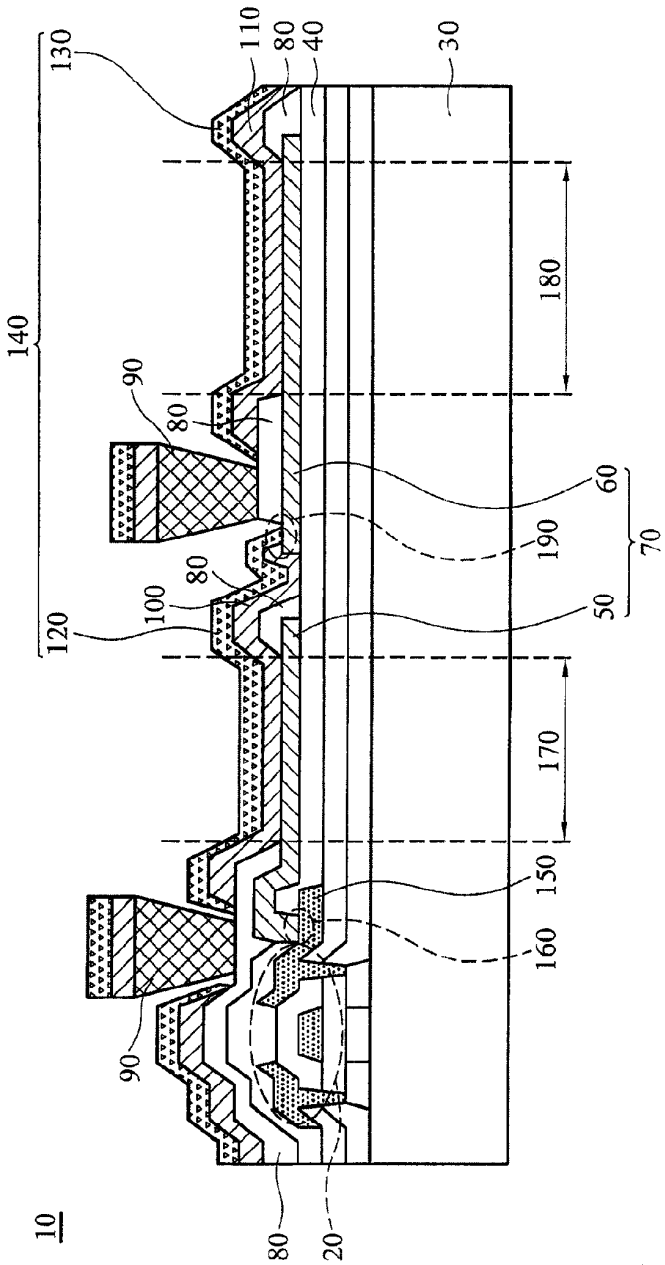



图1



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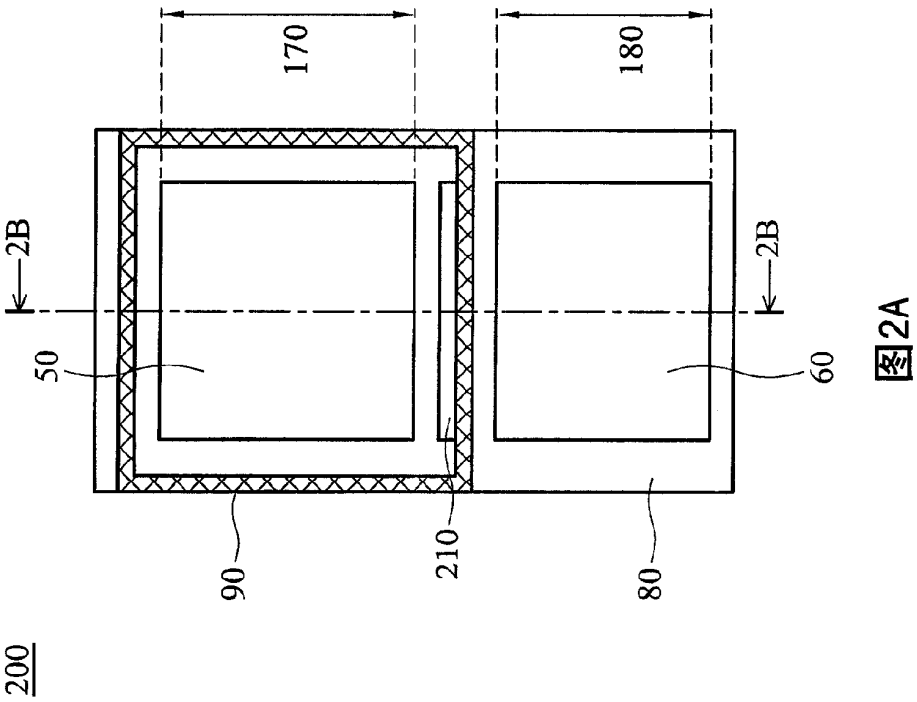



图2A



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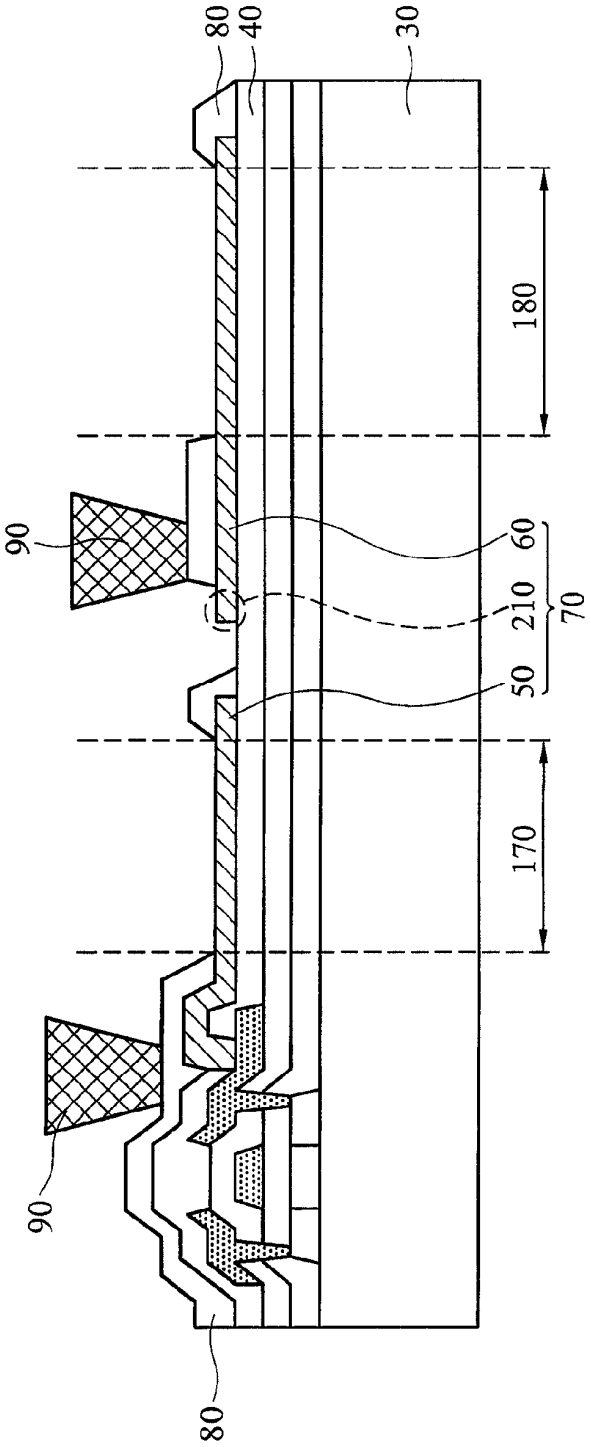



图2B



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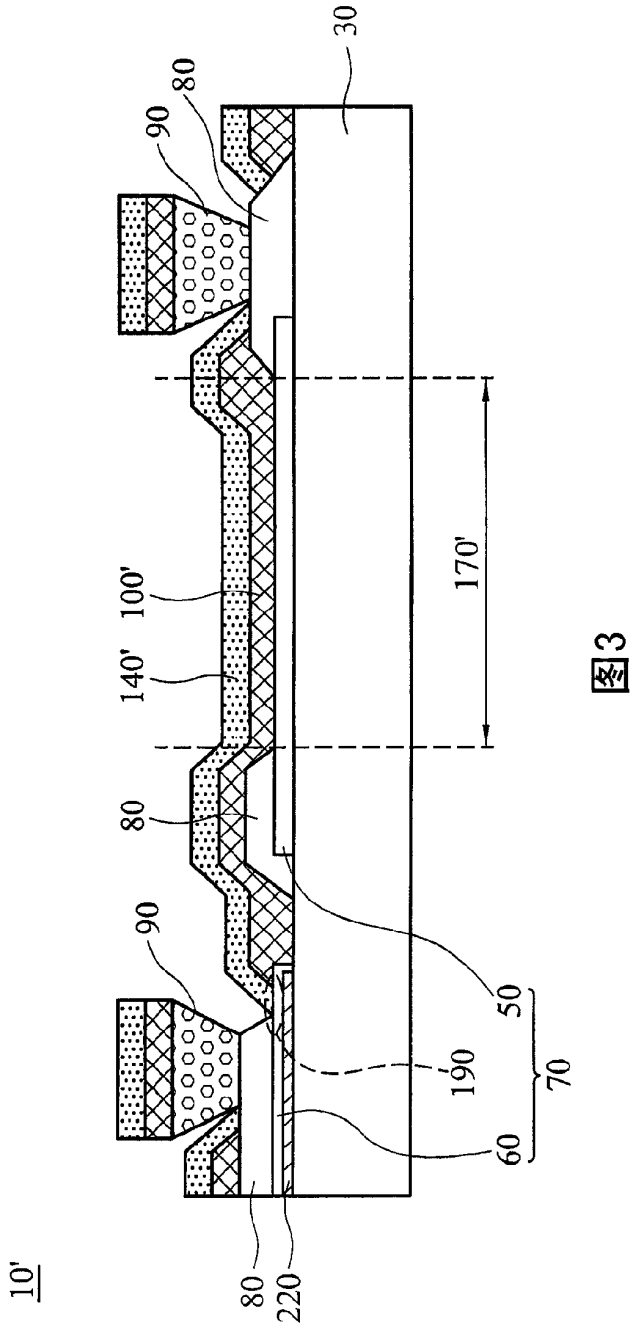



图3



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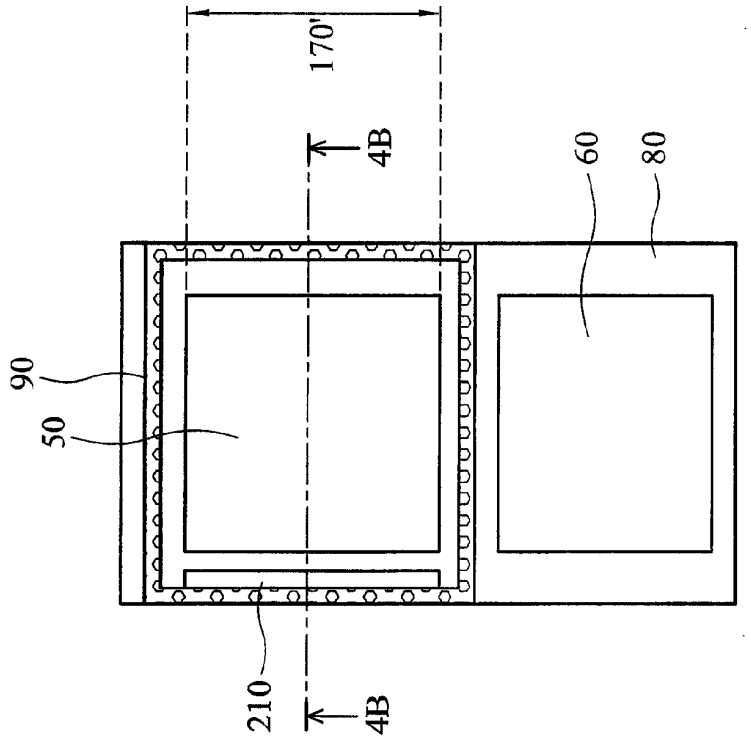



图4A



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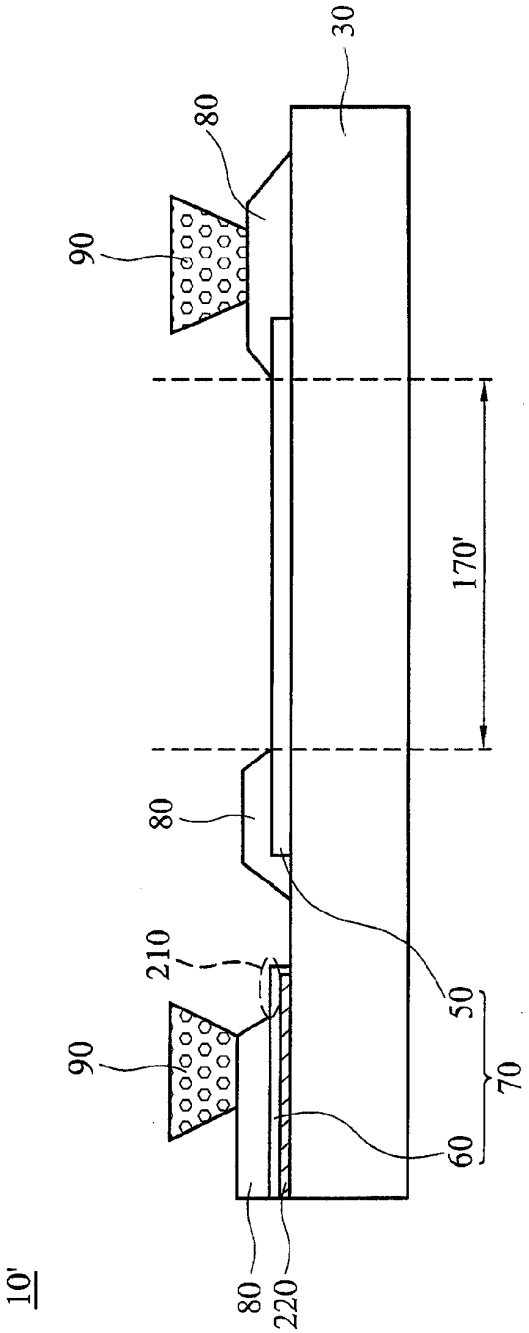



图4B



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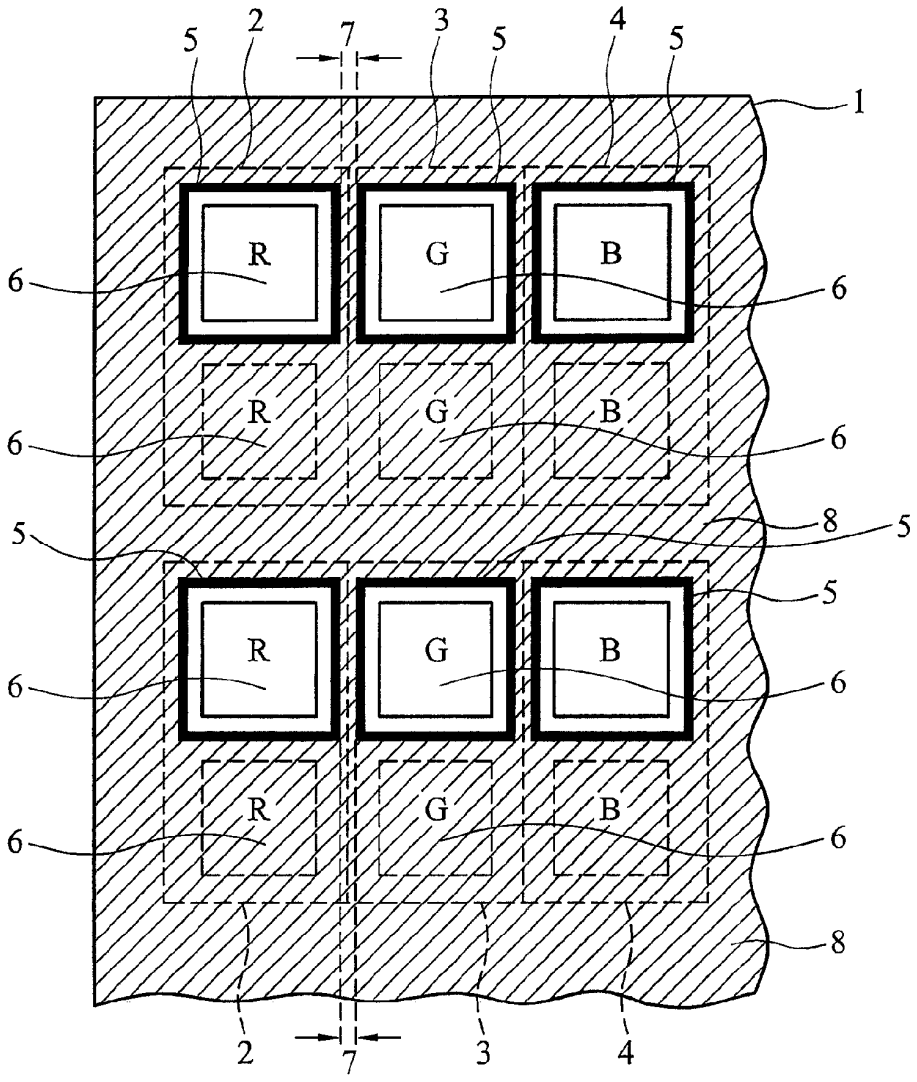



图5



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# Electronic Acknowledgement Receipt

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| **EFS ID:** | 30907091 |
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| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Young E. Jeon/Elizabeth Gomez |
| **Filer Authorized By:** | Jun-Young E. Jeon |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 09-NOV-2017 |
| **Filing Date:** | 13-SEP-2012 |
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| 13/614,197 | 11/14/2017 | 9818803 | 69657/S1437 | 4264 |

23363 7590 10/25/2017

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# ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

**Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)**
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 199 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Sang-Shin Lee, Yongin-si, KOREA, REPUBLIC OF;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

## PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail** **Mail Stop ISSUE FEE**
**Commissioner for Patents**
**P.O. Box 1450**
**Alexandria, Virginia 22313-1450**
**or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

23363 7590 07/11/2017
Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

**Certificate of Mailing or Transmission**
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

| | |
|---|---|
| Lisa Fluhr | (Depositor's name) |
| | (Signature) |
| October 10, 2017 (E-filed) | (Date) |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

TITLE OF INVENTION: PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | UNDISCOUNTED | $960 | $0 | $0 | $960 | 10/11/2017 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|---|---|---|
| YANG, KWANG-SU | 2691 | 345-082000 |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Lewis Roca Rothgerber Christie LLP
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Samsung Display Co., Ltd.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Yongin-si, Republic of Korea

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
☒ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies 0

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
☐ A check is enclosed.
☒ Payment by credit card.
☒ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 03-1728 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
☐ Applicant certifying micro entity status. See 37 CFR 1.29
NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
☐ Applicant asserting small entity status. See 37 CFR 1.27
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
☐ Applicant changing to regular undiscounted fee status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date October 10, 2017
Typed or printed name Jun-Young E. Jeon Registration No. 43,693



PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Petitioner Ex 1015, p. 26
BOE et al. v. Samsung, IPR2023-00988

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 13614197 |
| **Filing Date:** | 13-Sep-2012 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Filer:** | Jun-Young E. Jeon/Lisa Fluhr |
| **Attorney Docket Number:** | 69657/S1437 |

Filed as Large Entity

**Filing Fees for Utility under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| UTILITY APPL ISSUE FEE | 1501 | 1 | 960 | 960 |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Extension-of-Time:** | | | | |
| **Miscellaneous:** | | | | |
| | | **Total in USD ($)** | | **960** |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 30617063 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Young E. Jeon/Lisa Fluhr |
| **Filer Authorized By:** | Jun-Young E. Jeon |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 10-OCT-2017 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 18:09:16 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | CARD |
| Payment was successfully received in RAM | $960 |
| RAM confirmation Number | 101117INTEFSW18102000 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Issue Fee Payment (PTO-85B) | 069657_2017-10-10_ISSUE_FEE.PDF | 42315<br>a24dc155dbda13c9587b69468b32607eeda41794 | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 30514<br>9f6961fa7b732e464d1c98b6a1b6455566114972 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 72829 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 069657 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
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**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
| | | JP 10-39791 | 02-13-1998 | Nakamura et al. | Japan Patent Abstract |
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**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
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JEJ 101837553.1-*-07/11/2017 3:39 PM

| EXAMINER SIGNATURE | /KWANG-SU YANG/ | DATE CONSIDERED | 07/27/2017 |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

JEJ/eg



ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KY/

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | **Examiner** | **Art Unit** |
| | KWANG-SU YANG | 2691 |

| CPC | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | | | | | **Type** | **Version** |
| H01L | | 27 | / | 3216 | F | 2013-01-01 |
| H01L | | 27 | / | 3218 | I | 2013-01-01 |
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| CPC Combination Sets | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Symbol** | | | | | **Type** | **Set** | **Ranking** | **Version** |
| | | | / | | | | | |
| | | | / | | | | | |

| NONE | | **Total Claims Allowed:** | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 21 | |
| /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691 | 07/27/2017 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 5 |

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | **Examiner** | **Art Unit** |
| | KWANG-SU YANG | 2691 |

| US ORIGINAL CLASSIFICATION | | INTERNATIONAL CLASSIFICATION | |
|---|---|---|---|
| CLASS | SUBCLASS | CLAIMED | NON-CLAIMED |
| 345 | 82 | G 0 9 G 3 / 32 (2006.01.01) | |

| CROSS REFERENCE(S) | | | | | |
|---|---|---|---|---|---|
| CLASS | SUBCLASS (ONE SUBCLASS PER BLOCK) | | | | |
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|---|---|---|---|
| NONE | | **Total Claims Allowed:** | |
| (Assistant Examiner) | (Date) | 21 | |
| /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691 | 07/27/2017 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 5 |

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | **Examiner** | **Art Unit** |
| | KWANG-SU YANG | 2691 |

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 16 | 17 | | | | | | | | | | | | |
| 2 | 2 | 17 | 18 | | | | | | | | | | | | |
| 3 | 3 | 19 | 19 | | | | | | | | | | | | |
| 4 | 4 | 20 | 20 | | | | | | | | | | | | |
| 5 | 5 | 18 | 21 | | | | | | | | | | | | |
| 6 | 6 | 21 | 22 | | | | | | | | | | | | |
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| 15 | 16 | | | | | | | | | | | | | | |

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|---|---|---|---|
| NONE<br><br>(Assistant Examiner) | (Date) | **Total Claims Allowed:**<br>21 | |
| /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691<br><br>(Primary Examiner) | 07/27/2017<br><br>(Date) | O.G. Print Claim(s)<br>1 | O.G. Print Figure<br>5 |

U.S. Patent and Trademark Office

Part of Paper No. 20170727

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

23363 7590 08/01/2017

Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

| EXAMINER |
|---|
| YANG, KWANG-SU |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2691 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 08/01/2017 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pto@lrrc.com
pair_cph@firsttofile.com

| ***Corrected Notice of Allowability*** | **Application No.** 13/614,197 | **Applicant(s)** LEE, SANG-SHIN | |
|---|---|---|---|
| | **Examiner** KWANG-SU YANG | **Art Unit** 2691 | **AIA (First Inventor to File) Status** No |

***-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--***

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *07/12/2017 IDS*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-14 and 16-22*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   **Certified copies:**

   a) ☒ All b) ☐ Some *c) ☐ None of the:
   1. ☒ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE**.

5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   **Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☐ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☒ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/KWANG-SU YANG/
Primary Examiner, Art Unit 2691

## EXAMINER'S COMMENT

1. The present application is being examined under the pre-AIA first to invent provisions.

### *Rejoinder of Claims*

2. Claims 1-14 and 16-22 are allowable. Claims 6-14, previously withdrawn from consideration as a result of a restriction requirement, require all the limitations of an allowable claim. Pursuant to the procedures set forth in MPEP § 821.04(a), **the restriction requirement among invention's species, as set forth in the Office action mailed on 08/18/2014, is hereby withdrawn** and claims 6-14 are hereby rejoined and fully examined for patentability under 37 CFR 1.104. In view of the withdrawal of the restriction requirement, applicant is advised that if any claim presented in a continuation or divisional application is anticipated by, or includes all the limitations of, a claim that is allowable in the present application, such claim may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application. Once the restriction requirement is withdrawn, the provisions of 35 U.S.C. 121 are no longer applicable. See *In re Ziegler*, 443 F.2d 1211, 1215, 170 USPQ 129, 131-32 (CCPA 1971). See also MPEP § 804.01.

3. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

### *Inquiry*

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KWANG-SU YANG whose telephone number is (571)270-7307. The examiner can normally be reached on Mon - Fri 9:00am - 6:00pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chanh Nguyen can be reached on (571)272-7772. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KWANG-SU YANG/
Primary Examiner, Art Unit 2691

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 069657 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
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**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
| | | JP 10-39791 | 02-13-1998 | Nakamura et al. | Japan Patent Abstract |
| | | | | | |
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**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
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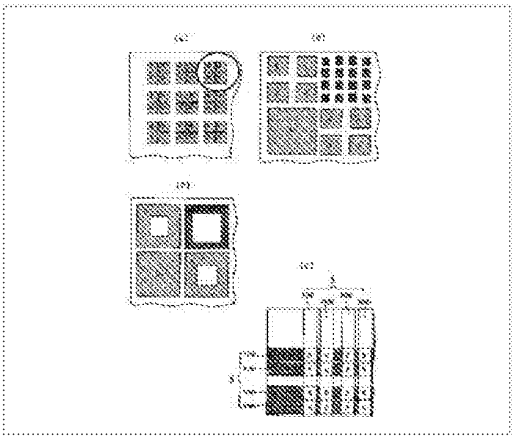


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**(54)ORGANIC ELECTROLUMINESCENCE DISPLAY DEVICE**

**(57)Abstract**
PROBLEM TO BE SOLVED: To provide an org. electroluminescence display device capable of maintaining luminance balance of red, blue and green without collapse over a long time. SOLUTION: The luminance ratios of respective emitted colors are controlled by changing the area ratios of respective color light emitting parts R, B, G of the red, blue and green. The areas of the respective color light emitting parts are so controlled that the luminance of the respective color light emitting parts attains the luminance ratios respectively attaining desired white balance values when the same driving voltage is impressed on the respective color light emitting parts, full color are displayed by controlling the time width of the driving voltage to each of the respective color light emitting parts. The respective color light emitting parts are mosaically arranged to the shape of a square with a cross inside. Two pieces of the light emitting parts of any one color among the red, blue and green are arranged on one diagonal line of the shape of the square with the cross inside and the light emitting parts of the remaining two colors are arranged by one piece each on the other diagonal line of the shape of the square with the cross inside. Any of the light emitting parts is divided to plural pieces of the light emitting parts and non-light emitting parts are arranged in the central parts of the light emitting parts.



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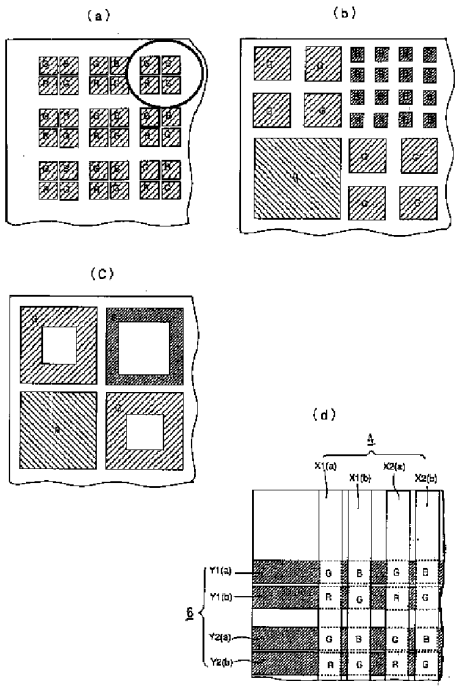
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(54)【発明の名称】　有機エレクトロルミネッセンス表示装置

(57)【要約】

【課題】　赤、緑、青各色の輝度バランスが長時間崩れないで維持できるような有機エレクトロルミネッセンス表示装置を提供する。

【解決手段】　赤、青、緑色の各色発光部Ｒ、Ｂ、Ｇの面積比を変えることにより各発光色の輝度比を制御した。また、上記各色発光部にそれぞれ同一の駆動電圧を印加したときに各色発光部の輝度がそれぞれ所望のホワイトバランス値をとる輝度比になるように各色発光部の面積を制御し、駆動電圧の時間幅を各色発光部毎に制御することによりフルカラーを表示するように構成した。また、各色発光部が田の字状にモザイク配列され、赤色、青色、および緑色のうちの何れか１色の発光部が田の字の一方の対角線上に２個、残る２色の発光部が田の字の他方の対角線上に１個ずつ配置されている。また、何れかの発光部を複数個の発光部分に分割したり、発光部の中央部に非発光部を配置したりした。






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【特許請求の範囲】
【請求項１】　赤色、青色、および緑色の発光部を有しフルカラーを表示する有機エレクトロルミネッセンス表示装置において、上記各色発光部の面積比を変えることにより上記各色発光部の輝度比を制御したことを特徴とする有機エレクトロルミネッセンス表示装置。
【請求項２】　上記各色発光部にそれぞれ同一の駆動電圧を印加したときに各色発光部の輝度がそれぞれ所望のホワイトバランス値をとる輝度比になるように上記各色発光部の面積を制御し、上記駆動電圧の時間幅を各色発光部毎に制御することによりフルカラーを表示するように構成した請求項１記載の有機エレクトロルミネッセンス表示装置。
【請求項３】　上記各色発光部が田の字状にモザイク配列され、赤色、青色、および緑色のうちの何れか１色の発光部が上記田の字の一方の対角線上に２個、残る２色の発光部が上記田の字の他方の対角線上に１個ずつ配置されている請求項１または２記載の有機エレクトロルミネッセンス表示装置。
【請求項４】　上記何れかの発光部が複数個の発光部分に分割されている請求項１ないし３の何れかに記載の有機エレクトロルミネッセンス表示装置。
【請求項５】　上記何れかの発光部の中央部に非発光部を配置した請求項１ないし３の何れかに記載の有機エレクトロルミネッセンス表示装置。
【請求項６】　上記各色発光部がストライプ状にトリオ配列され、面積が最小の発光部が中央に配置されている請求項１または２記載の有機エレクトロルミネッセンス表示装置。
【請求項７】　上記何れかの発光部に色吸収型フィルターを備えた請求項１ないし６の何れかに記載の有機エレクトロルミネッセンス表示装置。

【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、有機エレクトロルミネッセンス素子（有機ＥＬ素子）を使用した有機エレクトロルミネッセンス表示装置（有機ＥＬＤ）に関する。
【０００２】
【従来の技術】ＥＬ素子は、蛍光性化合物に電圧を加えることにより励起し、発光させる素子である。ルミネッセンス材料により、無機化合物を使用した無機ＥＬと有機化合物を使用した有機ＥＬに分けられる。無機ＥＬを使用したディスプレイ（無機ＥＬＤ）は一部実用化され、有機ＥＬを使用したディスプレイ（有機ＥＬＤ）は実用化が試みられているところである。
【０００３】中でも有機ＥＬは、例えば特開平６－９９５３号公報や刊行物（信学技報、電子情報通信学会発行、OME94-80(1995-03), p13～18「青色発光素子へのドーピング」出光興産　中村他）に記載されているような高輝度に発光する青色有機ＥＬ素子の発明により、カラー変換材料（例えば顔料や蛍光体）と呼ばれる材料を用いてエネルギーの高い青色から、エネルギーの低い緑色、赤色へ、変換する（波長を変換する）ことで、３原色を得ることができ、これら赤色、緑色、青色の画素を２次元配列することで、表示ディスプレイを構成し、画像を映し出すことができる。なお、カラー変換材料については例えば特開平５－２５８８６０号公報に、波長変換によるカラー変換については例えば刊行物（ASIA DISPLAY ' 95、Performance of RGB Multi-Color Organic EL Display　出光興産）に記載されている。
【０００４】以下、図をもとに上記青色有機ＥＬ素子を用いた従来の表示装置について説明する。図８（ａ）は従来の有機ＥＬＤの表示面を示す表面図、（ｂ）は（ａ）における線イの部分の断面図である。図において、１は表示面側透明基板、２ｒ、２ｇはそれぞれ青色を赤色および緑色に波長変換する色変換フィルター、３は保護層、４は透明電極（陽極）、５は発光層（有機ＥＬ層）、６は背面電極（陰極）、７は背面基板、８はブラックマトリックスであり、Ｒ、Ｇ、Ｂはそれぞれ赤、緑、青色の各発光部を示している。なお、図８（ａ）では明確のため各色発光部Ｒ、Ｇ、Ｂにそれぞれ異なるハッチングを施して示しており、以下の各図においても同様である。構造を簡単に説明すると、まず表示側透明基板１上にブラックマトリックス８が形成され、色変換フィルター２ｒ、２ｇがストライプ状に形成され、その色変換フィルター２ｒ、２ｇの凹凸を緩和するため透明の材料でつくられる保護層３が形成され、次に色変換フィルター２ｒ、２ｇのストライプ上に重なるように同じくストライプ状に陽極４（ITOなどの透明電極）が形成される。この上に一面に蒸着やスピンコーティングなどで発光層５（単層もしくは多層）が成膜され、陽極４に直交するようにストライプ状に背面電極６（陰極）があり、この背面電極６の上に背面基板７が順に張り合わされる。なお、ここで、発光層５は、通常１種または複数種の有機発光材料により構成されるが、有機発光材料と正孔輸送材料、電子注入材料が単体もしくは混合物により形成される。
【０００５】
【発明が解決しようとする課題】上記のような構成による有機ＥＬ表示装置では、発光層５で放出される青色発光と青色発光光を色変換フィルター２ｇ、２ｒで波長変換した緑色、赤色を用いるために、赤色と緑色の輝度が低下し、視覚特性を含めた赤色、緑色、青色の発光効率の比が、例えば上記刊行物（ASIA DISPLAY ' 95、Performance of RGB Multi-Color Organic EL Display　出光興産）によると、赤：緑：青＝0.3：1.2：1になることが記載されている。このため、この構成の有機ＥＬディスプレイは、赤色、緑色、青色を同一面積、同電圧で光らせた場合、赤色が一番弱く、ホワイトバランスの崩れ



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た青っぽい白色となり、綺麗なフルカラー表示がなされない。ＣＩＥ標準座標上で目標座標点の白色を得るため、輝度のバランスをとる必要がある。そこで、赤、緑、青各色発光部の面積が同一である時、輝度のバランスをとる１つの方法として、赤、緑、青各色発光部にそれぞれ異なる電圧を加える方法で輝度を調節する事が考えられる。しかし有機ＥＬ素子は、発光寿命が注入電流量に大きく依存しているためにこの方法であると赤色、緑色、青色の注入電流量が色により異なり、すなわち色により輝度の劣化の速さが違うために、時間とともにホワイトバランスが崩れてくる。

【０００６】本発明は、赤、緑、青各色の輝度バランスが長時間崩れないで維持できるような有機ＥＬＤを提供することを目的とする。

【０００７】

【課題を解決するための手段】本発明に係る有機エレクトロルミネッセンス表示装置は、赤、青、緑色の各色発光部の面積比を変えることにより上記各発光色の輝度比を制御したものである。

【０００８】また、上記各色発光部にそれぞれ同一の駆動電圧を印加したときに各色発光部の輝度がそれぞれ所望のホワイトバランス値をとる輝度比になるように上記各色発光部の面積を制御し、上記駆動電圧の時間幅を各色発光部毎に制御することによりフルカラーを表示するように構成したものである。

【０００９】また、上記各色発光部が田の字状にモザイク配列され、赤色、青色、および緑色のうちの何れか１色の発光部が上記田の字の一方の対角線上に２個、残る２色の発光部が上記田の字の他方の対角線上に１個ずつ配置されているものである。

【００１０】また、上記何れかの発光部が複数個の発光部分に分割されているものである。

【００１１】また、上記何れかの発光部の中央部に非発光部を配置したものである。

【００１２】また、上記各色発光部がストライプ状にトリオ配列され、面積が最小の発光部が中央に配置されているものである。

【００１３】また、上記何れかの発光部に色吸収型フィルターを備えたものである。

【００１４】

【発明の実施の形態】

実施の形態１．本発明の有機エレクトロルミネッセンス表示装置は、発光効率と白色表示の目標座標点から、赤、緑、青各色発光部（画素を構成する）の面積を決定することで輝度のバランスをとる。この面積比を決定するには、まず、赤色、緑色、青色の各色度座標点から、輝度比を計算する。白色表示の目標色度座標点を（$x_w$、$y_w$）、表示面で観測される赤色、緑色、青色の各色度座標点をそれぞれ（$x_r$、$y_r$）、（$x_g$、$y_g$）、（$x_b$、$y_b$）、表示面での赤色、緑色、青色の輝度比を$P_r$：$P_g$：１とすると、$P_r$、$P_g$は次式（１）（２）で表される。

【００１５】

【数１】

$$P_r = \frac{y_r\{(x_g-x_w)(y_b-y_w)-(x_b-x_w)(y_g-y_w)\}}{y_b\{(x_r-x_w)(y_g-y_w)-(x_g-x_w)(y_r-y_w)\}} \qquad (1)$$

$$P_g = \frac{y_g\{(x_r-x_w)(y_b-y_w)-(x_b-x_w)(y_r-y_w)\}}{y_b\{(x_g-x_w)(y_r-y_w)-(x_r-x_w)(y_g-y_w)\}} \qquad (2)$$

【００１６】この輝度比から、赤色、緑色、青色の発光効率の比をＲ：Ｇ：１とすると、各色発光部の面積比$S_r$：$S_g$：$S_b$は以下の式で表される。

$S_r$：$S_g$：$S_b$＝$P_r$／Ｒ：$P_g$／Ｇ：１／１

これにより求められた面積比で各色発光部を形成することで、それぞれの色に対して電圧値を変えることなく、白色の目標色度座標点を得る有機エレクトロルミネッセンス表示装置が提供される。例えば、輝度比を赤色：緑色：青色=2：7：1（ＣＲＴにおいてはこの輝度比が採用されることが多い）にする場合で、各色発光部の発光効率が従来例と同様に赤色：緑色：青色=0.3：1.2：1である場合、それぞれの発光部の面積比は赤色：緑色：青色=2/0.3：7/1.2：1/1=6.67：5.83：1になる。

【００１７】以下、本実施の形態による有機ＥＬＤをさらに詳細に説明する。図１は本発明の一実施の形態による有機ＥＬＤの要部を示し、（ａ）は表示面の平面図、（ｂ）は（ａ）における線イの部分の断面図である。図において、１、は表示面側透明基板、２ｒ、２ｇはそれぞれ青色を赤色および緑色に波長変換する色変換フィルター、３は保護層、４は透明電極（陽極）、５は発光層（有機ＥＬ層）、６は背面電極（陰極）、７は背面基板、８はブラックマトリックスであり、従来例と同様のものである。Ｒ、Ｇ、Ｂはそれぞれ赤、緑、青色発光部を示している。赤、緑、青の各色発光部Ｒ、Ｇ、Ｂ面積を所望の白色色度座標点になるように定める。即ち、上述したように赤色、緑色、青色発光部Ｒ、Ｇ、Ｂの発光効率が0.3：1.2：1であり、上述の通常のＣＲＴの場合、赤色、緑色、青色の輝度比が2：7：1で白色色度座標点が決まるとして、赤、緑、青各色発光部Ｒ、Ｇ、Ｂの面積比は6.67：5.83：1となるように構成される。このように、各色発光部の発光効率に基づき各色発光部Ｒ、Ｇ、Ｂの大きさを発光色によって変えることにより輝度比を制御して、各色発光部を同一の駆動電圧で駆動して所望の白色色度座標を得ることができる。

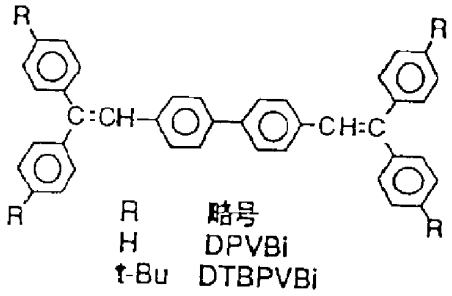


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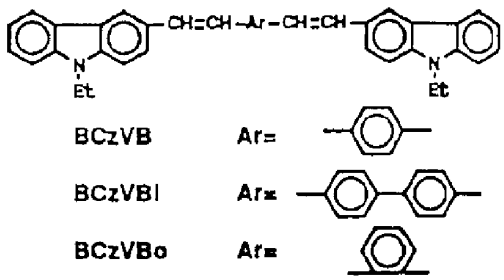
【００１８】次に製造方法について説明する。例えばガラス板、石英ガラスなどからなる表示面側透明基板１上に、ブラックマトリックス８を印刷法などにより形成し、青色から緑色、赤色に波長変換する色変換フィルター２ｇ、２ｒを顔料分散法もしくは印刷法などで形成し、その上に透明材料である例えばポリウレタン樹脂や石英ガラスからなる保護層３を色変換フィルター２ｇ、２ｒの凹凸が緩和されるように積層する。なお、色変換フィルター２ｇ、２ｒとしては、青色光を吸収してより長波長の可視光を発光することが知られている有機および無機化合物の中から選択することができ、赤色変換フィルター２ｒとしては、蛍光性の４－ジシアノメチレン－４Ｈ－ピランおよび４－ジシアノメチレン－４Ｈ－チオピラン等が用いられ、緑色変換フィルター２ｇとしては米国特許第４７６９２９２号明細書に開示されている緑色発光性ポリメチン系色素の何れかを含有したものが用いられる。具体的には例えば上述の特開平５－２５８８６０号公報に記載されているようなものが用いられる。次に色変換フィルター２ｇ、２ｒの形状に重なるように位置合わせされた陽極電極４を形成する。この陽極電極４として用いる導電体は、ＩＴＯ（イソジウムチンオキサイド）などの透明電極である。これら電極４や保護層３は、数十nm～数百μmの厚さで構成されている。次に、透明電極４の上に配置する発光層５は、バイポーラ性（電子、ホールとも輸送する性質）を有する有機単層部、または電子輸送層、発光層、ホール輸送層の性質を持つ層が１層もしくは２層以上ある有機多層部で形成される。これらの形成方法は、有機ＥＬ材料が低分子か高分子の材料であるかによって異なるが、真空加熱蒸着やディップコーティングやスピンコーティングなどによって形成される。なお、発光層５としては具体的には例えば、上述の信学技報に出光興産により発表された一般式（１）で表される固体状態で青色発光能を有するジスチリルビフェニル誘導体をホスト物質として、このホスト物質に発光効率の向上のために一般式（２）で示されるジスチリルアリーレン（ＤＳＡ）の末端にカルバゾリル基を保有するＤＳＡ誘導体である青色色素をドーピングした発光層５が挙げられる。

【００１９】

【化１】




（１）




（２）

【００２０】有機ＥＬ材料による発光層５の次は、陰極となる低仕事関数の金属電極６が例えば蒸着法やスパッタなどの方法で形成される。最後に、背面基板７が張り合わされて、密封される。なお、このような構造である有機ＥＬ素子の作製方法は特に制限されるものではなく、成膜は蒸着法のみによっても作製可能であるし、作製する順番についても背面側からでも可能である。以上のように、マトリクス状に陽極電極４と陰極電極６を配置し、そのマトリックス電極を操作し順次映像信号を入力することにより、順次発光させ、映像を写し出す。

【００２１】このように、各色発光部の面積比を調節することにより輝度比を調節するので、発光部の注入電流密度を各色とも等しくでき、輝度劣化特性に偏りがないので、時間と共に生じる輝度ばらつきが生じない。すなわち、色バランスのずれによる商品の短命化を防ぐことになる。また、駆動電圧が一定であることは、駆動回路、駆動電源も簡略化できる。なお、発光は透明電極４と背面電極６の交点部で起こるので、各色発光部の面積



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比を変えるには、透明電極４と背面電極６のいずれの電極比を変えてもよい。

【００２２】上記有機ＥＬＤにおいて、ある任意の色を表示したい場合は、赤色、緑色、青色を表示する各色発光部に同一電圧を印加し、その赤色、緑色、青色の印加時間幅を制御することで、それぞれの色が加色混合されて任意の色を表示する。この印加時間幅の階調数を増やすことで、美しいフルカラー表示が可能となる。

【００２３】実施の形態２．上記実施の形態１では各色発光部Ｒ、Ｇ、Ｂをストライプ状にトリオ配列するのに、面積が最小で細い線となる青色発光部Ｂを端に配置したが、図２に示すように面積が最小の青色発光部Ｂを中央に配置することにより、両端の発光色を同時に発光させる場合に発光色間の距離が近くなり、すなわち光の濃淡のピッチが小さくなるために画像のぎらつき感を少なくすることができる。

【００２４】実施の形態３．図３は本発明の他の実施の形態による有機ＥＬＤの要部を示し、（ａ）は表示面の平面図、（ｂ）は透明電極４および背面電極６の構成を説明する説明図である。明確のため一方の電極６にはハッチングを施して示している。３色の発光部Ｒ、Ｇ、Ｂを２列に並べ１列は赤色１色、残り１列は緑色と青色の２色で構成している。ここでの面積比は、実施の形態１と同様の白色色度座標を得ることができるサイズである。すなわち赤、緑、青各色発光部Ｒ、Ｇ、Ｂの面積比は6.67：5.83：1である。例えば、図３（ａ）に示した発光部構成の場合、赤色Ｒを光らせるには、図３（ｂ）に示すように走査電極Y1(a)、Y1(b)と信号電極X1(a)がonになり、緑色Ｇを光らせるにはY1(a)とX1(b)がONになり、青色Ｂを光らせるにはY1(b)とX1(b)がONになる。なお、この図では透明電極４が信号電極、背面電極６が走査電極である場合を示したが逆であってもよい。

【００２５】この配列にすることにより、各発光部の形状が正方形に近づくので、そのライン幅のサイズを大きくとれる。たとえば、同じ画素ピッチの場合、ストライプ状にトリオ配列された縦３ラインの各発光部が50μｍ幅であれば、この方式では、1.5倍の75μｍ幅にする事ができる。これにより、色変換フィルターや後に詳述するカラーフィルターのライン幅が広がるために、印刷などによる作製精度を容易な精度にすることができる。また、上記実施の形態１と同様に、輝度劣化の均一性と回路の簡単化の効果をもつ。

【００２６】実施の形態４．図４は本発明の他の実施の形態による有機ＥＬＤの要部を示し、（ａ）は表示面の平面図、（ｂ）は（ａ）における実線で囲んだ部分を拡大した平面図である。　各色発光部Ｒ、Ｇ、Ｂが田の字状にモザイク配列され、１色の発光部Ｇが田の字の一方の対角線上に２個、残る２色の発光部Ｒ、Ｂが田の字の他方の対角線上に１個ずつ配置されている。なお、これらの発光部の面積は、実施の形態１と同様の面積比すなわち赤色：緑色：青色＝6.67：5.83：1で構成されていてもよいが、図４では緑色発光部Ｇの面積を一番大きくしている。こうすることによりホワイトバランスは多少崩れるが、人間の視覚特性を考慮した発光輝度が上がるという効果がある。また、この構造の場合、静止画において赤、緑、緑、青色を１画素（実線囲み部分）とすると、隣接画素が重複し（波線囲み部分）、実質的画素数は約２倍に増加する。すなわち、モザイク配列は、高画質を得る上で実施の形態１に記載したようなトリオ配列の画素形状よりも有利である。さらに、図４（ｂ）に示すように、適切な拡大率で発光部ごとに矢印の方向に発光面積を拡大することも可能であり、画質を劣化することなく高輝度を得ることができる。また、この形状の場合も上記各実施の形態と同様に、製造の容易さと輝度劣化の均一性と回路の簡単化の効果をもつ。

【００２７】実施の形態５．図５は本発明の他の実施の形態による有機ＥＬＤの要部を示し、（ａ）は表示面の平面図、（ｂ）（ｃ）はそれぞれ（ａ）における実線で囲んだ部分を拡大した平面図、（ｄ）は透明電極および背面電極の構成を説明する説明図である。明確のため一方の電極にはハッチングを施して示している。同じサイズである発光部のモザイク配列を実現するために、１つの発光部の中でさらに区切って面積比を合わせた構造である。図５（ｂ）は緑および青色発光部Ｇ、Ｂを複数個の発光部分に分割した（１カラー画素を小さい四角で区切った）形状、図５（ｃ）は緑および青色発光部Ｇ、Ｂの中央部に非発光部を配置した（１カラー画素の中を抜いた）形状であり、どちらも目標座標点を得るための面積比（例えば実施の形態１と同様に赤色：緑色：青色＝6.67：5.83：1）となっている。上記各実施の形態で示したような、赤、緑、青各色発光部の面積比が１：１：１でない形状の時、近距離で見た場合に画像がざらついて感じられる。そこで、この実施の形態で示した形状にすることで、面積比のアンバランス（例えば赤色：緑色：青色＝6.67：5.83：1）を緩和でき、ざらつき感を緩和できる。ここで図５（ｂ）、（ｃ）で用いられる透明電極４と背面電極６は図５（ｄ）の様に構成され、（ｂ）、（ｃ）で描かれたそれぞれの小さな発光部分は透明電極４と背面電極６の交点上の点線の中に配置され、（ｂ）の小さな発光部分の間や（ｃ）の発光部の中央部の非発光部は黒色の材料（ブラックマトリックス）で構成される。例えば、図５（ｂ）（ｃ）に示した発光部構成の場合、赤色Ｒを光らせるには、図５（ｄ）に示すように走査電極Y1(b)と信号電極X1(a)がonになり、緑色Ｇを光らせるにはY1(a)とX1(a)、およびY1(b)とX1(b)がONになり、青色Ｂを光らせるにはY1(a)とX1(b)がONになる。なお、この図では透明電極４が信号電極、背面電極６が走査電極である場合を示したが逆であってもよい。

【００２８】実施の形態６．図６は本発明の他の実施の



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形態による有機ＥＬＤの要部を示し、（ａ）は表示面の平面図、（ｂ）（ｃ）はそれぞれ（ａ）における実線で囲んだ部分を拡大した平面図である。本実施の形態ではストライプ状にトリオ配列されており、図６（ｂ）は青色発光部Ｂを複数個の発光部分に分割した形状、図６（ｃ）は青色発光部Ｂの中央部に非発光部を配置した形状である。なお、実施の形態１と同じ面積比にした場合、赤色：緑色：青色＝6.67：5.83：1であり、赤色発光部Ｒと緑色発光部Ｇとは面積の差が小さいので、発光部分等に分割せずに実施の形態１と同様に発光部の面積を変えている。このような構成にしても実施の形態５と同様にざらつき感が緩和できる。

【００２９】実施の形態７．図７（ａ）～（ｃ）はそれぞれ本発明の他の実施の形態による有機ＥＬＤの要部を示す断面図である。図７（ａ）は青色の発光効率を赤色や緑色の発光効率に合わせるために透過率の低い青色カラーフィルター９ｂ（色吸収型フィルター）を備えた場合を示しており、各色発光部の面積比を変えて同じ注入電流量で発光させるのに、青色カラーフィルター９ｂを用いることで、上記各実施の形態のように青色発光部の面積比を他の発光部に比べて極端に小さくしなくても所望の輝度比が得られ、面積比のアンバランスを緩和でき、ざらつき感を緩和することができる。また、外光を反射しにくくなるので、コントラストも向上する。また、色の再現性の良いフィルターを用いることも可能である。

【００３０】さらに、カラーフィルターを用いるのは１色に限らず、図７（ｂ）のように、２色以上にカラーフィルター９ｂ、９ｇを配置することも可能で、この場合、輝度は低くなるが、色の再現性を良くすることができる。また、カラーフィルターは、上記実施の形態１～６と組み合わせることも可能である。

【００３１】また、図７（ｃ）に示すように、発光層５を白色発光させて各色発光部Ｒ、Ｇ、Ｂに備えたカラーフィルター９ｒ、９ｇ、９ｂにより白色発光から各色に変換してもよい。このように白色発光をカラーフィルター９ｒ、９ｇ、９ｂで各色に変換する場合には青色発光をカラー変換フィルター２ｒ、２ｇで他の色に変換する場合に比べて発光色による発光効率の違いは小さいが、所望の輝度比が得られるとは限らず、上記各実施の形態と同様に面積比を変えることで輝度比を制御することができる。なお、カラーフィルター９ｒ、９ｇ、９ｂとしては、カラー液晶ディスプレイに使用されるような染色型や顔料分散型のものなどが用いられる。

【００３２】なお、上記各実施の形態では発光寿命の劣化のばらつきを無くすために各色発光部Ｒ、Ｇ、Ｂを同一の駆動電圧で駆動し、輝度比は面積比を変えることで制御した場合について説明したが、例えば、面積比を変えて輝度比を大ざっぱに調整し、微調整は駆動電圧を変えることによって行うなどのように、駆動電圧も多少変えて、輝度比を面積比と駆動電圧の両方を変えることにより制御してもよい。この場合にも、輝度比を駆動電圧のみで調整する場合に比べて発光寿命の劣化のばらつきは大きく改善される。

【００３３】また、各色の輝度比は上述した実施の形態で説明した赤色：緑色：青色=2：7：1に限定されるものではなく、所望の白色に応じて適宜選択され得る。

【００３４】

【発明の効果】以上のように、本発明によれば、赤、青、緑色の各色発光部の面積比を変えることにより上記各発光色の輝度比を制御したので、輝度比を駆動電圧のみで調整する場合に比べて発光寿命の劣化のばらつきは大きく改善され、各色の輝度バランスが長時間崩れないで維持できる。

【００３５】また、上記各色発光部にそれぞれ同一の駆動電圧を印加したときに各色発光部の輝度がそれぞれ所望のホワイトバランス値をとる輝度比になるように上記各色発光部の面積を制御し、上記駆動電圧の時間幅を各色発光部毎に制御することによりフルカラーを表示するように構成したので、上記効果に加えて駆動回路や駆動電源を簡略化できる。

【００３６】また、上記各色発光部が田の字状にモザイク配列され、赤色、青色、および緑色のうちの何れか１色の発光部を上記田の字の一方の対角線上に２個、残る２色の発光部を上記田の字の他方の対角線上に１個ずつ配置すれば、実質的画素数が増加し、高画質が得られる。また、作製精度に裕度ができる。

【００３７】また、上記何れかの発光部を複数個の発光部分に分割したり、発光部の中央部に非発光部を配置したりすれば、面積比のアンバランスを緩和でき、近距離で見た場合の画像のざらつき感を緩和できる。

【００３８】また、上記各色発光部がストライプ状にトリオ配列され、面積が最小の発光部が中央に配置されていれば、画像のぎらつき感を緩和できる。

【００３９】また、上記何れかの発光部に色吸収型フィルターを備えることにより、面積比のアンバランスを緩和できる。

【図面の簡単な説明】

【図１】　本発明の実施の形態１による有機ＥＬＤの要部を示し、（ａ）は表示面の平面図、（ｂ）は（ａ）における線イの部分の断面図である。

【図２】　本発明の実施の形態２による有機ＥＬＤの要部を示し、（ａ）は表示面の平面図、（ｂ）は（ａ）における線イの部分の断面図である。

【図３】　本発明の実施の形態３による有機ＥＬＤの要部を示し、（ａ）は表示面の平面図、（ｂ）は透明電極および背面電極の構成を説明する説明図である。

【図４】　本発明の実施の形態４による有機ＥＬＤの要部を示し、（ａ）は表示面の平面図、（ｂ）は（ａ）における実線で囲んだ部分を拡大した平面図である。



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【図５】　本発明の実施の形態５による有機ＥＬＤの要部を示し、（ａ）は表示面の平面図、（ｂ）（ｃ）はそれぞれ（ａ）における実線で囲んだ部分を拡大した平面図、（ｄ）は透明電極および背面電極の構成を説明する説明図である。

【図６】　本発明の実施の形態６による有機ＥＬＤの要部を示し、（ａ）は表示面の平面図、（ｂ）（ｃ）はそれぞれ（ａ）における実線で囲んだ部分を拡大した平面図である。

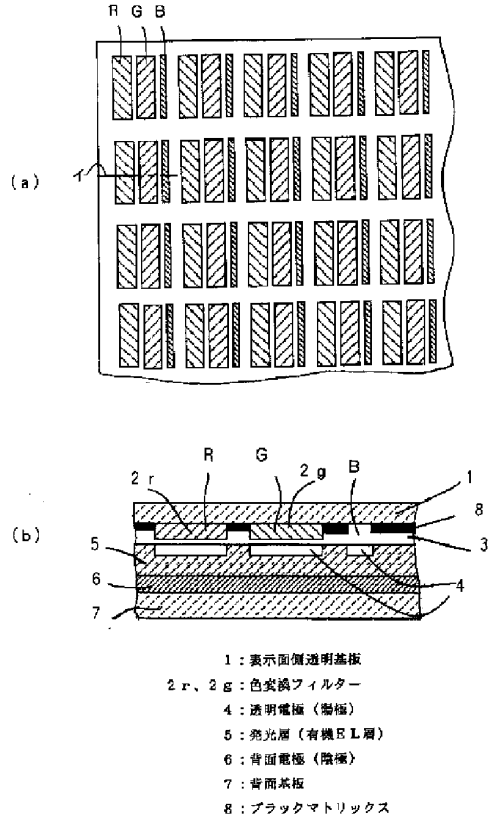
【図７】　本発明の実施の形態７による有機ＥＬＤの要部を示す平面図である。

【図８】　従来の実施の形態１による有機ＥＬＤの要部を示し、（ａ）は表示面の平面図、（ｂ）は（ａ）における線イの部分の断面図である。

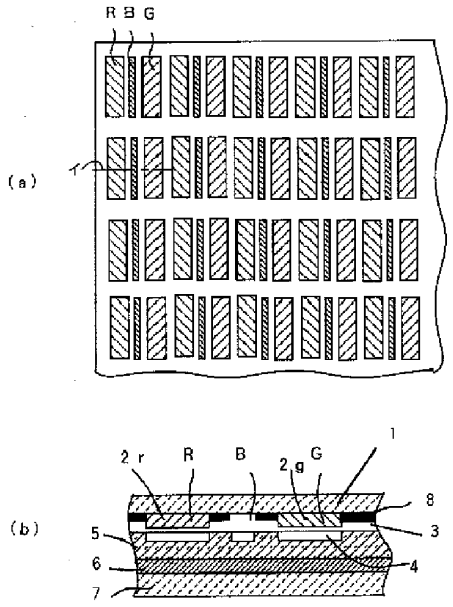
【符号の説明】

１　表示面側透明基板、　２ｒ、２ｇ　色変換フィルター、　４　透明電極、５　発光層、　６　背面電極、　７　背面基板、　８　ブラックマトリクス、９ｇ、９ｂ　カラーフィルター、　Ｒ　赤色発光部、　Ｇ　緑色発光部、　Ｂ青色発光部。

【図１】



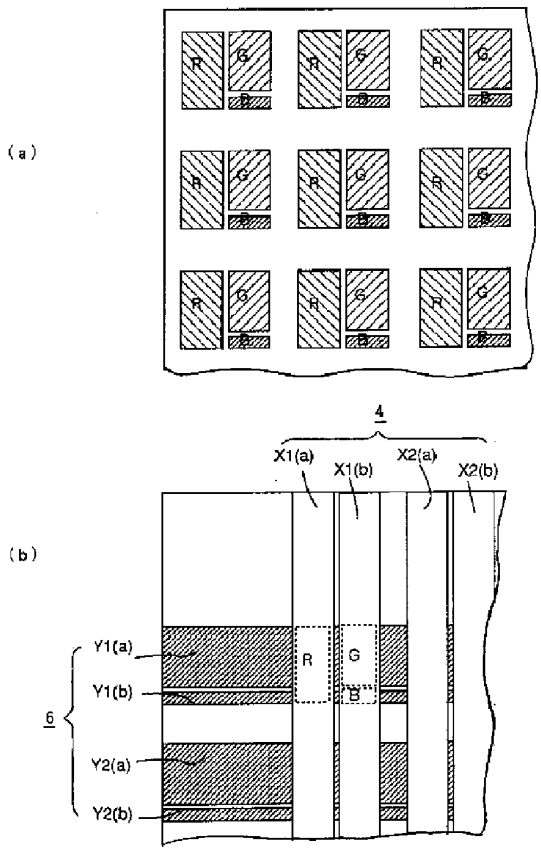

【図２】



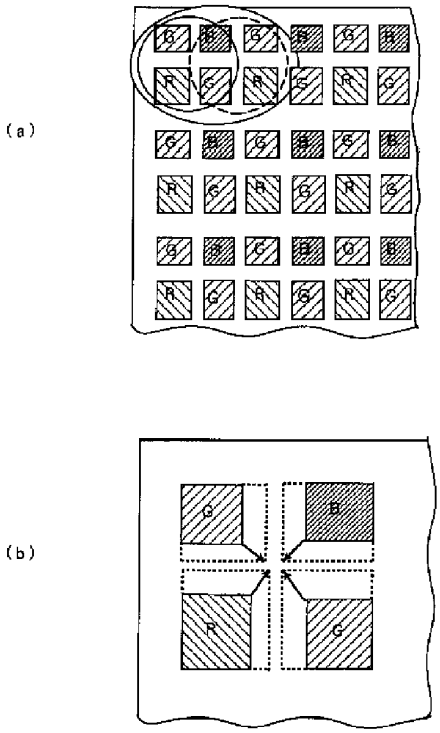



Petitioner Ex 1015, p. 47
BOE et al. v. Samsung, IPR2023-00988

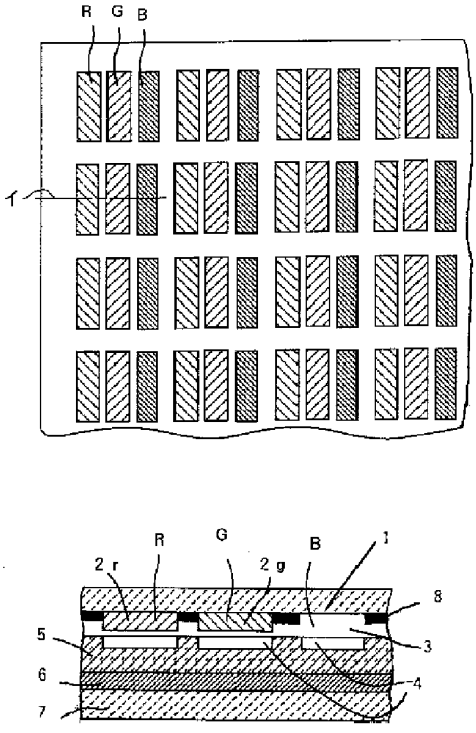
【図３】




【図４】



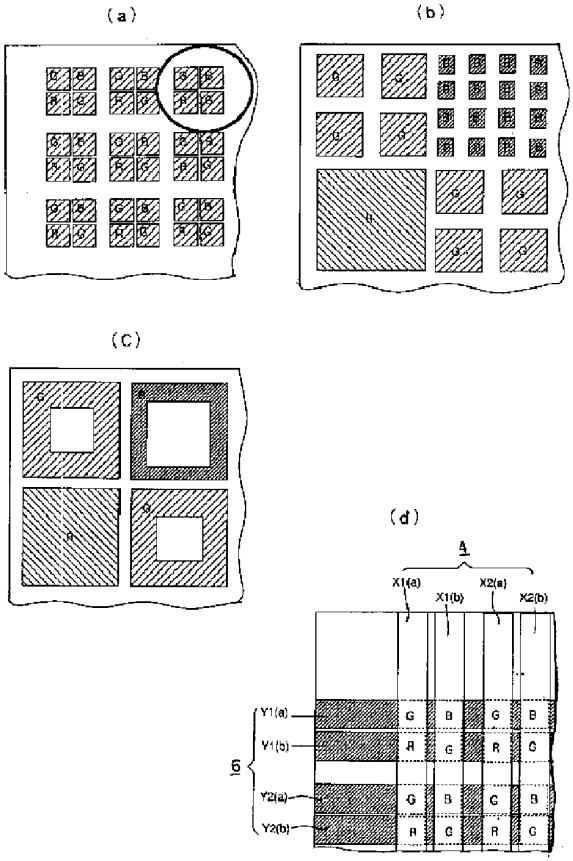

【図８】



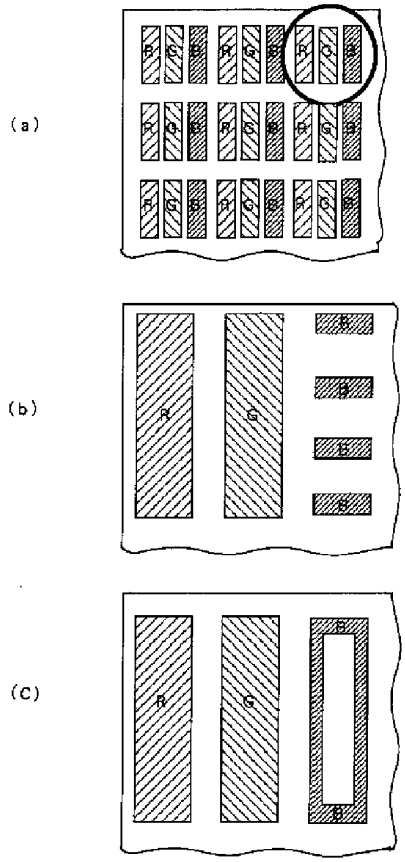



Petitioner Ex 1015, p. 48
BOE et al. v. Samsung, IPR2023-00988

【図５】



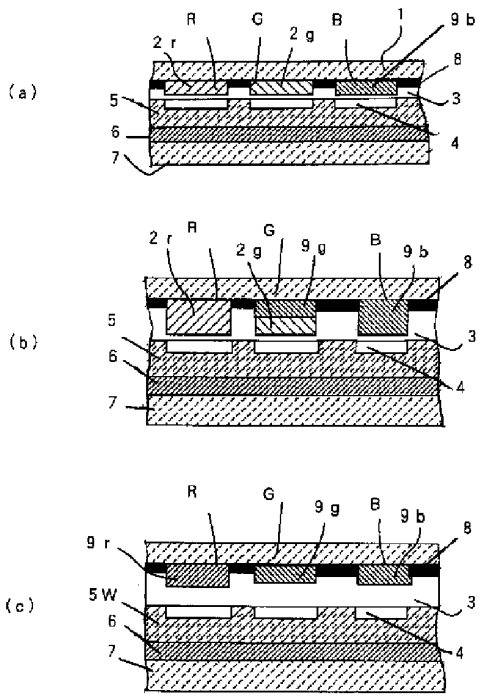

【図６】






Petitioner Ex 1015, p. 49
BOE et al. v. Samsung, IPR2023-00988

【図７】




９ｒ、９ｇ、９ｂ：カラーフィルター

---

フロントページの続き

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Petitioner Ex 1015, p. 50
BOE et al. v. Samsung, IPR2023-00988

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 13614197 |
| **Filing Date:** | 13-Sep-2012 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Filer:** | Jun-Young E. Jeon/Elizabeth Gomez |
| **Attorney Docket Number:** | 69657/S1437 |

Filed as Large Entity

**Filing Fees for Utility under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| Submission- Information Disclosure Stmt | 1806 | 1 | 180 | 180 |
| | | **Total in USD ($)** | | **180** |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 29766643 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Young E. Jeon/Elizabeth Gomez |
| **Filer Authorized By:** | Jun-Young E. Jeon |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 12-JUL-2017 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 18:39:03 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | CARD |
| Payment was successfully received in RAM | $180 |
| RAM confirmation Number | 071317INTEFSW18394100 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 69657_IDS.PDF | 34590<br>dc52bdc58238e04a78dc66ff260336d510d58753 | yes | 3 |
| | **Multipart Description/PDF files in .zip description** | | | | |
| | **Document Description** | | **Start** | **End** | |
| | Transmittal Letter | | 1 | 2 | |
| | Information Disclosure Statement (IDS) Form (SB08) | | 3 | 3 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Foreign Reference | JP_10039791.pdf | 6672196<br>9c34d39c27fb3f982bb608491c168c1b4beaafaa | no | 11 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Fee Worksheet (SB06) | fee-info.pdf | 30947<br>cb1d5758dd6ea4010c46fcad7937e32d4ad09f2b | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 6737733 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on July 12, 2017 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Elizabeth Gomez

Inventor(s) : Sang-Shin Lee Confirmation No. 4264
Application No. : 13/614,197
Filed : September 13, 2012
Title : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

Grp./Div. : 2691
Examiner : Kwang-Su Yang

Docket No. : 069657

**SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT WITH FEE UNDER 37 CFR §§ 1.97(d) AND 1.17(p)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
July 12, 2017

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is an information disclosure statement listing a reference that is known to applicant. A copy of the listed Foreign Patent Documents reference is enclosed.

It is respectfully requested that the listed reference be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of the information disclosure statement be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

Applicant's undersigned attorney hereby certifies, in accordance with 37 CFR § 1.97(e)(1), that each item of information contained in the information disclosure statement was first cited in a communication from any foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement.

The processing fee of $180.00 as required by 37 CFR § 1.17(p) is submitted herewith. The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
LEWIS ROCA ROTHGERBER CHRISTIE LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/eg
Enclosures: Information Disclosure Statement, w/reference

JEJ 101837534.1-*-07/11/2017 3:37 PM

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

# NOTICE OF ALLOWANCE AND FEE(S) DUE

23363 7590 07/11/2017
Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

| EXAMINER |
|---|
| YANG, KWANG-SU |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2691 | |

DATE MAILED: 07/11/2017

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

TITLE OF INVENTION: PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | UNDISCOUNTED | $960 | $0 | $0 | $960 | 10/11/2017 |

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.**

**THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.**

**HOW TO REPLY TO THIS NOTICE:**

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.**



PTOL-85 (Rev. 02/11)

Petitioner Ex 1015, p. 58
BOE et al. v. Samsung, IPR2023-00988

## PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail** **Mail Stop ISSUE FEE**
**Commissioner for Patents**
**P.O. Box 1450**
**Alexandria, Virginia 22313-1450**
**or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

23363 7590 07/11/2017
Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

**Certificate of Mailing or Transmission**
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

| |
|---|
| (Depositor's name) |
| (Signature) |
| (Date) |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

TITLE OF INVENTION: PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | UNDISCOUNTED | $960 | $0 | $0 | $960 | 10/11/2017 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|---|---|---|
| YANG, KWANG-SU | 2691 | 345-082000 |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:

❑ Issue Fee

❑ Publication Fee (No small entity discount permitted)

❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

❑ A check is enclosed.

❑ Payment by credit card. Form PTO-2038 is attached.

❑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

❑ Applicant asserting small entity status. See 37 CFR 1.27

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

❑ Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____



PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Petitioner Ex 1015, p. 59
BOE et al. v. Samsung, IPR2023-00988

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

23363 7590 07/11/2017

Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

| EXAMINER | |
|---|---|
| YANG, KWANG-SU | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2691 | |

DATE MAILED: 07/11/2017

**Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)**
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.



PTOL-85 (Rev. 02/11)

Petitioner Ex 1015, p. 60
BOE et al. v. Samsung, IPR2023-00988

## OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

## Privacy Act Statement

**The Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

| Notice of Allowability | Application No. 13/614,197 | Applicant(s) LEE, SANG-SHIN | |
|---|---|---|---|
| | Examiner KWANG-SU YANG | Art Unit 2691 | AIA (First Inventor to File) Status No |

***-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--***

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *RCE filed on 06/21/2017*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-14 and 16-22*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   **Certified copies:**

   a) ☒ All b) ☐ Some *c) ☐ None of the:
   1. ☒ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE**.

5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   **Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☐ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☒ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/KWANG-SU YANG/
Primary Examiner, Art Unit 2691

## EXAMINER'S AMENDMENT

1. The present application is being examined under the pre-AIA first to invent provisions.

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

### *Rejoinder of Claims*

3. Claims 1-14 and 16-22 are allowable. Claims 6-14, previously withdrawn from consideration as a result of a restriction requirement, require all the limitations of an allowable claim. Pursuant to the procedures set forth in MPEP § 821.04(a), **the restriction requirement among invention's species, as set forth in the Office action mailed on 08/18/2014, is hereby withdrawn** and claims 6-14 are hereby rejoined and fully examined for patentability under 37 CFR 1.104. In view of the withdrawal of the restriction requirement, applicant is advised that if any claim presented in a continuation or divisional application is anticipated by, or includes all the limitations of, a claim that is allowable in the present application, such claim may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application. Once the restriction requirement is withdrawn, the provisions of 35 U.S.C. 121 are no longer applicable. See *In re Ziegler*, 443 F.2d 1211, 1215, 170 USPQ 129, 131-32 (CCPA 1971). See also MPEP § 804.01.

4. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the

issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

***Inquiry***

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KWANG-SU YANG whose telephone number is (571)270-7307. The examiner can normally be reached on Mon - Fri 9:00am - 6:00pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Chanh Nguyen can be reached on (571)272-7772. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KWANG-SU YANG/
Primary Examiner, Art Unit 2691

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 069657 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
| | | 6,882,364 B1 | 04-19-2005 | Inuiya et al. |
| | | 2004/0183764 A1 | 09-23-2004 | Kim et al. |
| | | | | |
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**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
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**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | U.S. Office Action dated May 11, 2017, issued in cross-reference U.S. Patent Application No. 13/872,018 (16 pages) |
| | | |
| | | |
| | | |

JEJ 101692258.1-*-06/21/2017 11:07 AM

| EXAMINER SIGNATURE | /KWANG-SU YANG/ | DATE CONSIDERED | 07/05/2017 |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

JEJ/eg



ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KY/

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | Examiner | Art Unit |
| | KWANG-SU YANG | 2691 |

| CPC- SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| CPC COMBINATION SETS - SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| US CLASSIFICATION SEARCHED | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
| 345 | 82 419 | 10/24/2014 | KY |

| SEARCH NOTES | | |
|---|---|---|
| Search Notes | Date | Examiner |
| EAST: Inventor Search | 10/24/2014 | KY |
| EAST: Text Search | 10/24/2014; 10/27/2014 | KY |
| EAST: Updated Text Search | 02/27/2015 | KY |
| EAST: IDS Search | 03/07/2015 | KY |
| EAST: IDS Search | 07/09/2015 | KY |
| EAST: Updated Text Search | 07/09/2015 | KY |
| EAST: Updated Text Search | 11/25/2015; 11/27/2015 | KY |
| EAST: IDS Search | 04/02/2016 | KY |
| EAST: Updated Text Search | 04/02/2016 | KY |
| EAST: IDS Search | 10/08/2016 | KY |
| EAST: Updated Text Search | 10/08/2016; 10/11/2016 | KY |
| Updated Classification Search (345/82) | 03/15/2017 | KY |
| EAST: Updated Text Search | 03/15/2017 | KY |
| Updated Classification Search (345/82) | 07/05/2017 | KY |
| EAST: Updated Text Search | 07/05/2017 | KY |

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|---|---|
| | /KWANG-SU YANG/<br>Primary Examiner, Art Unit 2691 |

| INTERFERENCE SEARCH | | | |
|---|---|---|---|
| **US Class/ CPC Symbol** | **US Subclass / CPC Group** | **Date** | **Examiner** |
| US-PGPUB; USPAT | (third adj (pixel sub$1pixel dot) same (arrangement structure) same (organic adj light OLED OELD) same virtual adj square same (center central) same consecutive same first with green same (larger greater smaller less)).clm. | 03/15/2017 | KY |
| US-PGPUB; USPAT | (third adj (pixel sub$1pixel dot) same (arrangement structure) same (organic adj light OLED OELD) same virtual adj square same (center central) same consecutive same first same green same (larger greater smaller less)).clm. | 07/05/2017 | KY |

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| | /KWANG-SU YANG/<br>Primary Examiner, Art Unit 2691 |

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

# BIB DATA SHEET

**CONFIRMATION NO. 4264**

| SERIAL NUMBER | FILING or 371(c) DATE<br>RULE | CLASS | GROUP ART UNIT | ATTORNEY DOCKET NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | 345 | 2691 | 69657/S1437 |

**APPLICANTS**

**INVENTORS**
Sang-Shin Lee, Yongin-si, KOREA, REPUBLIC OF;

**** CONTINUING DATA ***************************

**** FOREIGN APPLICATIONS ***************************
REPUBLIC OF KOREA 10-2012-0022967 03/06/2012

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****
09/25/2012

| Foreign Priority claimed ☑ Yes ☐ No<br>35 USC 119(a-d) conditions met ☑ Yes ☐ No<br>Verified and Acknowledged /KWANG-SU YANG/ Examiner's Signature | ☐ Met after Allowance<br>Initials | STATE OR COUNTRY | SHEETS DRAWINGS | TOTAL CLAIMS | INDEPENDENT CLAIMS |
|---|---|---|---|---|---|
| | | KOREA, REPUBLIC OF | 5 | 20 | 1 |

**ADDRESS**

Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001
UNITED STATES

**TITLE**

PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

| FILING FEE RECEIVED | | |
|---|---|---|
| 1330 | FEES: Authority has been given in Paper<br>No._____ to charge/credit DEPOSIT ACCOUNT<br>No._____ for following: | ☐ All Fees<br>☐ 1.16 Fees (Filing)<br>☐ 1.17 Fees (Processing Ext. of time)<br>☐ 1.18 Fees (Issue)<br>☐ Other _____<br>☐ Credit |

**EAST Search History**

**EAST Search History (Prior Art)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L1 | 3379 | 345/82.ccls. | US-PGPUB; USPAT; USOCR | OR | ON | 2017/07/05 18:16 |
| L2 | 178373 | organic adj light adj emitting OLED OELD | US-PGPUB; USPAT; USOCR | OR | ON | 2017/07/05 18:17 |
| L3 | 46391 | (pixel sub$1pixel) near3 (arrangement layout) | US-PGPUB; USPAT; USOCR | OR | ON | 2017/07/05 18:17 |
| L4 | 4836 | (center central) same (vertex node) same square | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2017/07/05 18:18 |
| L5 | 2 | 1 and 2 and 3 and 4 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2017/07/05 18:18 |
| L6 | 14 | 2 and 3 and 4 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2017/07/05 18:19 |
| L7 | 4 | ("6882364" "20040183764").pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2017/07/05 18:20 |

**EAST Search History (Interference)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L8 | 0 | (third adj (pixel sub$1pixel dot) same (arrangement structure) same (organic adj light OLED OELD) same virtual adj square same (center central) same consecutive same first same green same (larger greater smaller less)).clm. | US-PGPUB; USPAT | OR | ON | 2017/07/05 18:24 |

**7/5/2017 6:25:21 PM**
**C:\Users\kyang\Documents\EAST\Workspaces\13614197.wsp**



Petitioner Ex 1015, p. 69
BOE et al. v. Samsung, IPR2023-00988

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | **Examiner** | **Art Unit** |
| | KWANG-SU YANG | 2691 |

| CPC | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | | | | | **Type** | **Version** |
| H01L | | 27 | / | 3216 | F | 2013-01-01 |
| H01L | | 27 | / | 3218 | I | 2013-01-01 |
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| CPC Combination Sets | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Symbol** | | | | | **Type** | **Set** | **Ranking** | **Version** |
| | | | / | | | | | |
| | | | / | | | | | |

| NONE | | **Total Claims Allowed:** | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 21 | |
| /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691 | 07/05/2017 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 5 |

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | **Examiner** | **Art Unit** |
| | KWANG-SU YANG | 2691 |

| US ORIGINAL CLASSIFICATION | | INTERNATIONAL CLASSIFICATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | SUBCLASS | CLAIMED | | | | | NON-CLAIMED | | | | | |
| 345 | 82 | G | 0 | 9 | G | 3 / 32 (2006.01.01) | | | | | | |

| CROSS REFERENCE(S) | | | | | |
|---|---|---|---|---|---|
| CLASS | SUBCLASS (ONE SUBCLASS PER BLOCK) | | | | |
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| NONE | | Total Claims Allowed: | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 21 | |
| /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691 | 07/05/2017 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 5 |

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | **Examiner** | **Art Unit** |
| | KWANG-SU YANG | 2691 |

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 16 | 17 | | | | | | | | | | | | |
| 2 | 2 | 17 | 18 | | | | | | | | | | | | |
| 3 | 3 | 19 | 19 | | | | | | | | | | | | |
| 4 | 4 | 20 | 20 | | | | | | | | | | | | |
| 5 | 5 | 18 | 21 | | | | | | | | | | | | |
| 6 | 6 | 21 | 22 | | | | | | | | | | | | |
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| 11 | 11 | | | | | | | | | | | | | | |
| 12 | 12 | | | | | | | | | | | | | | |
| 13 | 13 | | | | | | | | | | | | | | |
| 14 | 14 | | | | | | | | | | | | | | |
| | 15 | | | | | | | | | | | | | | |
| 15 | 16 | | | | | | | | | | | | | | |

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|---|---|---|---|
| NONE<br><br>(Assistant Examiner) | (Date) | **Total Claims Allowed:**<br>21 | |
| /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691<br><br>(Primary Examiner) | 07/05/2017<br><br>(Date) | O.G. Print Claim(s)<br>1 | O.G. Print Figure<br>5 |

**REQUEST FOR CONTINUED EXAMINATION (RCE) TRANSMITTAL**

*I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on June 21, 2017 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Elizabeth Gomez'

| | | | |
|---|---|---|---|
| Application Number | : | 13/614,197 | Confirmation No. 4264 |
| Filing Date | : | September 13, 2012 | |
| Inventor(s) | : | Sang-Shin Lee | |
| Title | : | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| Group Art Unit | : | 2691 | |
| Examiner Name | : | Kwang-Su Yang | |
| Docket No. | : | **069657** | Date: June 21, 2017 |

**MAIL TO: Mail Stop RCE**

This is a Request for Continued Examination (RCE) under 37 CFR § 1.114 of the above-identified application.

This application is **not** an application of the kind specified in 37 CFR § 1.114(e).

1. THE STATUS OF THE APPLICATION IS AS FOLLOWS:
   a. __X__ Pending (no review proceedings active)
      (1) ____ An Action was mailed by the Office on _, as to which no appeal under 37 CFR § 1.191 has been filed and
         ____ a response under 37 CFR § 1.116 was filed on
            ____ via Express Mail
            ____ with certificate of electronic transmission under 37 CFR § 1.8
         ____ that Action was a Final Rejection, the finality of which is to be withdrawn by this Request
         ____ an appeal or civil action under 35 U.S.C. 141,145 or 146 has been terminated
      (2) __X__ Allowed: the Notice of Allowance was mailed by the Office on March 22, 2017
         __X__ the Issue Fee has not been paid
         ____ the Issue Fee has been paid **and** a petition under 37 CFR § 1.313 was granted on
   b. ____ Pending (with review proceeding active)
      An appeal under 37 CFR § 1.191 has been filed. **Applicant(s) hereby withdraw that appeal and request reopening of the prosecution of the application.**
2. SUBMISSION(S) REQUIRED (check at least one)
   a. Previously submitted
      ____ Consider the amendments/reply under 37 CFR § 1.116 previously filed on
      ____ Consider the arguments in the Appeal or Reply Brief previously filed on



Petitioner Ex 1015, p. 73
BOE et al. v. Samsung, IPR2023-00988

____ Other:

b. Enclosed

____ Amendment/Reply
____ Affidavit(s)/Declaration(s)
__X__ Information Disclosure Statement
____ Documents under 37 CFR § 1.48
____ Petition for Extension of Time
__X__ Other: Form SB/08/A/B with References

Please direct all correspondence to **CUSTOMER NUMBER 23363**. Direct telephone calls to 626/795-9900, **LEWIS ROCA ROTHGERBER CHRISTIE LLP, P.O. Box 29001, Glendale, CA 91209-9001.**

Respectfully submitted,

LEWIS ROCA ROTHGERBER CHRISTIE LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/eg

## REQUEST FOR CONTINUED EXAMINATION (RCE)
## FEE CALCULATION SHEET

**Application No. 13/614,197**

| PART I -- BASIC FILING FEE | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | Large Entity Rate | Small Entity Rate | Micro Entity Rate | FEE |
| Basic Filing Fee | | | | 1,700.00 | 850.00 | 425.00 | 1,700.00 |
| **PART II -- ADDITIONAL CLAIMS (compared to application before RCE)** | | | | | | | |
| | Claims Remaining After Amendment | Highest Number Paid For | Number Extra Claims | Large Entity Rate | Small Entity Rate | Micro Entity Rate | FEE |
| Total Claims | 21 - | * 21 | = 0 | x 80.00 | 40.00 | 20.00 | 0 |
| Independent Claims | 1 - | ** 3 | = 0 | x 420.00 | 210.00 | 105.00 | 0 |
| First Presentation of Multiple Dependent Claims | | | | 780.00 | 390.00 | 195.00 | 0.00 |
| TOTAL FILING FEE | | | | | | | $1,700.00 |
| LIST INDEPENDENT CLAIMS: 1 | | | | | | | |
| * IF THE "HIGHEST NUMBER OF TOTAL CLAIMS PREVIOUSLY PAID FOR" IS 20 OR LESS, WRITE "20" IN THIS SPACE<br>** IF HIGHEST NUMBER OF INDEPENDENT CLAIMS PREVIOUSLY PAID FOR IS 3 OR LESS, WRITE "3" IN THIS SPACE | | | | | | | |

1. FEES *(The RCE fee under 37 CFR § 1.17(e) is required by 37 CFR § 1.114 when the RCE is filed.)*

   a. Amount (total from Fee Calculation Sheet)

   The fee of $1,700.00 is submitted herewith.

   b. X The Commissioner is hereby authorized to charge any fees under 37 CFR 1.16 and 1.17 which may be required for this transaction to Deposit Account No. 03-1728. Please show our docket number with any charge or credit to our Deposit Account.

JEJ 101695625.1-*-06/21/2017 12:04 PM

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 069657 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
| | | 6,882,364 B1 | 04-19-2005 | Inuiya et al. |
| | | 2004/0183764 A1 | 09-23-2004 | Kim et al. |
| | | | | |
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| | | | | |

**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
| | | | | | |
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**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | U.S. Office Action dated May 11, 2017, issued in cross-reference U.S. Patent Application No. 13/872,018 (16 pages) |
| | | |
| | | |
| | | |

JEJ 101692258.1-*-06/21/2017 11:07 AM

| EXAMINER SIGNATURE | | DATE CONSIDERED | |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

JEJ/eg

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on June 21, 2017 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Elizabeth Gomez

Inventor(s) : Sang-Shin Lee Confirmation No. 4264
Application No. : 13/614,197
Filed : September 13, 2012
Title : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

Grp./Div. : 2691
Examiner : Kwang-Su Yang

Docket No. : 069657

**SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT**
**37 CFR § 1.97(b)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
June 21, 2017

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is an information disclosure statement listing the references that are known to applicant. A copy of the listed Other Documents reference is enclosed. This filing is timely because it is made during one of the periods described in 37 CFR § 1.97(b).

It is respectfully requested that the listed references be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of the information disclosure statement be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
LEWIS ROCA ROTHGERBER CHRISTIE LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/eg
Enclosures: Information Disclosure Statement, w/references
JEJ 101692253.1-*-06/21/2017 11:05 AM

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 13614197 |
| **Filing Date:** | 13-Sep-2012 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Filer:** | Jun-Young E. Jeon/Elizabeth Gomez |
| **Attorney Docket Number:** | 69657/S1437 |

Filed as Large Entity

**Filing Fees for Utility under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| RCE- 2ND AND SUBSEQUENT REQUEST | 1820 | 1 | 1700 | 1700 |
| | | **Total in USD ($)** | | **1700** |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 29570661 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Young E. Jeon/Elizabeth Gomez |
| **Filer Authorized By:** | Jun-Young E. Jeon |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 21-JUN-2017 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 19:18:37 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | CARD |
| Payment was successfully received in RAM | $1700 |
| RAM confirmation Number | 062217INTEFSW19193300 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Request for Continued Examination (RCE) | 69657_RCE.PDF | 32268<br>ddbee7d23c45bda88d0d2a6e7f346049241214f7 | no | 3 |
| **Warnings:** | | | | | |
| This is not a USPTO supplied RCE SB30 form. | | | | | |
| **Information:** | | | | | |
| 2 | | 69657_IDS.PDF | 34575<br>bde73ae3275a005022d440420e2cffff7caeb418 | yes | 3 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Information Disclosure Statement (IDS) Form (SB08) | 3 | 3 |
| | Transmittal Letter | 1 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Non Patent Literature | 05_11_2017_FOA_72827.pdf | 522490<br>99b3fd13bb11c19b4686c80676deed5dc269de7e | no | 16 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 4 | Fee Worksheet (SB06) | fee-info.pdf | 30929<br>730ad974d590955b33d60e5b7c51d834ade7c7f4 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 620262 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

# NOTICE OF ALLOWANCE AND FEE(S) DUE

23363 7590 03/22/2017

Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

| EXAMINER | |
|---|---|
| YANG, KWANG-SU | |
| ART UNIT | PAPER NUMBER |
| 2691 | |

DATE MAILED: 03/22/2017

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

TITLE OF INVENTION: PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | UNDISCOUNTED | $960 | $0 | $0 | $960 | 06/22/2017 |

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.**

**THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.**

**HOW TO REPLY TO THIS NOTICE:**

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.**



PTOL-85 (Rev. 02/11)

Petitioner Ex 1015, p. 84
BOE et al. v. Samsung, IPR2023-00988

## PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail** **Mail Stop ISSUE FEE**
**Commissioner for Patents**
**P.O. Box 1450**
**Alexandria, Virginia 22313-1450**
**or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

23363 7590 03/22/2017
Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

**Certificate of Mailing or Transmission**
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

| (Depositor's name) |
|---|
| (Signature) |
| (Date) |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

TITLE OF INVENTION: PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | UNDISCOUNTED | $960 | $0 | $0 | $960 | 06/22/2017 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|---|---|---|
| YANG, KWANG-SU | 2691 | 345-082000 |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ Applicant certifying micro entity status. See 37 CFR 1.29
  NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ❑ Applicant asserting small entity status. See 37 CFR 1.27
  NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ❑ Applicant changing to regular undiscounted fee status.
  NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____



PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Petitioner Ex 1015, p. 85
BOE et al. v. Samsung, IPR2023-00988

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

23363 7590 03/22/2017

Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

| EXAMINER | |
|---|---|
| YANG, KWANG-SU | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2691 | |

DATE MAILED: 03/22/2017

**Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)**
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.



PTOL-85 (Rev. 02/11)

Petitioner Ex 1015, p. 86
BOE et al. v. Samsung, IPR2023-00988

## OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

## Privacy Act Statement

**The Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

| Notice of Allowability | Application No. 13/614,197 | Applicant(s) LEE, SANG-SHIN | |
|---|---|---|---|
| | Examiner KWANG-SU YANG | Art Unit 2691 | AIA (First Inventor to File) Status No |

***-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--***

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *Response filed on 03/02/2017*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-14 and 16-22*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   **Certified copies:**

   a) ☒ All b) ☐ Some *c) ☐ None of the:
   1. ☒ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE**.

5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   **Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☐ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☒ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/KWANG-SU YANG/
Primary Examiner, Art Unit 2691

## EXAMINER'S AMENDMENT

1. The present application is being examined under the pre-AIA first to invent provisions.

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

### *Rejoinder of Claims*

3. Claims 1-14 and 16-22 are allowable. Claims 6-14, previously withdrawn from consideration as a result of a restriction requirement, require all the limitations of an allowable claim. Pursuant to the procedures set forth in MPEP § 821.04(a), **the restriction requirement among invention's species, as set forth in the Office action mailed on 08/18/2014, is hereby withdrawn** and claims 6-14 are hereby rejoined and fully examined for patentability under 37 CFR 1.104. In view of the withdrawal of the restriction requirement, applicant is advised that if any claim presented in a continuation or divisional application is anticipated by, or includes all the limitations of, a claim that is allowable in the present application, such claim may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application. Once the restriction requirement is withdrawn, the provisions of 35 U.S.C. 121 are no longer applicable. See *In re Ziegler*, 443 F.2d 1211, 1215, 170 USPQ 129, 131-32 (CCPA 1971). See also MPEP § 804.01.

4. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the

issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

***Inquiry***

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KWANG-SU YANG whose telephone number is (571)270-7307. The examiner can normally be reached on Mon - Fri 9:00am - 6:00pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Chanh Nguyen can be reached on (571)272-7772. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KWANG-SU YANG/
Primary Examiner, Art Unit 2691

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 069657 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
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**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
| | | KR 10-2008-0111130 | 12-22-2008 | CAMBRIDGE DISPLAY TECHNOLOGY LIMITED | Korea Patent Abstract |
| | | | | | |
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**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | |
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EG PAS1462028.1-*-02/6/17 9:25 AM

| EXAMINER SIGNATURE | /KWANG-SU YANG/ | DATE CONSIDERED | 03/15/2017 |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

JEJ/eg



ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KY/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

# BIB DATA SHEET

**CONFIRMATION NO. 4264**

| SERIAL NUMBER | FILING or 371(c) DATE<br>RULE | CLASS | GROUP ART UNIT | ATTORNEY DOCKET NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | 345 | 2691 | 69657/S1437 |

**APPLICANTS**

**INVENTORS**

Sang-Shin Lee, Yongin-si, KOREA, REPUBLIC OF;

**** CONTINUING DATA ***************************

**** FOREIGN APPLICATIONS ***************************

REPUBLIC OF KOREA 10-2012-0022967 03/06/2012

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

09/25/2012

| Foreign Priority claimed ☑ Yes ☐ No<br>35 USC 119(a-d) conditions met ☑ Yes ☐ No<br>Verified and Acknowledged /KWANG-SU YANG/ Examiner's Signature | ☐ Met after Allowance<br>Initials | STATE OR COUNTRY | SHEETS DRAWINGS | TOTAL CLAIMS | INDEPENDENT CLAIMS |
|---|---|---|---|---|---|
| | | KOREA, REPUBLIC OF | 5 | 20 | 1 |

**ADDRESS**

Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001
UNITED STATES

**TITLE**

PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

| FILING FEE RECEIVED | | |
|---|---|---|
| 1330 | FEES: Authority has been given in Paper<br>No._____ to charge/credit DEPOSIT ACCOUNT<br>No._____ for following: | ☐ All Fees<br>☐ 1.16 Fees (Filing)<br>☐ 1.17 Fees (Processing Ext. of time)<br>☐ 1.18 Fees (Issue)<br>☐ Other _____<br>☐ Credit |

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 069657 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
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**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
| | | TW I328207 | 08-01-2010 | Chao et al. | Abstract of TW 2008-02221, listed below |
| | | | | | |
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**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | English Abstract of TW 2008-02221 A, also published as TW I328207, listed above |
| | | TIPO Office Action dated October 11, 2016, for corresponding Taiwanese Patent Application No. 102124953 (6 pages) |
| | | |

EG PAS1454420.1-*-12/15/16 2:32 PM

| EXAMINER SIGNATURE | /KWANG-SU YANG/ | DATE CONSIDERED | 12/19/2016 |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

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Sheet 1 of 1

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KY/

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | Examiner | Art Unit |
| | KWANG-SU YANG | 2691 |

| CPC- SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| CPC COMBINATION SETS - SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| US CLASSIFICATION SEARCHED | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
| 345 | 82 419 | 10/24/2014 | KY |

| SEARCH NOTES | | |
|---|---|---|
| Search Notes | Date | Examiner |
| EAST: Inventor Search | 10/24/2014 | KY |
| EAST: Text Search | 10/24/2014; 10/27/2014 | KY |
| EAST: Updated Text Search | 02/27/2015 | KY |
| EAST: IDS Search | 03/07/2015 | KY |
| EAST: IDS Search | 07/09/2015 | KY |
| EAST: Updated Text Search | 07/09/2015 | KY |
| EAST: Updated Text Search | 11/25/2015; 11/27/2015 | KY |
| EAST: IDS Search | 04/02/2016 | KY |
| EAST: Updated Text Search | 04/02/2016 | KY |
| EAST: IDS Search | 10/08/2016 | KY |
| EAST: Updated Text Search | 10/08/2016; 10/11/2016 | KY |
| Updated Classification Search (345/82) | 03/15/2017 | KY |
| EAST: Updated Text Search | 03/15/2017 | KY |

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|---|---|
| | /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691 |

| INTERFERENCE SEARCH | | | |
|---|---|---|---|
| **US Class/ CPC Symbol** | **US Subclass / CPC Group** | **Date** | **Examiner** |
| US-PGPUB; USPAT | (third adj (pixel sub$1pixel dot) same (arrangement structure) same (organic adj light OLED OELD) same virtual adj square same (center central) same consecutive same first with green same (larger greater smaller less)).clm. | 03/15/2017 | KY |

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| | /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691 |

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | **Examiner** | **Art Unit** |
| | KWANG-SU YANG | 2691 |

| CPC | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Symbol** | | | | | | **Type** | **Version** |
| H01L | | 27 | / | 3216 | | F | 2013-01-01 |
| H01L | | 27 | / | 3218 | | I | 2013-01-01 |
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| CPC Combination Sets | | | | | | | |
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| **Symbol** | | | | | **Type** | **Set** | **Ranking** | **Version** |
| | | | / | | | | | |
| | | | / | | | | | |

| NONE | | **Total Claims Allowed:** | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 21 | |
| /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691 | 03/15/2017 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 5 |

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | **Examiner** | **Art Unit** |
| | KWANG-SU YANG | 2691 |

| US ORIGINAL CLASSIFICATION | | INTERNATIONAL CLASSIFICATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLASS | SUBCLASS | CLAIMED | | | | | NON-CLAIMED | | | | | |
| 345 | 82 | G | 0 | 9 | G | 3 / 32 (2006.01.01) | | | | | | |

| CROSS REFERENCE(S) | | | | | |
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| CLASS | SUBCLASS (ONE SUBCLASS PER BLOCK) | | | | |
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| NONE | | Total Claims Allowed: | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 21 | |
| /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691 | 03/15/2017 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 5 |

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | **Examiner** | **Art Unit** |
| | KWANG-SU YANG | 2691 |

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 16 | 17 | | | | | | | | | | | | |
| 2 | 2 | 17 | 18 | | | | | | | | | | | | |
| 3 | 3 | 19 | 19 | | | | | | | | | | | | |
| 4 | 4 | 20 | 20 | | | | | | | | | | | | |
| 5 | 5 | 18 | 21 | | | | | | | | | | | | |
| 6 | 6 | 21 | 22 | | | | | | | | | | | | |
| 7 | 7 | | | | | | | | | | | | | | |
| 8 | 8 | | | | | | | | | | | | | | |
| 9 | 9 | | | | | | | | | | | | | | |
| 10 | 10 | | | | | | | | | | | | | | |
| 11 | 11 | | | | | | | | | | | | | | |
| 12 | 12 | | | | | | | | | | | | | | |
| 13 | 13 | | | | | | | | | | | | | | |
| 14 | 14 | | | | | | | | | | | | | | |
| | 15 | | | | | | | | | | | | | | |
| 15 | 16 | | | | | | | | | | | | | | |

| | | | |
|---|---|---|---|
| NONE<br><br>(Assistant Examiner) | (Date) | **Total Claims Allowed:**<br>21 | |
| /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691<br><br>(Primary Examiner) | 03/15/2017<br><br>(Date) | O.G. Print Claim(s)<br>1 | O.G. Print Figure<br>5 |

**EAST Search History**

**EAST Search History (Prior Art)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L1 | 13560 | 345/82,419.ccls. | US-PGPUB; USPAT; USOCR | OR | ON | 2017/03/15 13:11 |
| L2 | 273160 | organic adj light adj emitting OLED OELD | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2017/03/15 13:23 |
| L3 | 52171 | (pixel sub$1pixel) near3 (arrangement layout) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2017/03/15 13:23 |
| L4 | 4719 | (center central) same (vertex node) same square | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2017/03/15 13:23 |
| L5 | 2 | 1 and 2 and 3 and 4 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2017/03/15 13:23 |
| L6 | 27 | 2 and 3 and 4 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2017/03/15 13:24 |

**EAST Search History (Interference)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L7 | 0 | (third adj (pixel sub$1pixel dot) same (arrangement structure) same (organic adj light OLED OELD) same virtual adj square same (center central) same consecutive same first with green same (larger greater smaller less)).clm. | US-PGPUB; USPAT | OR | ON | 2017/03/15 13:30 |

**3/15/2017 2:02:29 PM**
**C:\Users\kyang\Documents\EAST\Workspaces\13614197.wsp**



Petitioner Ex 1015, p. 99
BOE et al. v. Samsung, IPR2023-00988

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on March 2, 2017 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Anna J. O'Connor

| | | |
|---|---|---|
| Appl No. | : 13/614,197 | Confirmation No. 4264 |
| Inventor | : Sang-Shin Lee | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| TC/A.U. | : 2691 | |
| Examiner | : Yang, Kwang-Su | |
| Docket No. | : 069657 | |
| Customer No. | : 23363 | |

**AMENDMENT *EX PARTE QUAYLE***

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
March 2, 2017

Commissioner:

In response to the *Ex Parte Quayle* Office action of January 5, 2017, please amend the above-identified application as follows:

**Amendments to the Claims** are reflected in the listing of claims which begins on page 2 of this paper.

**Remarks/Arguments** begin on page 7 of this paper.



Petitioner Ex 1015, p. 100
BOE et al. v. Samsung, IPR2023-00988

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**
**AMENDMENT TRANSMITTAL LETTER**

*I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on March 2, 2017 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Anna J. O'Connor

Inventor : Sang-Shin Lee — Confirmation No. 4264
Application No. : 13/614,197
Filed : September 13, 2012
Title : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

Grp./Div. : 2691
Examiner : Yang, Kwang-Su

Docket No. : 069657

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
March 2, 2017

Commissioner:

Enclosed is an amendment to the above-identified application.

| CLAIMS AS AMENDED | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Claims Remaining After Amendment | Highest Number Previously Paid For | Number Extra Claims | Large Entity Rate | Small Entity Rate | Micro Entity Rate | FEE |
| Total Claims | 21 - | * 21 | = 0 | 0 x $80.00 | $40.00 | $20.00 | $0.00 |
| Independent Claims | 1 - | ** 3 | = 0 | 0 x $420.00 | $210.00 | $105.00 | $0.00 |
| Multiple Dependent Claims*** | | | | $780.00 | $390.00 | $195.00 | $0.00 |
| | | | | | | Total Additional Fee | $0.00 |
| List Independent Claims: 1 | | | | | | | |
| * If the "Highest Number of Total Claims Previously Paid For" is less than 20, enter "20" in this space<br>** If the "Highest Number of Independent Claims Previously Paid For" is less than 3, enter "3" in this space<br>*** Pay this fee only when "Multiple Dependent Claims" are added for the first time | | | | | | | |

__X__ No additional fee is required.

_____ A Petition for Extension of Time and the required fee are enclosed.

_____ Other enclosures: _____



Petitioner Ex 1015, p. 101
BOE et al. v. Samsung, IPR2023-00988

The Commissioner is hereby authorized to charge any fees under 37 CFR 1.16 and 1.17 which may be required by or to give effect to this paper to Deposit Account No. 03-1728. Please show our docket number with any charge or credit to our Deposit Account.

Respectfully submitted,

LEWIS ROCA ROTHGERBER CHRISTIE LLP

By _____

Jimmy Y. Kwun
Reg. No. 66,490
626/795-9900

JYK/ajo

AJO PAS1465968.1-*-03/2/17 9:46 AM

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 28518872 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Yong J. Kwun/Anna O'Connor |
| **Filer Authorized By:** | Yong J. Kwun |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 02-MAR-2017 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 16:31:02 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 069657_AMD-ExParte.PDF | 201362<br>18e873b51468903b7e21828f74ce9a9f17c66ba | yes | 10 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Applicant Arguments/Remarks Made in an Amendment | 9 | 10 |
| | Claims | 4 | 8 |
| | Response after Ex Parte Quayle Action | 3 | 3 |
| | Transmittal Letter | 1 | 2 |

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|---|---|
| **Warnings:** | |
| **Information:** | |
| **Total Files Size (in bytes):** | 201362 |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

## REMARKS/ARGUMENTS

Claims 1-14 and 16-22 remain in the present application, of which claim 1 is independent. Claims 6-14 were previously withdrawn from consideration. Claim 15 was previously cancelled without prejudice. Claims 8-12 are amended herein. No new matter has been introduced. Applicant thanks the Examiner for indicating that claims 1-5 and 16-22 are allowable. Applicant respectfully requests rejoinder and allowance of claims 6-14.

### Quayle Action

Applicants were requested to clean up the claims languages for claims 1-13, and 16-21. Particularly, it appears that the Office action suggests amending withdrawn claims 8-12 and canceling claims 14 and 22.

Accordingly, claims 8-12 were amended herein as suggest in the Office action, in addition to other amendments for better claim form.

As for claims 14 and 22, these claims depend, directly or indirectly, from claim 1, and each appear to contain additional limitations. For example, while claim 1 requires that only a second pixel has a larger area than that of a third pixel, claim 14 (which depends from claims 1-6 and 13) requires that each of the second pixel and the another second pixel of claim 2 has a larger area than that of each of the third pixel and the another third pixel of claim 3. As for claim 22 (which directly depends from claim 1), the feature that the second pixel has a larger area than that of the first pixel is not a feature of claim 1.

Applicant, therefore, respectfully requests that claims 6-14 be rejoined, and that claims 1-14 and 16-22 be allowed.

**Allowable Subject Matter**

Applicant thanks the Examiner for indicating that claims 1-5 and 16-22 are allowed.

**Concluding Remarks**

In view of the foregoing amendments and remarks, Applicant earnestly solicits a timely issuance of a Notice of Allowance. If there are any remaining issues that can be addressed over the telephone, the Examiner is cordially invited to call Applicant's attorney at the number listed below.

Respectfully submitted,
LEWIS ROCA ROTHGERBER CHRISTIE LLP

By _____
Jimmy Y. Kwun
Reg. No. 66,490
626/795-9900

JYK/ajo

AJO PAS1459599.1-*-03/2/17 9:21 AM

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. (Previously Presented) A pixel arrangement structure of an organic light emitting diode (OLED) display, comprising:

a plurality of pixels for displaying an image on the OLED display and comprising:

a first pixel having a center coinciding with a center of a virtual square;

a second pixel separated from the first pixel and having a center at a first vertex of the virtual square;

another first pixel on a line defined by the center of the virtual square and the first vertex, the first pixel, the second pixel, and the other first pixel being consecutive pixels on the line from among the plurality of pixels; and

a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square,

wherein the second pixel has a larger area than that of the third pixel, and

wherein the first pixel is configured to emit green light.

2. (Previously Presented) The pixel arrangement structure of claim 1,

wherein the plurality of pixels further comprises another second pixel separated from the first pixel and having a center at a third vertex neighboring the second vertex of the virtual square, and

wherein the second pixels are separated from each other by the first pixel.



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3. (Previously Presented) The pixel arrangement structure of claim 2,

wherein the plurality of pixels further comprises another third pixel separated from the first pixel and having a center at a fourth vertex neighboring the third vertex of the virtual square, and

wherein the third pixels are separated from each other by the first pixel.

4. (Original) The pixel arrangement structure of claim 3, wherein the second pixels and the third pixels enclose the first pixel in the virtual square.

5. (Previously presented) The pixel arrangement structure of claim 4, wherein

the first pixel, the second pixels, and the third pixels have polygonal shapes, and

each of the second pixels and each of the third pixels has a larger area than the first pixel.

6. (Withdrawn) The pixel arrangement structure of claim 5, wherein

the first pixel has a quadrilateral shape, and

the second pixels and the third pixels have hexagonal or octagonal shapes.

7. (Withdrawn) The pixel arrangement structure of claim 6, wherein the second pixels and the third pixels have octagonal shapes.

8. (Withdrawn-Currently Amended) The pixel arrangement structure of claim 7, wherein a shortest distance between the first pixel and ~~each of~~ corresponding ones of the second pixels, a shortest distance between the first pixel and ~~each of~~ corresponding ones of the third pixels, and a shortest distance between each of the second pixels and ~~each of~~ corresponding ones of the third pixels are a same first length.

9. (Withdrawn-Currently Amended) The pixel arrangement structure of claim 8, wherein

the first pixel comprises a plurality of first pixels,

the plurality of first pixels have a same quadrilateral shape, and

a shortest distance between neighboring pixels of the plurality of first pixels is a second length that is longer than the first length.

10. (Withdrawn-Currently Amended) The pixel arrangement structure of claim 6, wherein

each of the second pixels has a larger area than each of the third pixels,

a shortest distance between each of the second pixels and [[each]] corresponding ones of the third pixels is a same first length, and

a shortest distance between the first pixel and [[each]] corresponding ones of the second pixels, and a shortest distance between the first pixel and [[each]] corresponding ones of the third pixels are a same second length.

11. (Withdrawn-Currently Amended) The pixel arrangement structure of claim 10, wherein

the first pixel comprises a plurality of first pixels,

the plurality of first pixels have a same quadrilateral shape, and

a shortest distance between neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

12. (Withdrawn-Currently Amended) The pixel arrangement structure of claim 10, wherein

the first pixel comprises a plurality of first pixels,

neighboring pixels of the plurality of first pixels have quadrilateral shapes that are symmetrical to each other, and

a shortest distance between the neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

13. (Withdrawn) The pixel arrangement structure of claim 6, wherein

the first pixel comprises a plurality of first pixels, and

neighboring pixels of the plurality of first pixels have quadrilateral shapes that are symmetrical to each other.

14. (Withdrawn) The pixel arrangement structure of claim 13, wherein each of the second pixels has a larger area than each of the third pixels.

15. (Canceled)

16. (Previously presented) The pixel arrangement structure of claim 5, wherein

the first pixel has an octagonal shape, and

the second pixels and the third pixels have quadrilateral shapes.

17. (Previously presented) The pixel arrangement structure of claim 16, wherein

each of the second pixels has a larger area than each of the third pixels,

a shortest distance between each of the second pixels and each of the third pixels is a same first length, and

a shortest distance between the first pixel and each of the second pixels, and a shortest distance between the first pixel and each of the third pixels are a same second length.

18. (Previously presented) The pixel arrangement structure of claim 17, wherein

the first pixel comprises a plurality of first pixels, and

neighboring pixels of the plurality of first pixels have octagonal shapes that are symmetrical to each other.

19. (Original) The pixel arrangement structure of claim 1, wherein the first pixel, the second pixel, and the third pixel are configured to emit different color lights.

20. (Previously presented) The pixel arrangement structure of claim 19, wherein the second pixel and the third pixel are configured to emit blue light and red light, respectively.

21. (Previously presented) The pixel arrangement structure of claim 18, wherein a shortest distance between the neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

22. (Previously presented) The pixel arrangement structure of claim 1, wherein the second pixel has a larger area than that of the first pixel.



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PTO/SB/06 (09-11)
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# PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

| Application or Docket Number | Filing Date | ☐ To be Mailed |
|---|---|---|
| 13/614,197 | 09/13/2012 | |

**ENTITY:** ☒ LARGE ☐ SMALL ☐ MICRO

## APPLICATION AS FILED – PART I

| FOR | (Column 1) NUMBER FILED | (Column 2) NUMBER EXTRA | RATE ($) | FEE ($) |
|---|---|---|---|---|
| ☐ BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | |
| ☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | |
| ☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | minus 20 = | * | X $ = | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | minus 3 = | * | X $ = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | |

## APPLICATION AS AMENDED – PART II

AMENDMENT **03/02/2017**

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * 21 | Minus | ** 21 | = 0 | X $80 = | 0 |
| Independent (37 CFR 1.16(h)) | * 1 | Minus | ***3 | = 0 | X $420 = | 0 |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | TOTAL ADD'L FEE | 0 |

AMENDMENT

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * | Minus | ** | = | X $ = | |
| Independent (37 CFR 1.16(h)) | * | Minus | *** | = | X $ = | |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
GLORIA NORRIS

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 069657 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
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**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
| | | KR 10-2008-0111130 | 12-22-2008 | CAMBRIDGE DISPLAY TECHNOLOGY LIMITED | Korea Patent Abstract |
| | | | | | |
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**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | |
| | | |

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| EXAMINER SIGNATURE | | DATE CONSIDERED | |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

JEJ/eg

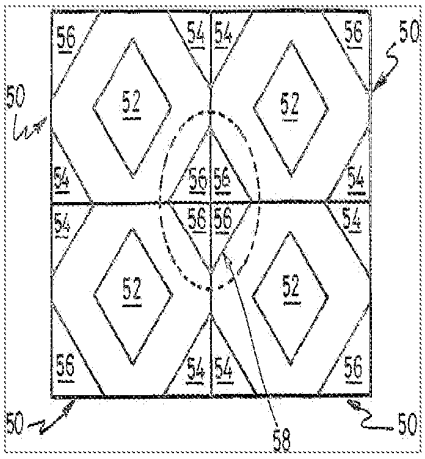


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# 광전자 디스플레이 및 그 제조 방법

OPTOELECTRONIC DISPLAY AND METHOD OF MANUFACTURING THE SAME

| | |
|---|---|
| (51) Int. CL | H01L 27/32(2008.12.17) |
| (52) CPC ◈ | |
| (21) Application No.(Date) | 1020087027582 (2008.11.11) |
| (71) Applicant | CAMBRIDGE DISPLAY TECHNOLOGY LIMITED |
| Translation submission Date | (2008.11.11) |
| (11) Registration No.(Date) | 1013479960000 (2013.12.27) |
| (65) Unex. Pub. No.(Date) | 1020080111130 (2008.12.22) |
| (11) Publication No.(Date) | (2014.01.07) |
| (86) Int'l Application No.(Date) | PCT/GB2007/001268(2007.04.05) |
| (87) Int'l Unex. Pub. No.(Date) | WO2007128971(2007.11.15) |
| (30) Priority info.<br>(Country / No. / Date) | 영국(GB) \| 0607369.6 \| 2006.04.12 |
| Legal Status | Registered |
| Examination Status | Decision to grant (General) |
| Trial info | |
| Kind/Right of Org. Application | / |
| Right of Org. Application No.(Date) | |
| Related Application No. | |
| Request for an examination(Date) | Y(2012.04.02) |
| Number of examination claims | 25 |




(57) Korea Patent Abstract

An optoelectronic display comprising a plurality of pixels, each pixel comprising a plurality of sub-pixels, wherein the optoelectronic display comprises a colour-forming layer which is patterned providing a plurality of discrete colour-forming regions in a two-dimensional array, and wherein an addressing array is



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provided for addressing the discrete colour-forming regions, at least some of the discrete colour-forming regions having portions which are separately addressable by the addressing array, each portion defining a sub-pixel of the optoelectronic display.© KIPO & WIPO 2009

(19) 대한민국특허청(KR)
(12) 공개특허공보(A)

(11) 공개번호 10-2008-0111130
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(51) Int. Cl.
*H01L 27/32* (2006.01)
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심사청구일자 없음
번역문제출일자 2008년11월11일
(86) 국제출원번호 PCT/GB2007/001268
국제출원일자 2007년04월05일
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국제공개일자 2007년11월15일
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0607369.6 2006년04월12일 영국(GB)

(71) 출원인
**캠브리지 디스플레이 테크놀로지 리미티드**
영국 캠브리지 캠브리지셔 씨비23 6디더블유 캠버른 비지니스 파크 캠버른 빌딩 2020
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**스미스 유안**
영국 씨비23 6디더블유 캠버른 캠브리지셔 캠버른 비즈니스 파크 빌딩 2020 캠브리지 디스플레이 테크놀로지 리미티드 아이피 디파트먼트
**베일 마크**
영국 씨비21 4알피 캠브리지 캠브리지셔 웨스트 윅캠 스트리틀리 엔드 37
(74) 대리인
**김창세, 김원준**

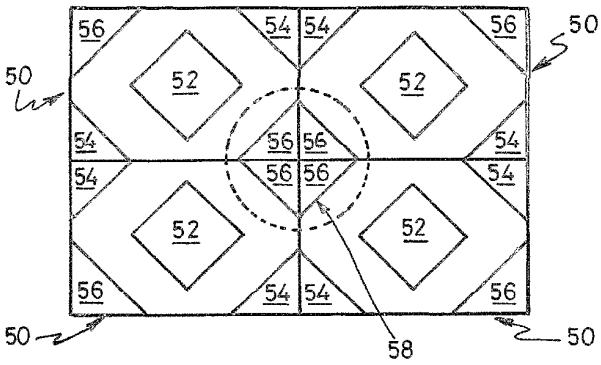
전체 청구항 수 : 총 26 항

# (54) 광전자 디스플레이 및 그 제조 방법

*(57) 요 약*

각 픽셀이 다수의 서브 픽셀(52,54,56)을 포함하는 다수의 픽셀(50)을 포함하는 광전자 디스플레이는 다수의 이산 컬러 형성 영역(58)을 2차원 어레이로 제공하도록 패터닝된 컬러 형성 층을 포함하되, 상기 이산 컬러 형성 영역을 어드레싱하는 어드레싱 어레이가 제공되고, 상기 이산 컬러 형성 영역(58)의 적어도 일부는 상기 어드레싱 어레이에 의해 개별적으로 어드레싱가능한 부분을 구비하며, 각 부분은 상기 광전자 디스플레이의 서브 픽셀(56)을 규정한다.

*대 표 도*






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*특허청구의 범위*

**청구항 1**

각 픽셀이 다수의 서브 픽셀을 포함하는 다수의 픽셀을 포함하는 광전자 디스플레이에 있어서,

상기 광전자 디스플레이는 다수의 이산 컬러 형성 영역(discrete colour-forming region)을 2차원 어레이로 제공하는 패터닝된 컬러 형성 층을 포함하고,

상기 이산 컬러 형성 영역을 어드레싱(addressing)하는 어드레싱 어레이가 제공되고, 상기 이산 컬러 형성 영역의 적어도 일부는 상기 어드레싱 어레이에 의해 개별적으로 어드레싱가능한 부분을 구비하며, 각각의 상기 부분은 상기 광전자 디스플레이의 서브 픽셀을 규정하는

광전자 디스플레이.

**청구항 2**

제 1 항에 있어서,

각각의 상기 개별적으로 어드레싱가능한 부분은 상기 광전자 디스플레이에서 상이한 픽셀의 서브 픽셀을 규정하는

광전자 디스플레이.

**청구항 3**

제 1 항 또는 제 2 항에 있어서,

상기 이산 컬러 형성 영역은 2, 3, 4 또는 6개의 개별적으로 어드레싱가능한 부분을 포함하는

광전자 디스플레이.

**청구항 4**

제 1 항 내지 제 3 항 중 어느 한 항에 있어서,

상기 픽셀은 정사각형, 직사각형, 삼각형 또는 육각형의 형상인

광전자 디스플레이.

**청구항 5**

제 1 항 내지 제 4 항 중 어느 한 항에 있어서,

상기 이산 컬러 형성 영역은 정사각형, 직사각형, 원형, 타원형 또는 육각형 중 하나 이상의 형상인

광전자 디스플레이.

**청구항 6**

제 1 항 내지 제 5 항 중 어느 한 항에 있어서,

상기 광전자 디스플레이는 다중컬러 디스플레이인

광전자 디스플레이.

**청구항 7**

제 1 항 내지 제 8 항 중 어느 한 항에 있어서,

상기 컬러 형성 층은 발광층인

광전자 디스플레이.



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**청구항 8**

제 7 항에 있어서,

상기 광전자 디스플레이는,

기판과,

상기 기판 상에 배치된 제 1 전극 층과,

상기 제 1 전극 층 상에 배치된 발광층과,

상기 발광층 위에 배치된 제 2 전극 층을 포함하되,

상기 발광층은 다수의 이산 발광 영역을 2차원 어레이로 제공하도록 패터닝되고, 상기 제 1 전극 층 및/또는 상기 제 2 전극 층은 다수의 전극을 포함하되, 각 전극은 각각의 이산 발광 영역과 연관된 적어도 두 개의 서브 전극을 포함하는

광전자 디스플레이.

**청구항 9**

제 8 항에 있어서,

상기 광전자 디스플레이는 각각의 서브 전극을 상이한 전압으로 구동할 수 있는 구동 회로를 더 포함하는

광전자 디스플레이.

**청구항 10**

제 9 항에 있어서,

상기 디스플레이는 능동 매트릭스 디스플레이고, 각 서브 픽셀은 그와 연관된 능동 스위칭 소자를 구비하여 상이한 구동 전압을 각각의 서브 전극에 제공하는

광전자 디스플레이.

**청구항 11**

제 8 항 내지 제 10 항 중 어느 한 항에 있어서,

상기 서브 전극 사이의 측면 도전(lateral conduction)을 방지하기 위해 상기 서브 전극 사이에 갭이 제공되는

광전자 디스플레이.

**청구항 12**

제 11 항에 있어서,

상기 갭은 상기 전극의 상위 표면을 평탄화하기 위해 절연 물질로 채워지는

광전자 디스플레이.

**청구항 13**

제 12 항에 있어서,

상기 절연 물질은 무기 유전체 물질 또는 유기 포토레지스트 물질인

광전자 디스플레이.

**청구항 14**

제 8 항 내지 제 13 항 중 어느 한 항에 있어서,

상기 서브 전극은 도전성 물질의 패터닝된 층과 도전성 물질의 패터닝되지 않은 층을 포함하고, 상기 패터닝되



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지 않은 층은 상기 패터닝된 층보다 덜 도전성이어서 상기 서브 전극 간의 측면 도전을 방지하는

광전자 디스플레이.

**청구항 15**

제 14 항에 있어서,

상기 패터닝된 층은 상기 서브 전극을 규정하는 패터닝된 도전성 접촉 층을 포함하고, 상기 패터닝되지 않은 층은 전하 주입 물질의 균일한 층을 포함하는

광전자 디스플레이.

**청구항 16**

제 8 항 내지 제 15 항 중 어느 한 항에 있어서,

상기 발광층은 다수의 웰(well)을 규정하는 상기 제 1 전극 층 위에 배치된 뱅크 구조체를 제공함으로써 패터닝되고, 각 웰은 상기 이산 발광 영역들 중 하나를 포함하며, 적어도 두 개의 서브 전극은 각 웰과 연관되는

광전자 디스플레이.

**청구항 17**

제 8 항 내지 제 16 항 중 어느 한 항에 있어서,

상기 제 1 전극 층은 상기 서브 전극을 포함하는

광전자 디스플레이.

**청구항 18**

제 8 항 내지 제 17 항 중 어느 한 항에 있어서,

상기 서브 전극은 애노드인

광전자 디스플레이.

**청구항 19**

제 8 항 내지 제 18 항 중 어느 한 항에 있어서,

상기 발광층은 유기 발광 물질을 포함하는

광전자 디스플레이.

**청구항 20**

제 19 항에 있어서,

상기 발광층은 폴리머 발광 물질을 포함하는

광전자 디스플레이.

**청구항 21**

제 8 항 내지 제 20 항 중 어느 한 항에 있어서,

도전성 폴리머 층이 상기 전극 층들 중 하나와 상기 발광층 사이에 배치되는

광전자 디스플레이.

**청구항 22**

제 1 항 내지 제 21 중 어느 한 항에 따른 광전자 디스플레이를 제조하는 방법에 있어서,

상기 컬러 형성 층은 용액(solution)으로부터 증착되는



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광전자 디스플레이 제조 방법.

**청구항 23**

제 22 항에 있어서,

상기 컬러 형성 층은 잉크젯 프린팅 또는 스핀 코팅에 의해 증착되는

광전자 디스플레이 제조 방법.

**청구항 24**

제 22 항 또는 제 23 항에 있어서,

기판을 제공하는 단계와,

상기 기판 상 제 1 전극 층을 증착하는 단계와,

상기 제 1 전극 층 상에 상기 컬러 형성 층으로서 발광층을 증착하는 단계와,

상기 발광층 위에 제 2 전극 층을 증착하는 단계를 포함하되,

상기 발광층은 패터닝되어 2차원 어레이의 이산 발광 영역을 제공하고, 상기 제 1 전극 층 및/또는 상기 제 2 전극 층은 다수의 전극을 포함하되, 각 전극은 각각의 이산 발광 영역과 연관된 적어도 두 개의 서브 전극을 포함하는

광전자 디스플레이 제조 방법.

**청구항 25**

제 24 항에 있어서,

상기 발광층은 상기 발광층을 증착하기 전에 다수의 웰을 규정하는 상기 제 1 전극 층 위에 배치된 뱅크 구조체를 증착함으로써 패터닝되고, 상기 발광층은 후속하여 각 웰이 상기 이산 발광 영역들 중 하나를 포함하도록 증착되어, 적어도 두 개의 서브 전극이 각 웰과 연관되는

광전자 디스플레이 제조 방법.

**청구항 26**

제 24 항 또는 제 25 항에 있어서,

상기 서브 전극은 레이저 제거, e-빔 제거, 건식 에칭, 습식 에칭 또는 직접 기록(writing)을 통해 패터닝되는

광전자 디스플레이 제조 방법.

## 명세서

### 기술 분야

<1> 본 발명은 광전자(optoelectronic) 디스플레이 및 이의 제조 방법에 관한 것이다.

### 배경 기술

<2> 다양한 유형의 광전자 디스플레이가 종래 기술에 알려져 있다. 이들은 예를 들어 액정 디스플레이(LCD), 전장 발광(ElectroLuminescent)(EL) 디스플레이 및 플라즈마 디스플레이(PD)를 포함한다.

<3> 다색의 디스플레이는 전형적으로 다수의 픽셀을 포함하는데, 각 픽셀은 다수의 서브 픽셀을 포함한다. 전체 컬러 디스플레이에서, 적색, 녹색 및 청색 서브 픽셀이 제공된다. 서브 픽셀은 컬러 형성 층에 의해 규정된다. 컬러 형성 층은 서브 픽셀을 규정하는 상이한 발광 물질의 다수의 이산 발광 영역을 포함하는 발광 층일 수 있다. 예를 들어, EL 디스플레이는 발광층의 이산 발광 영역에 대응하는 개개의 서브 픽셀을 어드레스할 수 있도록 패터닝된 전극 사이에 배치된 발광층을 구비한다.

<4> 이와 달리, 컬러 형성 층은 서브 픽셀을 규정하는 상이한 컬러의 다수의 이산 영역을 포함하는 컬러 필터일 수



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있다. 예를 들어, LCD는 백색 백라이트를 구비한 필터 및 이 필터의 이산 컬러 영역에 대응하는 개개의 서브 픽셀을 어드레싱하는 액정 장치를 포함할 수 있다.

<5> 발광 디스플레이의 픽셀 및 서브 픽셀에 대한 다양하고 상이한 구성이 종래 기술에 제안되었다. 도 1은 각 픽셀(2)이 단일의 적색 서브 픽셀(4), 단일의 녹색 서브 픽셀(6) 및 단일의 청색 서브 픽셀(8)을 포함하는 표준 픽셀 구성을 도시하는데, 상기 서브 픽셀 모두는 동일한 크기를 갖는다.

<6> 도 1에 도시되어 있는 기본 구성에 대한 개선된 구성, 예를 들어 US 2003/0117423, WO 03/060870 및 2004/0080479에 개시되어 있는 구성이 제시되었다. 이들 "바둑판 모양" 구성은 도 1에 도시되어 있는 표준 구성에 비해 보다 나은 가시 성능을 제공하도록 개조된다. 일예가 본 출원의 도 2에 도시되어 있는데, 각 픽셀(2)은 중앙에 위치한 하나의 청색 서브 픽셀(8)과, 마주보는 대각선 코너에 한 쌍으로 위치한 적색 서브 픽셀(4)과, 마주보는 대각선 코너에 다른 한 쌍으로 위치한 녹색 서브 픽셀(6)을 포함한다. 서브 픽셀은 네 개의 인접 픽셀들 사이의 교차점 주위에서 서브 픽셀이 적색과 녹색을 번갈아 가며 위치하도록 정렬된다.

<7> 전술한 구성이 가지고 있는 문제점은 복잡하게 패터닝된 컬러 형성 층을 제공하기가 어렵다는 것이다. 또한, 사용되는 물질 및 패터닝 기법에 따라서, 신뢰성 있게 형성될 수 있는 이산 컬러 형성 영역의 크기의 하한이 보다 낮게 될 것이다.

<8> 본 발명의 실시예는 보다 용이하게 제조되고 양호한 가시 성능을 갖는 픽셀/서브 픽셀 구성을 제공함으로써 전술한 종래 기술의 문제점을 해결하고자 한다.

## 발명의 상세한 설명

<9> 본 발명의 제 1 측면에 따르면, 각 픽셀이 다수의 서브 픽셀을 포함하는 다수의 픽셀을 포함하는 광전자 디스플레이가 제공되는데, 이 광전자 디스플레이는 다수의 이산 컬러 형성 영역을 2차원으로 제공하도록 패터닝된 컬러 형성 층을 포함하고, 어드레싱 어레이가 제공되어 이산 컬러 형성 영역을 어드레싱하며, 상기 이산 컬러 형성 영역의 적어도 일부는 어드레싱 어레이에 의해 개별적으로 어드레싱가능한 부분을 가지며, 각각의 부분은 광전자 디스플레이의 서브-픽셀을 규정한다.

<10> 2차원 어레이에 대해 말하자면, 본 명세서에서는 포인트형의 이산 컬러 형성 영역을 다수 포함하는 어레이를 의미한다. 포인트형 컬러 형성 영역은 원형, 타원형, 직사각형, 정사각형 및 6각형을 포함하는 다양한 형상을 가질 수 있다.

<11> "이산 컬러 형성 영역"에 대해 말하자면, 다수의 컬러 형성 영역이라기 보다는 컬러 형성 물질의 연속적인 영역을 의미한다. 연속적인 영역에 대해 말하자면, 디스플레이의 평면 내에서의 연속을 의미한다. 이산 컬러 형성 영역은 디스플레이의 평면에 대해 직각인 방향으로 적층되어 있는 다수의 층을 포함할 수 있다. 그러나, 이러한 층이 디스플레이의 평면 내에서 연속적인 경우, 이들 층은 이산 컬러 형성 영역을 구성할 수 있다.

<12> 본 발명은 종래의 "바둑판 모양" 구성과 관련하여 전술한 문제점을, 각 서브 픽셀이 대응하는 이산 컬러 형성 영역에 의해 규정될 필요가 없다는 점에서 해결한다. 이산 컬러 형성 영역들 중 적어도 일부는 어드레싱 어레이에 의해 개별적으로 어드레싱가능한 다수의 서브 픽셀을 포함한다. 이것은 컬러 형성 층을 위한 패터닝 프로세스를 간단히 하면서도 디스플레이의 가시 성능을 크게 저하시키지는 않는다. 또한, 컬러 형성 층의 패턴을 변경하지 않고도 해상도를 증가시킬 수 있다.

<13> 바람직하게, 각각 개별적으로 어드레싱 가능한 부분은 광전자 디스플레이에서 상이한 픽셀의 서브 픽셀을 정의한다. 이산 컬러 형성 영역은 임의의 수의 개별적 액세스가능 부분을 포함할 수 있다. 그러나, 바람직한 구성에 있어서, 이산 컬러 형성 영역은 2,3,4 또는 6개의 개별적 어드레싱가능 부분을 갖는다.

<14> 본 발명의 몇몇 실시예에 따르면, 컬러 형성 층은 방사성(emissive)이다. 이와 달리, 컬러 형성 필터는 컬러 필터 층, 인광물질 층 또는 형광 염료와 같은 컬러 변경 매체이다. 일예는 기판, 이 기판 상에 배치된 제 1 전극 층, 제 1 전극 층 상에 배치된 발광층 및 이 발광층 위에 배치된 제 2 전극 층을 포함하는 광전자 디스플레이이다. 발광층은 다수의 이산 발광 영역을 2차원 어레이로 제공하도록 패터닝된 컬러 형성 층을 구성한다. 전극 층은 다수의 전극을 포함하는 제 1 전극 층 및/또는 제 2 전극 층을 구비한 어드레싱 어레이를 구성하는데, 각 전극은 각각의 이산 발광 영역과 구동가능하게 연관된 적어도 두 개의 서브 전극을 포함한다.

<15> 각각의 이산 발광 영역과 연관된 적어도 두 개의 서브 전극을 제공하게 되면, 이산 발광 영역의 구역들은 별개로 구동될 수 있다. 따라서, 이산 발광 영역은 다수의 상이한 서브 픽셀에 기여할 수 있다.



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<16> 바람직한 실시예에서, 발광층은 다수의 웰(well)을 정의하는 제 1 전극 위에 배치된 뱅크 구조물을 제공함으로써 패터닝되고, 각 웰은 상기 이산 발광 영역들 중 하나를 포함하며, 서브 전극들 중 적어도 두 개는 각 웰과 연관된다.

<17> 바람직하게, 제 1 전극 층은 각각의 이산 발광 영역과 연관된 서브 전극들 중 적어도 두 개를 갖는 상기 다수의 전극을 포함한다. 바람직하게, 제 1 전극은 애노드이다. 애노드는 임의의 적절한 물질일 수 있지만, 바람직하게는 ITO이다.

<18> 광전자 디스플레이의 일 부류는 발광용으로 유기 물질을 사용하는 것이다. 이들 장치의 기본 구조는 예를 들어 음전하 캐리어(전자)를 유기 층에 주입하는 캐소드와 양전하 캐리어(홀)를 유기 층에 주입하는 애노드 사이에 배치된 폴리(p-폴리페닐렌비닐렌(p-phenylenevinylene))("PPV") 또는 폴리플루오렌의 필름인 발광 유기 층이다. 전자 및 홀은 광자를 생성하는 유기 층에서 결합된다. WO90/13148에서, 유기 발광 물질은 폴리머이다. US 4,539,507에서, 유기 발광 물질은 (8-이드록시퀴놀린) 알루미늄("Alq3")과 같은 작은 분자 물질로서 알려진 부류에 속한다. 실제 장치에 있어서, 전극들 중 하나는 투명하여, 광자가 장치로부터 탈출할 수 있도록 한다.

<19> 전형적인 유기 발광 디스플레이(OLED)는 ITO(Indium-Tin-Oxide)와 같은 투명 애노드로 코팅된 유리 또는 플라스틱 기판 상에 제조된다. 적어도 하나의 전장발광 유기 물질의 박막의 층은 제 1 전극을 커버한다. 끝으로, 캐소드는 전장발광 유기 물질의 층을 커버한다.

<20> 캐소드는 전형적으로 금속 또는 합금이며 알루미늄과 같은 단일 층, 또는 칼슘 및 알루미늄과 같은 다수의 층을 포함할 수 있다.

<21> 동작시, 홀은 애노드를 통해 장치로 주입되고 전자는 캐소드를 통해 장치로 주입된다. 홀 및 전자는 유기 전장발광 층 내에서 결합되어 여기자(excitons)를 형성하고, 그런 다음 이 여기자는 복사 붕괴(radiative decay)를 겪게되어 광을 제공한다(광 검출 장치에서, 이 프로세스는 본질적으로 반대로 수행된다).

<22> 유기 발광 디스플레이는 전광(electro-optic) 디스플레이의 특히 바람직한 형태를 제공할 수 있다. 이들은 밝고, 색채가 풍부하며, 스위칭이 빠르며, 넓은 시야각을 제공하고 다양한 기판에 용이하게 제조되며 제조 비용이 낮다. (본 명세서에서는 유기금속을 포함하는) 유기 발광 디스플레이는 사용되는 물질에 따라 컬러 범위에서 (즉, 멀티-컬러 디스플레이에서) 폴리머 또는 작은 분자를 사용하여 제조될 수 있다.

<23> 유기 발광 디스플레이는 픽셀의 매트릭스 형태로 기판 상에 증착되어 단일 또는 다수 컬러의 픽셀 디스플레이를 형성할 수 있다. 멀티 컬러 디스플레이는 적색, 녹색 및 청색 발광 픽셀의 그룹을 사용하여 구성될 수 있다. 소위 능동 매트릭스 디스플레이는 각 픽셀과 연관된 메모리 소자, 전형적으로 저장 캐패시터 및 트랜지스터를 구비하는 반면, 수동 매트릭스 디스플레이는 이러한 메모리 소자를 구비하지 않으며 대신 반복적으로 스캐닝되어 정적 이미지의 인쇄를 제공한다.

<24> 바람직하게, 도전성 폴리머 층이 제 1 전극 층과 발광 층 사이에 배치된다. 이 층은 임의의 적절한 물질일 수 있지만, 바람직하게는 PEDOT-PSS이다.

<25> 바람직하게, 도전성 폴리머 층 및 발광 층 중 적어도 하나는 잉크젯 프린팅에 의해 증착된다.

<26> 서브 전극의 물질이 측면 도전성을 무시할 수 있을 정도로 충분히 낮은 낮은 도전성을 갖는 경우, 서브 전극 사이에는 갭이 제공될 필요가 없다. 예를 들어, 서브 전극은 측면 저항을 증가시키고 측면 도전성을 감소시켜 서브 전극 사이의 갭이 필요로 하지 않게 하기 위해 얇은 물질 층으로 구성될 수 있다. 그러나, 이 경우, 특히 수동 매트릭스 디스플레이에 대해서는 대개 부가적인 도전성 접속 라인이 요구될 것이며, 그렇지 않으면, 디스플레이 양단의 저항은 일반적으로 매우 높게 될 것이다. 이것은 각 이산 발광 영역이 그 자신의 구동기를 갖게 되는 능동 매트릭스 디스플이에서는 문제가 되지 않는다.

<27> 예를 들어, 수동 매트릭스 디스플레이에서, 전형적으로 150nm의 두께를 갖는 ITO 애노드가 표준 장치에 사용되나. 서브 전극 사이의 측면 도전성을 피하기 위해 본 발명의 실시예에 따르면 보다 얇은 두께, 예를 들어 상기 두께의 1/2 또는 1/4의 두께를 갖는 층이 사용될 수 있다. 이 경우, 보다 도전성의 접속 라인이 제공될 수 있다. 능동 매트릭스 디스플레이에서, 이러한 보다 낮은 두께의 ITO 애노드는 구동기 사이의 간격으로서 이용될 수 있고 픽셀은 작다.

<28> 본 발명의 실시예에서, 서브 전극은 예를 들어 전극 물질의 얇은 부분에 의해 제공될 수 있는 저항 접속부를 통해 도전성의 접속 라인에 접속된다. 공통 도전체 라인과 서브 전극 사이의 저항 접속부를 제공하게 되면 "소프



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트" 전기 접속이 제공되며, 따라서 단락이 있는 경우 디스플레이 픽셀의 모든 라인이 소실되지는 않을 것이다.

<29> 이와 달리, 서브 전극 사이에 갭이 제공될 수 있다. 이 갭은 애노드의 상위 표면을 평탄화하기 위해 절연 물질로 채워질 수 있다. 적절한 평탄화 및 절연 물질의 예는 실리콘 이산화물 또는 포토레지스트와 같은 유전체를 포함한다. 평탄화 및 절연 물질이 이 물질 위에 증착된 물질에 대한 서브 전극의 물질과 유사한 습윤 특성을 갖는 것이 바람직하다. 더 나아가, 뱅크 물질을 패터닝하는 경우 에칭되지 않는 평탄화 및 절연 물질을 선택하는 것이 바람직하다. 평탄화 및 절연 물질을 제공하는 것과는 달리, 서브 전극 사이의 갭은 그 위에 증착된 물질이 갭을 연결한도록 충분히 작게 구성될 수 있다. 전극 층이 얇은 경우 층을 평탄화할 필요성이 적으며 또는 그럴 필요가 없다.

<30> 중첩되는 층에서 불균일성을 방지하기 위해 전극 층이 일정한 두께를 갖도록 하는 것이 바람직하다.

<31> 일 구성에서, 서브 전극을 포함하는 전극 층은 두 개의 층, 즉 서브 전극을 정의하는 패터닝된 도전성 접촉 층과 그 위의 전하 주입 물질의 균일한 층을 포함한다. 예를 들어, 패터닝된 금속 접촉 층에는 그 위에 증착된 ITO의 균일한 층이 제공될 수 있다. 전하 주입 물질은 측면 도전성을 방지하기 위해 충분히 낮은 도전성을 가져야 한다. 이것은 예를 들어 전하 주입 층으로서 ITO의 비교적 얇은 층을 제공함으로써 달성될 수 있다.

<32> 전극 층은 표준 포토리소그래피에 의해 패터닝될 수 있다. 그러나, 예를 들어 레이저 제거, e-빔 제거, 건식 에칭 및 습식 에칭을 포함하는 임의의 패터닝 기법이 사용될 수 있다. 더 나아가, 패터닝 방법을 뺄 필요는 없으며 잉크젯 프린팅과 같은 직접 기록 기법이 채용될 수 있다.

<33> 본 발명의 또 다른 측면에 따르면, 본 발명의 제 1 측면에 따른 발광 디스플레이를 제공하는 방법이 제공되는데, 컬러 형성 층은 잉크젯 프린팅에 의해 증착된다.

<34> 잉크젯 프린팅은 특히 그의 확장성 및 적응성 때문에 유용하다. 확장성으로 인해 임의의 큰 기판이 패터닝될 수 있고, 적응성으로 인해 일 제품에서 다른 제품으로의 변경과 관련된 설비 비용은 무시될 수 있는데, 그 이유는 기판 상에 프린트된 도트의 이미지는 소프트웨어에 의해 정의되기 때문이다.

<35> 그러나, 잉크젯 프린팅에는 몇 가지 문제점이 있다. 얼마나 작은 개별 서브 픽셀이 잉크젯 프린팅에 의해 제작될 수 있느냐에 대한 한계가 있다. 더 나아가, 잉크는 복잡한 웰 형상의 조밀한 코너에는 습윤되지 않는다. 이들 문제는 서브 픽셀의 복잡성이 과도하게 증가하지 않고 그들의 크기가 과도하게 감소되지 않게 하면서 고해상도의 디스플레이를 생성할 수 있는 본 발명에 의해 해결될 수 있다. 주로, 본 발명의 실시예는 잉크젯 프린트된 디스플레이에 유용한데, 그 이유는 큰 영역에 대해 평탄한 필름을 달성하는 것에 관련된 문제점 및 매우 작은 영역을 신뢰성 있게 프린팅하는데 있어서의 어려움 때문이다. 그러나, 본 발명의 실시예는 다른 증착 기법을 사용하는 경우에도 유용할 수 있음을 알 수 있다.

<36> 컬러 형성 층이 작은 분자의 진공 증착에 의해 증착되는 경우, 새도우 마스크가 전형적으로 사용되어 필요한 해상도를 제공한다. 새도우 마스크의 해상도에는 한계가 존재하고 따라서 본 발명의 실시예는 서브 픽셀의 복잡성을 과도하게 증가시키지 않거나 또는 그들의 크기를 과도하게 증가시키지 않으면서 보다 높은 해상도의 디스플레이를 제공할 수 있다.

<37> 본 발명의 실시예는 첨부한 도면을 참조하여 단지 예로서 기술될 것이다.

## 실 시 예

<55> 도 3은 OLED 장치(100)의 일예의 수직 단면도를 나타낸다. 이 장치의 구조는 예시 목적으로 다소 간소화되어 있다.

<56> OLED(100)는 전형적으로 0.7 ㎜ 또는 1.1㎜의 유리이나 선택에 따라서는 투명 플라스틱인 기판(102)을 포함하며, 상기 기판(102) 상에는 네 개의 개별 구동가능 서브 애노드(도 4에 도시)를 포함하는 애노드 층(106)이 증착된다. 애노드 층은 전형적으로 약 150 ㎚ 두께의 ITO(인듐 주석 산화물)을 포함하며, 그 위에 전형적으로 애노드 금속으로도 지칭되는 약 500㎚의 알루미늄인 금속 접촉 층이 제공된다. ITO 및 접촉 금속으로 코팅된 유리 기판은 코닝 USA로부터 구입할 수 있다. 접촉 금속 (및 선택에 따라서는 ITO)은 에칭에 선행하는 종래의 포토리소그래피 공정에 의해 필요에 따라 패터닝되어 디스플레이를 방해하지 않는다.

<57> 실질적으로 투명한 홀 도전성 층(108a)은 애노드 금속 위에 제공되며 그에 후속하여 전장발광 층(108b)이 제공된다. 뱅크(112)는 기판 상에서 예를 들어 포지티브 또는 네거티브 포토레지스트 물질로부터 형성되어 웰(114)을 형성하며 그 웰 내로 이들 능동 유기 층이 예를 들어 방울 증착 또는 잉크젯 프린팅 기법에 의해 선택적으



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로 증착될 수 있다. 따라서, 웰은 디스플레이의 발광 영역 또는 픽셀을 정의한다.

<58> 캐소드 층(110)은 소위 물리 기상 증착에 의해 도포된다. 캐소드 층은 전형적으로 보다 두꺼운 알루미늄의 캐핑 층으로 커버되며 선택에 따라서는 개선된 전자 에너지 레벨 매칭을 위해 리튬 플루오르화물의 층과 같은 전자발광 층에 바로 인접한 부가적인 층을 포함하는 칼슘 또는 바륨과 같은 낮은 일함수 금속을 포함한다. 캐소드 라인의 상호 전기적 격리는 캐소드 분리기를 사용하여 달성될 수 있다. 전형적으로, 다수의 디스플레이는 단일 기판 상에 제조되고 제조 공정의 종료시 기판에는 선이 그어지고 디스플레이는 분리된다. 유리판 또는 금속 캔과 같은 인캡슐런트(encapsulant)가 사용되어 산화 및 습기 유입을 방지한다.

<59> 이러한 일반적인 유형의 유기 LED는 폴리머, 덴드리머 및 소위 작은 분자를 포함하는 범위의 물질을 사용하여 제조되어 다양한 구동 전압 및 효율에서의 범위의 파장을 방출한다. 폴리머 기반 OLED 물질의 예는 WO90/13148, WO9506400 및 WO99/48160에 개시되어 있으며, 덴드리머 기반 물질의 예는 WO99/21935 및 WO02/067343에 개시되어 있고, 작은 분자 OLED 물질의 예는 US 4,539,507에 개시되어 있다. 전술한 폴리머, 덴드리머 및 작은 분자는 일중항 여기자(singlet excitons)(형광성)의 복사성 붕괴에 의해 광을 방출한다. 그러나, 최대 75%의 여기자는 대개 복사성 붕괴를 겪지 않는 3중항(triplet) 여기자이다. 3중항 여기자(인광성)의 복사성 붕괴에 의한 전장발광은 예를 들어 "Very high-efficiency green organic light-emitting devices based on electrophosphorescence" M.A. Baldo, S. Lamansky, P.E. Burrows, M.E. Thompson and S.R. Forrest *Applied Physics Letters*, Vol. 75(1) pp.4-6, July 5, 1999"에 개시되어 있다. 폴리머 기반 OLED의 경우, 층(108)은 홀 도전성 층(108a) 및 발광 폴리머(LEP) 전장발광 층(108b)을 포함한다. 전장발광 층은 예를 들어 애노드 층과 전장발광 층의 홀 에너지 레벨을 매칭시키는데 도움을 주는 약 70nm(건식) 두께의 PPV(폴리(p-폴리페닐렌비닐렌(p-phenylenevinylene)) 및 홀 도전 층을 포함할 수 있고, 도전성의 유기 물질, 예를 들어 50-200nm, 바람직하게는 약 150nm(건식) 두께의 PEDOT:PSS(polystyrene-sulphonate-doped polyethylene-dioxythiophene)를 포함할 수 있다.

<60> 도 4는 본 발명의 일 실시시예에 따른 네 개의 서브 애노드(106a,106n,106c,106d)를 포함하는 애노드(106)의 평면도를 나타낸다.

<61> 도 5는 도 4에 도시되어 있는 유형의 전극을 사용하는 본 발명의 일 실시예에 따른 서브 픽셀 구성을 나타낸다. 각 픽셀(50)은 도 2에 도시되어 있는 종래의 구성과 마찬가지로 중앙의 청색 서브 픽셀(52)과, 대각선으로 마주보는 코너에 위치한 한 쌍의 적색의 서브 픽셀(54) 및 대각선으로 마주보는 코너에 위치한 한 쌍의 녹색 서브 픽셀(56)을 포함한다. 그러나, 도 2의 구성과는 달리, 네 개의 인접하는 픽셀 사이의 접합부에서의 서브 픽셀들은 동일한 컬러이고 단일 이산 컬러 형성 영역(58)에 의해 형성된다. 이산 컬러 형성 영역(58)은 개별적으로 액세스가능한 네 개의 부분을 구비하는데, 각 부분은 도시되어 있는 네 개의 픽셀 중 하나에 대한 하나의 서브 픽셀에 기여한다. 부분들은 네 개의 서브 전극을 갖는 도 4에 도시되어 있는 유형의 전극을 이용하여 개별적으로 액세스가능하다.

<62> 이러한 구성은 도 2에 도시되어 있는 종래의 구성을 간단히 한다. 보다 작은 이산 컬러 형성 영역이 요구되고 이산 컬러 형성 영역은 뛰어난 가시 특성을 갖는 디스플레이를 여전히 제공하면서 보다 크게 만들어질 수 있고 또한 보다 덜 복잡한 형상을 가질 수 있다.

<63> 본 발명을 이용하는 다른 구성이 또한 안출된다. 예를 들어, 이산 컬러 형성 영역의 관련 크기 및 형성은 변경될 수 있다. 유기 발광 물질의 경우, 청색 발광 물질의 수명은 장치 수명에 대한 제한 요소인 경우가 빈번하다. 이 경우, 적색 및 녹색 컬러 형성 영역보다 큰 영역을 갖는 청색 컬러 형성 영역을 제공하는 것이 바람직하다. 보다 큰 영역을 갖는 청색 컬러 형성 영역을 제공함으로써, 이들은 보다 낮은 전압으로 구성될 수 있고 그에 따라 장치의 청색 컬러 형성 물질의 수명을 증가시킬 수 있다. 청색, 녹색 및/또는 적색 컬러 형성 영역 중 임의의 영역은 물질의 성능 특성 및 디스플레이의 바람직한 성능 특성에 따라 상이한 크기를 가질 수 있음을 이해해야 한다.

<64> 도 6은 정사각형 보다는 둥근 형태의 이산 컬러 형성 영역을 이용하는 도 5의 구성과 유사한 구성을 도시한다. 이 구성은 도 5와 비교해 보다 낮은 개구 비율을 가질 수 있지만, 둥근 형태의 컬러 형성 영역이 보다 쉽게 잉크젯 프린트될 수 있다는 점에서 유리하다. 이산 컬러 형성 영역(58)은 도 4에 도시된 것과 유사하나 네 개의 세그먼트를 갖는 원형 형상의 전극을 이용하여 개별적으로 액세스가능한 네 개의 부분을 갖는다.

<65> 도 7은 정사각형보다는 6각형의 이산 컬러 형성 영역을 이용하는 도 5의 구성과 유사한 구성을 도시한다. 이 구성은 정사각형 구성에 비해 큰 각도를 가짐으로써 잉크가 각 이산 컬러 형성 영역의 전체를 쉽게 적실 수 있



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도록 하는 양호한 개구 비율을 제공한다.

<66> 도 8은 도 5의 구성과 유사하나 약간 상이한 배향을 갖는 정사각형 이산 컬러 형성 영역을 갖는 구성을 도시한다.

<67> 도 9는 도 5의 구성과 유사하나 인접 픽셀의 중앙 서브 픽셀이 연속하는 스트립으로 병합되는 구성을 나타낸다.

<68> 도 10은 도 9의 구성과 유사한 구성을 도시하나, 연속하는 스트립 사이에는 원형의 이산 컬러 형성 영역이 배치되고, 이 원형 영역은 도 4에 도시되어 있는 것과 유사하나 두 개의 세그먼트를 갖는 원형 형태의 전극을 이용하여 개별적으로 액세스가능한 두 개의 부분을 갖는다.

<69> 도 11은 모든 이산 컬러 형성 영역이 개별적으로 액세스가능한 두 개의 부분을 포함하는 구성을 도시한다.

<70> 도 12는 백색 컬러 형성 영역(58)을 더 포함하는 구성을 나타낸다.

<71> 도 13은 도 11에 도시되어 있는 구성과 유사하나 백색 컬러 형성 영역(58)을 더 포함하는 구성을 나타낸다.

<72> 앞서 도시한 구성들은 정사각형 픽셀을 포함한다. 그러나, 본 발명은 그에 제한되는 것은 아니다. 픽셀은 예를 들어 도 14 내지 도 16에 도시되어 있는 육각형, 정사각형 또는 삼각형을 가질 수 있다.

<73> 도 17은 이산 발광 영역이 실질적으로 직사각형 또는 정사각형을 가지며 픽셀은 실질적으로 삼각형인 두 개의 또 다른 구성을 나타낸다. 이들 구성은 이산 발광 영역마다의 대부분의 픽셀을 "정사각형 타일" 유형의 구성으로 가지고 있다. 상위 레이아웃은 평탄한 마크로 픽셀 아웃라인(smooth macro-pixel outline)에 대해 최적화되어 있다. 그러나, 이 구성에서, 마크로 픽셀의 중심은 정사각형 타일 구성의 정사각형 타일 지점에 정확히 위치하지는 않는다. 하위 레이아웃은 평탄 마크로 픽셀 아웃라인을 가지지 않는다. 그러나, 이 구성에서, 마크로 픽셀의 중심은 정사각형 타일 지점에 위치한다. 다른 고려사항은 건조 효과에 대한 잉크 손실 영역을 포함하고, 이 경우, 상위 레이아웃은 이들 효과에 보다 덜 영향을 받는데, 그 이유는 각 서브 픽셀이 웰 에지 및 웰 중심 영역에 대해 대략 동일한 비율을 갖기 때문이다.

<74> 컬러 형성 영역의 다수의 부분을 개별적으로 어드레스할 수 있는 어드레싱 어레이를 제공함으로써, 디스플레이의 해상도는 컬러 형성 층의 패턴을 변경하지 않고도 증가된다. 예를 들어, 도 14 내지 도 16에 도시되어 있는 구성에서, 해상도는 이산 컬러 형성 영역이 개별적으로 어드레싱 가능한 부분을 포함하지 않는 유사한 구성과 비교해 볼 때, 컬러 형성 영역의 패턴을 변경하는 일 없이 각각 3,4 및 6의 팩터만큼 증가되었다.

<75> 이 구성은 강화된 해상도를 제공하고 픽셀 크기가 육안의 공간 해상도의 에지 상에 있는 경우 가장 효과적일 수 있다. 특히, 스크린 상의 원색의 블록은 디더링(dithered)된 것으로 나타날 수 있는데, 그 이유는 사실 이러한 기법을 사용하는 경우 고른 분포보다는 하나의 서브 픽셀 컬러의 클러스터가 존재하기 때문이다. 그러나, 휘도 변화에 대한 육안의 해상도는 그 자체가 청색-황색 컬러 해상도의 두 배인 그의 적색-녹색 컬러 해상도에 대해 두 배이다. 따라서, 마크로 픽셀 이격이 이웃 픽셀을 구별할 수 있는 육안의 능력과 동일한 미세한 해상도를 위해, 이 클러스터링은 분명하지 않을 것이다.

<76> 이 기법은 보다 작은 잉크 웰을 요구하는 일 없이 3D 디스플레이에 필요한 증가된 해상도를 달성하는데 사용될 수 있다. 3-D 디스플레이에서, 상이한 마크로 픽셀이 상이한 방향으로 투영되어 다수의 시야를 야기하는 경우, 오직 유사한 서브 픽셀 그룹만이 임의의 주어진 방향으로 투영되고 그에 따라 서브 픽셀 클러스터링의 가시 효과를 제거하도록 구성될 수 있다.

<77> 본 발명의 바람직한 실시예가 유기 발광 디스플레이를 참조하여 설명하였지만, LCD 및 플라즈마 디스플레이와 같은 다른 유형의 디스플레이, 및 무기 EL 디스플레이와 같은 다른 EL 디스플레이가 본 발명을 이용할 수 있다.

## 도면의 간단한 설명

<38> 도 1은 전체 컬러의 발광 디스플레이의 표준 서브 픽셀 구성을 나타내는 도면,

<39> 도 2는 전체 컬러의 발광 디스플레이의 개선된 종래 기술의 서브 픽셀 구성을 나타내는 도면,

<40> 도 3은 OLED 장치의 일 예의 수직 단면을 나타내는 도면,

<41> 도 4는 본 발명에 일 실시예에 따라 네 개의 서브 전극을 포함하는 일 전극의 평면도,

<42> 도 5는 본 발명의 일 실시예에 따른 서브 픽셀 구성을 나타내는 도면,



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<43> 도 6은 본 발명의 다른 실시예에 따른 서브 픽셀 구성을 나타내는 도면,

<44> 도 7은 본 발명의 다른 실시예에 따른 서브 픽셀 구성을 나타내는 도면,

<45> 도 8은 본 발명의 다른 실시예에 따른 서브 픽셀 구성을 나타내는 도면,

<46> 도 9는 본 발명의 다른 실시예에 따른 서브 픽셀 구성을 나타내는 도면,

<47> 도 10은 본 발명의 다른 실시예에 따른 서브 픽셀 구성을 나타내는 도면,

<48> 도 11은 본 발명의 다른 실시예에 따른 서브 픽셀 구성을 나타내는 도면,

<49> 도 12는 본 발명의 다른 실시예에 따른 서브 픽셀 구성을 나타내는 도면,

<50> 도 13은 본 발명의 다른 실시예에 따른 서브 픽셀 구성을 나타내는 도면,

<51> 도 14는 픽셀이 6각형인 구성을 나타내는 도면,

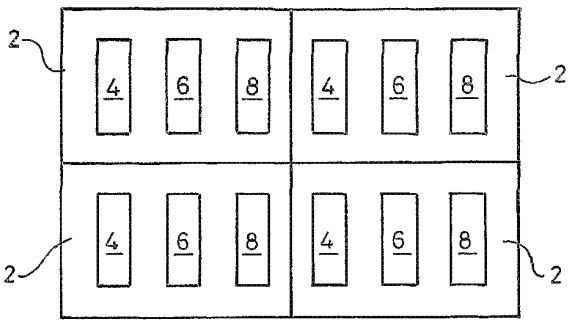
<52> 도 15는 픽셀이 정사각형인 구성을 나타내는 도면,

<53> 도 16은 이산 발광 영역이 원형이고 픽셀은 삼각형인 구성을 나타내는 도면,

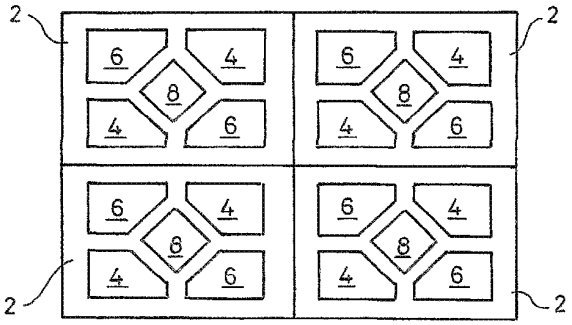
<54> 도 17은 이산 발광 영역이 실질적으로 직사각형이고 픽셀은 실질적으로 삼각형인 구성을 나타내는 도면.

도면

도면1



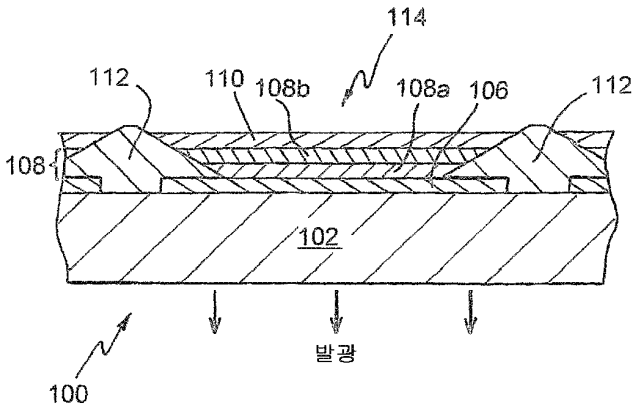

도면2



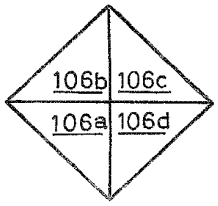



Petitioner Ex 1015, p. 126
BOE et al. v. Samsung, IPR2023-00988

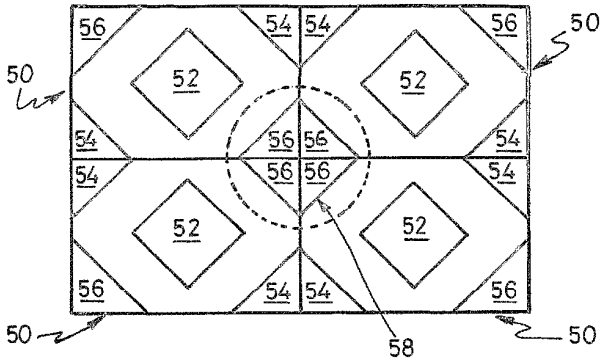
도면3




도면4



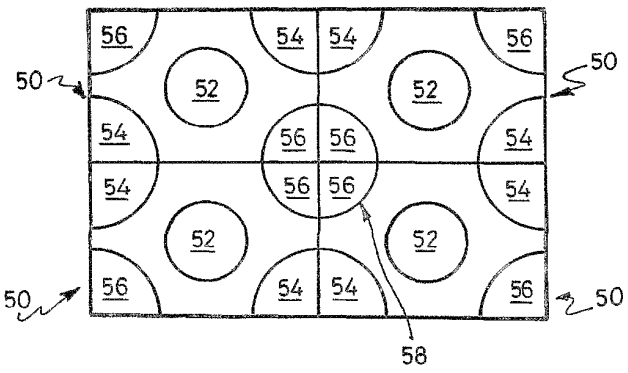

도면5



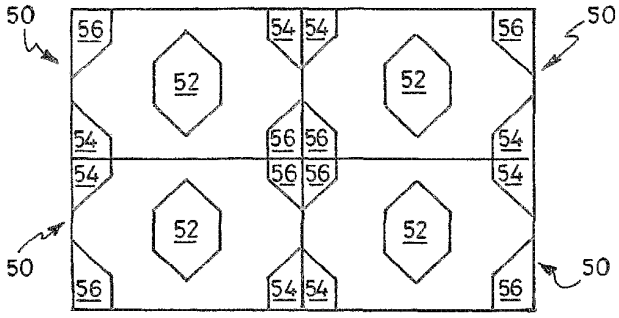



Petitioner Ex 1015, p. 127
BOE et al. v. Samsung, IPR2023-00988

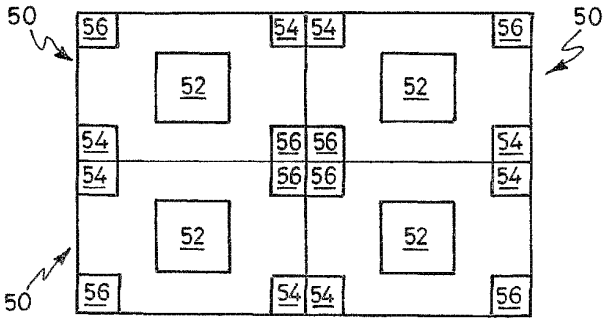
도면6




도면7



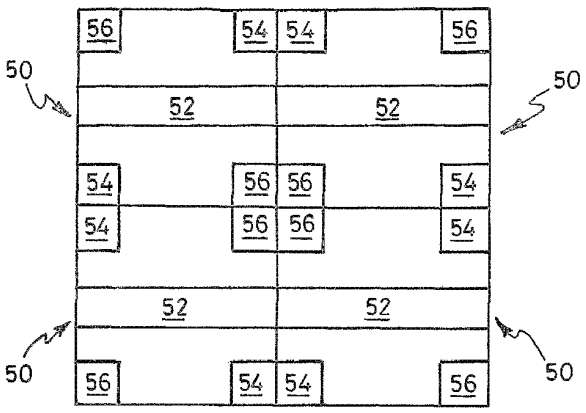

도면8



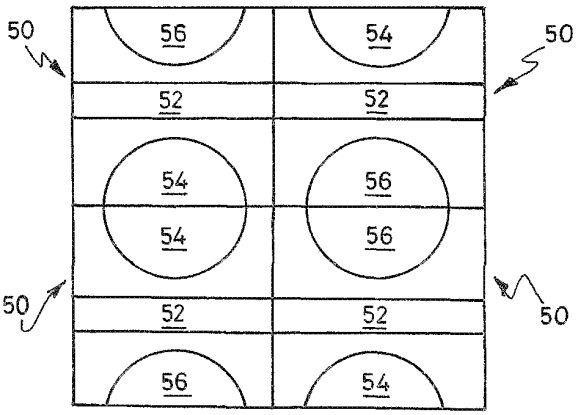



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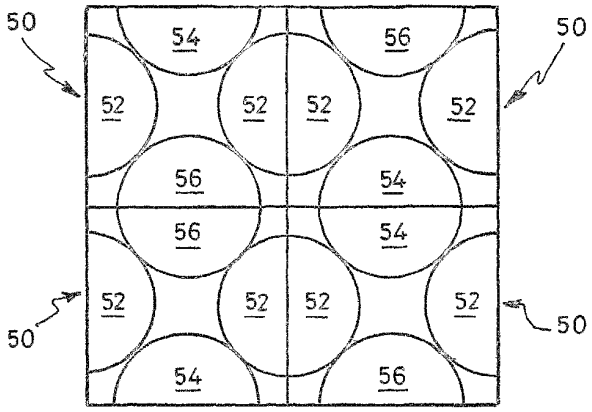
도면9




도면10



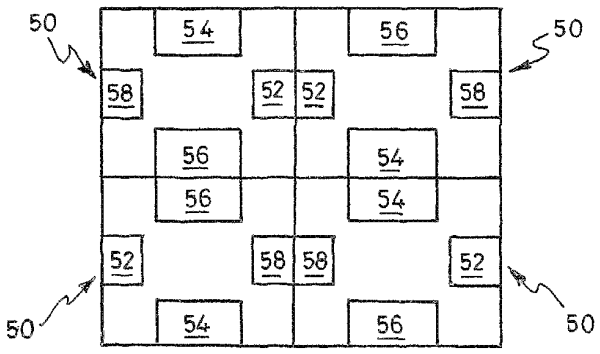

도면11



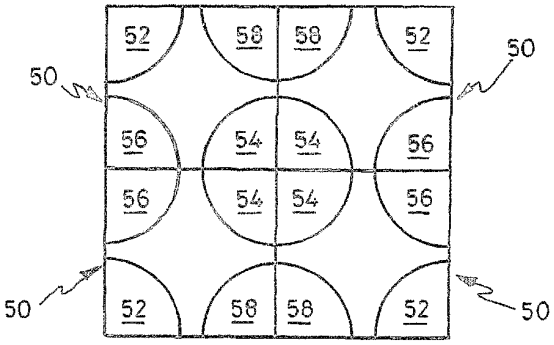



Petitioner Ex 1015, p. 129
BOE et al. v. Samsung, IPR2023-00988

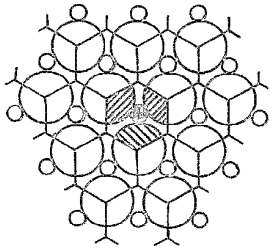
도면12



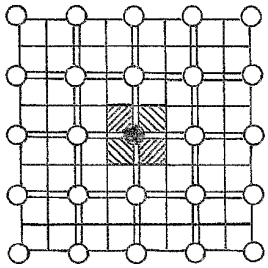

도면13




도면14



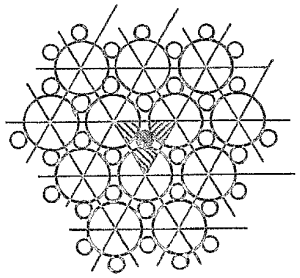
도면15



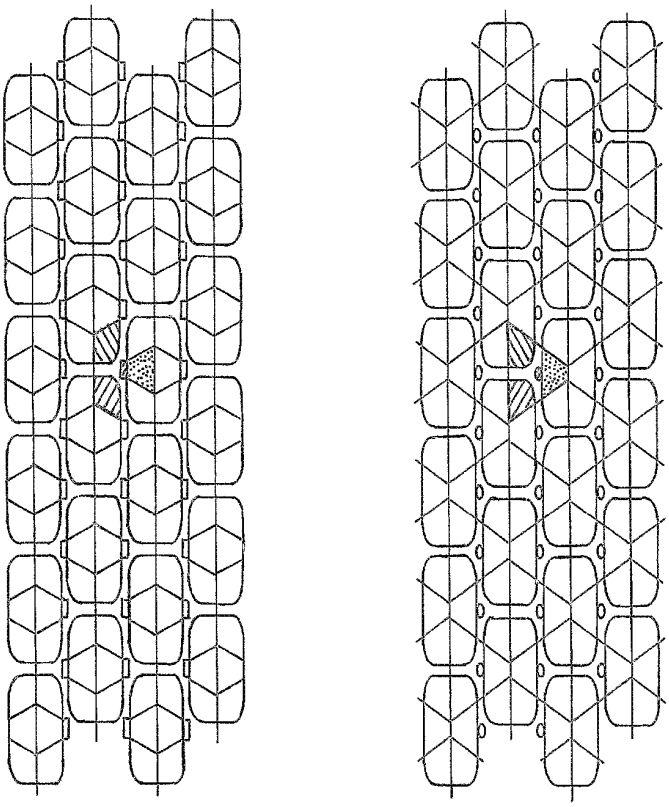


Petitioner Ex 1015, p. 130
BOE et al. v. Samsung, IPR2023-00988

도면16



도면17





Petitioner Ex 1015, p. 131
BOE et al. v. Samsung, IPR2023-00988

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 13614197 |
| **Filing Date:** | 13-Sep-2012 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Filer:** | Jun-Young E. Jeon/Elizabeth Gomez |
| **Attorney Docket Number:** | 69657/S1437 |

Filed as Large Entity

**Filing Fees for Utility under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| Submission- Information Disclosure Stmt | 1806 | 1 | 180 | 180 |
| | | **Total in USD ($)** | | **180** |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 28279267 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Young E. Jeon/Elizabeth Gomez |
| **Filer Authorized By:** | Jun-Young E. Jeon |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 06-FEB-2017 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 18:40:34 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | CARD |
| Payment was successfully received in RAM | $180 |
| RAM confirmation Number | 020717INTEFSW18413200 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 69657_IDS.PDF | 73545<br>34e38b74681591c1824ff137be32b64be46f b6fd | yes | 3 |
| | **Multipart Description/PDF files in .zip description** | | | | |
| | **Document Description** | | **Start** | **End** | |
| | Transmittal Letter | | 1 | 2 | |
| | Information Disclosure Statement (IDS) Form (SB08) | | 3 | 3 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Foreign Reference | KR_1020080111130.pdf | 1314713<br>9812f80d1049d648c86c54e4183884a7457 c8469 | no | 18 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Fee Worksheet (SB06) | fee-info.pdf | 30947<br>0c3789003b681e16e35d1fba42c5ccba501 d6e08 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 1419205 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on February 6, 2017 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Elizabeth Gomez

Inventor(s) : Sang-Shin Lee Confirmation No. 4264
Application No. : 13/614,197
Filed : September 13, 2012
Title : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

Grp./Div. : 2691
Examiner : Kwang-Su Yang

Docket No. : 069657

**SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT WITH FEE UNDER 37 CFR §§ 1.97(d) AND 1.17(p)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
February 6, 2017

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is an information disclosure statement listing a reference that is known to applicant. Copies of each of the listed Foreign Patent Documents and Other Documents references are enclosed.

It is respectfully requested that the listed reference be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of the information disclosure statement be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

Applicant's undersigned attorney hereby certifies, in accordance with 37 CFR § 1.97(e)(1), that each item of information contained in the information disclosure statement was first cited in a communication from any foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement.

The processing fee of $180.00 as required by 37 CFR § 1.17(p) is submitted herewith. The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
LEWIS ROCA ROTHGERBER CHRISTIE LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/eg
Enclosures: Information Disclosure Statement, w/reference

EG PAS1462026.1-*-02/6/17 9:22 AM



Petitioner Ex 1015, p. 138
BOE et al. v. Samsung, IPR2023-00988

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

23363 7590 01/05/2017
Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

| EXAMINER | |
|---|---|
| YANG, KWANG-SU | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2691 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 01/05/2017 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pto@lrrc.com
pair_cph@firsttofile.com



Petitioner Ex 1015, p. 139
BOE et al. v. Samsung, IPR2023-00988

| Office Action Summary | Application No. 13/614,197 | Applicant(s) LEE, SANG-SHIN | |
|---|---|---|---|
| | Examiner KWANG-SU YANG | Art Unit 2691 | AIA (First Inventor to File) Status No |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 2 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *12/05/2016*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☒ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims***

5)☒ Claim(s) *1-14 and 16-22* is/are pending in the application.

5a) Of the above claim(s) *6-14* is/are withdrawn from consideration.

6)☒ Claim(s) *1-5 and 16-22* is/are allowed.

7)☐ Claim(s) _____ is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

**Application Papers**

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

## DETAILED ACTION

### *Notice of Pre-AIA or AIA Status*

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

### *Quayle Action*

2. This application is in condition for allowance except for the following formal matters:

In the claims:

8. (Withdrawn-currently amended) The pixel arrangement structure of claim 7, wherein a shortest distance between the first pixel and each of the second pixels, a shortest distance between the first pixel and each of the third pixels, and a shortest distance between each of the second pixels and each of the third pixels are a same first length.

9. (Withdrawn-currently amended) The pixel arrangement structure of claim 8, wherein the first pixel comprises a plurality of first pixels,
the plurality of first pixels have a same quadrilateral shape, and
a shortest distance between neighboring pixels of the plurality of first pixels is a second length that is longer than the first length.

10. (Withdrawn-currently amended) The pixel arrangement structure of claim 6, wherein each of the second pixels has a larger area than each of the third pixels,
a shortest distance between each of the second pixels and each of the third pixels is a same first length, and
a shortest distance between the first pixel and each of the second pixels, and a shortest distance between the first pixel and each of the third pixels are a same second length.

11. (Withdrawn-currently amended) The pixel arrangement structure of claim 10, wherein the first pixel comprises a plurality of first pixels,
the plurality of first pixels have a same quadrilateral shape, and
a shortest distance between neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

12. (Withdrawn-currently amended) The pixel arrangement structure of claim 10, wherein the first pixel comprises a plurality of first pixels,
neighboring pixels of the plurality of first pixels have quadrilateral shapes that are symmetrical to each other, and
a shortest distance between the neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

14. (Canceled)

22. (Canceled)

Applicant is requested to clean up the claims languages for all claims 1-13 and 16-21. Applicant is requested to draft the claims following the requirement of MPEP. The abovementioned objections are only samples of all irregularities. Appropriate correction is required.

***Allowable Subject Matter***

3. Claims 1-5 and 16-22 are allowable over the prior art of record.

The following is an examiner's statement of reasons for allowance: The prior art of record, Credelle (U.S. Pub. No. US 2003/0128179 A1), Kim (U.S. Patent No. US

8,354,789 B2) and Louwsma (U.S. Pub. No. US 2008/0308819 A1), does not establish supporting for conclusion of obviousness in combining the above references for rejecting claim 1.

***Conclusion***

4. Prosecution on the merits is closed in accordance with the practice under *Ex parte Quayle*, 25 USPQ 74, 453 O.G. 213, (Comm'r Pat. 1935).

A shortened statutory period for reply to this action is set to expire **TWO MONTHS** from the mailing date of this letter.

***Inquiry***

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kwang-Su Yang whose telephone number is 571-270-7307. The examiner can normally be reached on Mon-Fri during 9:00am-6:00pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chanh Nguyen can be reached on 571-272-7772. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/KWANG-SU YANG/
Primary Examiner, Art Unit 2691

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | **Examiner** | **Art Unit** |
| | KWANG-SU YANG | 2691 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 10/27/2014 | 03/07/2015 | 07/09/2015 | 11/27/2015 | 04/02/2016 | 10/11/2016 | 12/31/2016 | | |
| | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | = | | |
| | 2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | = | | |
| | 3 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | = | | |
| | 4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | = | | |
| | 5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | = | | |
| | 6 | N | N | N | N | N | N | N | | |
| | 7 | N | N | N | N | N | N | N | | |
| | 8 | N | N | N | N | N | N | N | | |
| | 9 | N | N | N | N | N | N | N | | |
| | 10 | N | N | N | N | N | N | N | | |
| | 11 | N | N | N | N | N | N | N | | |
| | 12 | N | N | N | N | N | N | N | | |
| | 13 | N | N | N | N | N | N | N | | |
| | 14 | N | N | N | N | N | N | N | | |
| | 15 | N | - | - | - | - | - | - | | |
| | 16 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | = | | |
| | 17 | O | ✓ | O | O | O | O | = | | |
| | 18 | O | O | O | O | O | O | = | | |
| | 19 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | = | | |
| | 20 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | = | | |
| | 21 | | | | O | O | O | = | | |
| | 22 | | | | ✓ | ✓ | ✓ | = | | |

ENTER
/KY/
12/31/2016

PATENT
RESPONSE UNDER 37 CFR 1.116
EXPEDITED PROCEDURE
EXAMINING GROUP 2691

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on December 5, 2016 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Anna J. O'Connor

| | | |
|---|---|---|
| Appl No. | : 13/614,197 | Confirmation No. 4264 |
| Inventor | : Sang-Shin Lee | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| TC/A.U. | : 2691 | |
| Examiner | : Yang, Kwang-Su | |
| Docket No. | : 069657 | |
| Customer No. | : 23363 | |

**RESPONSE AFTER FINAL ACTION**

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
December 5, 2016

Commissioner:

Applicant responds as follows to the Office action of October 14, 2016, issued in the above-identified application:

**The Listing of Claims begins** on page 2 of this paper.

**Remarks/Arguments** begin on page 6 of this paper.



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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

23363 7590 01/04/2017
Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

| EXAMINER | |
|---|---|
| YANG, KWANG-SU | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2691 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 01/04/2017 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pto@lrrc.com
pair_cph@firsttofile.com



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BOE et al. v. Samsung, IPR2023-00988

| Examiner-Initiated Interview Summary | Application No. | Applicant(s) | | |
|---|---|---|---|---|
| | 13/614,197 | LEE, SANG-SHIN | | |
| | Examiner | Art Unit | AIA (First Inventor to File) Status | Page |
| | KWANG-SU YANG | 2691 | No | 1 of 1 |

All participants (applicant, applicant's representative, PTO personnel):

1. KWANG-SU YANG (Primary Examiner); Telephonic
2. Michael Curry (Attorney of Record); Telephonic

**Date of Interview:** 27 December 2016

**Claim(s) discussed:** 8-14 and 22

**Amendment Proposed:** Examiner proposed to amend the limitations "a distance" to "a shortest distance" in claims 8-12 for rejoining the claims and cancel claims 14 and 22.

**Brief Description of main topic of discussion:** Examiner proposed the amendments for rejoining withdrawn claims 8-13 and cancelling claims 14 and 22 in order to place the application in condition for allowance.

## Issues Discussed:

**Proposed Amendments:**
Examiner proposed the amendments for rejoining withdrawn claims 8-13 and cancelling claims 14 and 22 in order to place the application in condition for allowance. However, Applicant needs time to determine whether Applicant will authorize the proposed amendments and would like to receive Ex parte Qualye action at this time. Agreement was reached that Ex parte Qualye action would be mailed.

| /KWANG-SU YANG/<br>Primary Examiner, Art Unit 2691 | |
|---|---|

**Applicant recordation instructions:** It is not necessary for applicant to provide a separate record of the substance of the interview.

**Examiner recordation instructions:** Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

**Applicant is reminded that a complete written statement as to the substance of the interview must be made of record in the application file. It is the applicant's responsibility to provide the written statement, unless the interview was initiated by the Examiner and the Examiner has indicated that a written summary will be provided. See MPEP 713.04**

Please further see:

**MPEP 713.04**
**Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews, paragraph (b)**
**37 CFR § 1.2 Business to be transacted in writing**



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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 069657 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
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**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
| | | TW I328207 | 08-01-2010 | Chao et al. | Abstract of TW 2008-02221, listed below |
| | | | | | |
| | | | | | |
| | | | | | |
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**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | English Abstract of TW 2008-02221 A, also published as TW I328207, listed above |
| | | TIPO Office Action dated October 11, 2016, for corresponding Taiwanese Patent Application No. 102124953 (6 pages) |
| | | |

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| EXAMINER SIGNATURE | | DATE CONSIDERED | |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

JEJ/eg



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Espacenet

# Bibliographic data: TWI328207 (B) — 2010-08-01

## Display panels capable of displaying color images and method for forming the same and displays and full color displays comprising three-color pixel elements

**Inventor(s):** CHAO CHING IAN [TW]; WU YUAN CHUN [TW] ± (CHAO, CHING -IAN, ; WU, YUAN-CHUN, ; CHAO, CHING IAN, ; WU, YUAN CHUN)

**Applicant(s):** AU OPTRONICS CORP [TW] ± (AU OPTRONICS CORP)

**Classification:** - international: ***G09F9/302; H05B33/00***
- cooperative: **H01L27/3211; H01L27/3218**

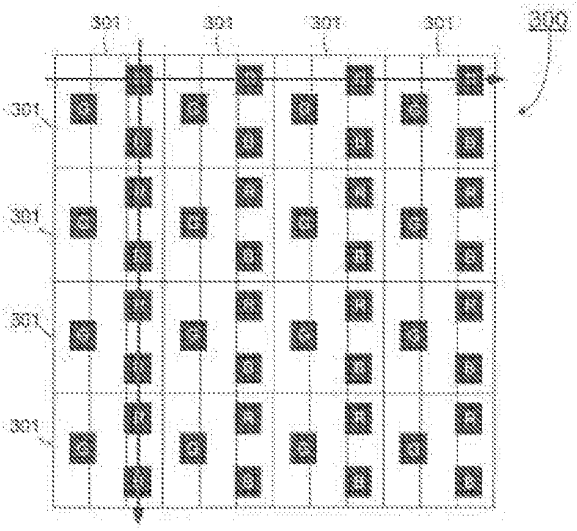
**Application number:** TW20070114023 20070420

**Priority number (s):** US20060478921 20060630

**Also published as:** TW200802221 (A) US2008001525 (A1) CN101051648 (A) JP2008015521 (A)

### Abstract of TW200802221 (A)

A color display panel formed with a plurality of pixels in a matrix, each pixel comprising a first sub-pixel, a second sub-pixel and a third sub-pixel, and a red light emission zone, a green light emission zone and a blue light emission zone. The color display panel comprises an arrangement of the red, green and blue light emission zones in a triangle with the geometrical center of each emission zone located at a respective vertex of the triangle such that one side of the triangle is substantially parallel to one of a row direction and a column direction. Any two adjacent light emission zones of different colors in the row direction define a gap having a distance, and any two adjacent light emission zones of different colors in the column direction define a gap having a distance substantially the same as the distance of the gap defined in the row direction.






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## 四、聲明事項：

☐ 主張專利法第二十二條第二項☐第一款或☐第二款規定之事實，其事實發生日期為：　年　月　日。

☑ 申請前已向下列國家（地區）申請專利：

【格式請依：受理國家（地區）、申請日、申請案號　順序註記】

☑ 有主張專利法第二十七條第一項國際優先權：

美國 US；2006 年 6 月 30 日；11/478,921

☐ 無主張專利法第二十七條第一項國際優先權：

☐ 主張專利法第二十九條第一項國內優先權：

【格式請依：申請日、申請案號　順序註記】

☐ 主張專利法第三十條生物材料：

☐ 須寄存生物材料者：

國內生物材料　【格式請依：寄存機構、日期、號碼　順序註記】

國外生物材料　【格式請依：寄存國家、機構、日期、號碼　順序註記】

☐ 不須寄存生物材料者：

所屬技術領域中具有通常知識者易於獲得時，不須寄存。



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## 九、發明說明：

【發明所屬之技術領域】

本發明是有關於一種彩色顯示面板，特別是有關於一種有機發光顯示元件之次畫素排列設計。

【先前技術】

一般來說，全彩顯示面板是由紅色、綠色及藍色等次畫素元件所構成，傳統上是參照液晶顯示器的設計架構，以條紋(stripe)、馬賽克(mosaic)、或三角形(delta)型式排列，藉由對顯示面板中從不同次畫素元件發射出來各顏色光線的混合而提供全彩效果。由於體積輕薄、高解析度、低功率消耗、自發光及快速反應等優點，有機發光二極體(organic light emitting diode, OLED)顯示面板已逐漸應用在全彩影像的高清晰度顯示器。

傳統上，將液晶顯示器之紅色、綠色及藍色次畫素元件的排列應用在 OLED 顯示面板，如第 6 圖所示。在此排列中，畫素矩陣 600 中的每一畫素 601 具有一第一次畫素 610、一第二次畫素 620 與一第三次畫素 630，彼此相鄰沿畫素矩陣 600 的列(row)方向排列，且一紅色次畫素元件 650、一綠色次畫素元件 660 與一藍色次畫素元件 670 沿畫素矩陣 600 的列方向分別設置在第一次畫素 610、第二次畫素 620 與第三次畫素 630 中。如此，在列方向上，於兩相鄰的次畫素元件間定義一具有一距離 Lr 的間隙，在行(column)方向上，於兩相鄰的次畫素元件間定義一具有一距離 Lc 的間隙，其中 Lc 遠大於 Lr，如第 6 圖所示。

然而，上述次畫素元件的排列方式會使顯示面板的製



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造過程產生相當大的困難度。例如，在全彩 OLED 顯示面板的製造過程，一般會利用遮罩(shadow mask)對準方法藉由沈積不同有機層於顯示面板之基板上，以形成各別的紅色、綠色及藍色次畫素元件。OLED 顯示面板的解析度與遮罩的開口尺寸息息相關。在如第 6 圖所示的次畫素元件排列中，列方向上兩相鄰次畫素元件間的距離 Lr 遠小於行方向上兩相鄰次畫素元件間的距離 Lc。因此，在顯示面板的製造過程中，在列方向上的次畫素元件的對準容許度(Lr/2)會遠低於行方向上次畫素元件的對準容許度(Lc/2)。如此，將導致 OLED 顯示面板次畫素元件在列向容易產生對準失誤，而造成次畫素中之各色彩之有機層沈積於其它次畫素中，而導致各次畫素元件所發出之光線產生混色現象或於各二相鄰之次畫素元件中之上、下電極發生短路而不發光問題。此種次畫素元件的排列亦使得對應的遮罩在蝕刻製造上遭遇相當困難，因此，利用傳統的次畫素元件的排列方式將很難製造出高解析度的 OLED 顯示器。

因此，勢必提供有效的技術方案，以克服上述缺點或不足之處。

【發明內容】

本發明之目的是提供一種可顯示彩色影像之顯示面板。在一實施例中，該顯示面板包括複數個畫素，以一列方向與一行方向排列成一矩陣，每一畫素包括一第一次畫素、一第二次畫素與一第三次畫素，彼此相鄰且沿該矩陣之該列方向排列，以及一第一發光區、一第二發光區與一



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第三發光區，排列成一三角形，每一發光區之幾何中心位於該三角形之不同頂點，使該三角形之一邊實質上平行於該列方向與該行方向其中之一，其中每一第一發光區、第二發光區與第三發光區發出單獨顏色之光線。該等畫素排列於該列方向上任意兩相鄰且不同顏色之發光區間定義出一具有一距離之間隙，以及於該行方向上任意兩相鄰且不同顏色之發光區間定義出一具有一距離之間隙，該兩間隙之距離實質上相等。

在一實施例中，每一第一發光區、第二發光區與第三發光區包括對應之一紅色發光區、一綠色發光區與一藍色發光區其中之一。每一紅色發光區、綠色發光區與藍色發光區具有一該列方向之寬度與一該行方向之長度，其中每一紅色發光區、綠色發光區與藍色發光區之該寬度與該長度係不同或實質上相同。在一實施例中，每一紅色發光區、綠色發光區與藍色發光區之幾何中心分別位於對應之該第一次畫素、該第二次畫素與該第三次畫素，使該三角形之一邊實質上平行於該列方向。在另一實施例中，該紅色發光區、該綠色發光區及該藍色發光區其中之一之幾何中心位於該畫素之該第一次畫素及該第三次畫素其中之一，且該紅色發光區、該綠色發光區及該藍色發光區其餘之幾何中心位於該畫素之另一該第一次畫素及該第三次畫素，以使該三角形之一邊實質上平行於該行方向。

每一紅色發光區、綠色發光區與藍色發光區包括一可發射紅色、綠色及藍色不同顏色光線之發光二極體元件。在一實施例中，該發光二極體元件型式包含一有機發光二極體元件(organic light emitting diode, OLED)或複數個串



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聯之有機發光二極體元件。每一有機發光二極體元件之發光方式包含一上發射(top-emission)型有機發光二極體元件及一下發射(bottom-emission)型有機發光二極體元件之其中之一。此外，每一有機發光二極體元件結構包含一正常結構及一反置(inverted)結構之其中之一。

該顯示面板更包括一驅動電路，分別驅動每一畫素之該紅色發光區、該綠色發光區與該藍色發光區，以從該等發光區發射對應顏色之光線。在一實施例中，該顯示面板之驅動方式對應一被動矩陣與一主動矩陣其中之一。

本發明之次一目的是提供一種可顯示彩色影像之顯示面板，形成有複數個畫素，以一列方向與一行方向排列成一矩陣，每一畫素包括一第一次畫素、一第二次畫素與一第三次畫素，彼此相鄰且沿該矩陣之該列方向排列，以及一紅色發光區、一綠色發光區與一藍色發光區。在一實施例中，該顯示面板具有於該畫素中之該紅色發光區、該綠色發光區與該藍色發光區所排列形成一三角形，每一發光區之幾何中心位於該三角形之不同頂點，使該三角形之一邊實質上平行於該列方向與該行方向其中之一，該等畫素中，該列方向上任意兩相鄰且不同顏色之發光區間定義出一具有一距離之間隙，以及於該行方向上任意兩相鄰且不同顏色之發光區間定義出一具有一距離之間隙，該兩間隙之距離實質上相等。每一紅色發光區、綠色發光區與藍色發光區包括一可發射紅色、綠色及藍色不同顏色光線之發光二極體元件。

在一實施例中，每一紅色發光區、綠色發光區與藍色發光區之幾何中心分別位於對應之該第一次畫素、該第二



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次畫素與該第三次畫素，以使該三角形之一邊實質上平行於該列方向。在另一實施例中，該紅色發光區、該綠色發光區及該藍色發光區其中之一之幾何中心位於該畫素之該第一次畫素及該第三次畫素其中之一，且該紅色發光區、該綠色發光區及藍色發光區其餘之幾何中心位於該畫素之另一該第一次畫素及該第三次畫素，以使該三角形之一邊實質上平行於該行方向。

本發明之另一目的是提供一種形成顯示彩色影像之顯示面板之方法，其中顯示面板具有複數個畫素，以一列方向與一行方向排列成一矩陣，每一畫素包括一第一次畫素、一第二次畫素與一第三次畫素，彼此相鄰且沿該矩陣之該列方向排列，以及一紅色發光區、一綠色發光區與一藍色發光區。在一實施例中，該方法包括排列該畫素之該紅色發光區、該綠色發光區與該藍色發光區成一三角形，每一發光區之幾何中心位於該三角形之不同頂點，以使該三角形之一邊實質上平行於該列方向與該行方向其中之一，以便於該等畫素之該矩陣中，該列方向上任意兩相鄰且不同顏色之發光區間定義一具有一距離之間隙，以及於該行方向上任意兩相鄰且不同顏色之發光區間定義一具有一距離之間隙，該兩間隙之距離實質上相等。每一紅色發光區、綠色發光區與藍色發光區包括一可發射紅色、綠色及藍色不同顏色光線之發光二極體元件。

本發明次另一目的是提供一種可顯示彩色影像之顯示面板，包括複數個畫素，以一列方向與一行方向排列成一矩陣。在一實施例中，每一畫素包括一第一次畫素、一第二次畫素與一第三次畫素，以及一第一發光區、一第二



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發光區與一第三發光區，排列成一三角形，每一發光區之幾何中心位於該三角形之不同頂點，使該三角形之一邊實質上平行於該列方向與該行方向其中之一，其中每一第一發光區、第二發光區與第三發光區發出單獨顏色之光線。在一實施例中，每一第一發光區、第二發光區與第三發光區係包括對應之一紅色發光區、一綠色發光區與一藍色發光區其中之一。該等畫素之排列於該列方向上任意兩相鄰且不同顏色之發光區間定義出一具有一距離之間隙，以及於該行方向上任意兩相鄰且不同顏色之發光區間定義出一具有一距離之間隙，該兩間隙之距離實質上相等。

本發明再次另一目的是提供一種顯示器之三原色畫素元件。在一實施例中，該三原色畫素元件包括一第一次畫素、一第二次畫素與一第三次畫素，彼此相鄰且以一列方向與一行方向排列成一畫素矩陣，以及一第一發光區、一第二發光區與一第三發光區，排列成一三角形，每一發光區之幾何中心位於該三角形之不同頂點，以使該三角形之一邊實質上平行於該列方向與實質上垂直該列方向之該行方向其中之一，其中於該列方向上任意兩相鄰且不同顏色之發光區間定義出一具有一第一距離之間隙，以及於該行方向上任意兩相鄰且不同顏色之發光區間定義出一具有一第二距離之間隙，其中該第一距離與該第二距離實質上相等。每一第一發光區、第二發光區與第三發光區發出單獨顏色之光線。

本發明是提供一種由上述三原色畫素元件製作而成之全彩顯示器。

為讓本發明之上述目的、特徵及優點能更明顯易懂，



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下文特舉一較佳實施例，並配合所附圖式，作詳細說明如下：

【實施方式】

本發明全彩顯示面板具有複數個畫素，其以一列方向及一與列方向垂直的行方向排列成一矩陣。請參閱第1a~1c圖，每一畫素100包括一第一次畫素110、一第二次畫素120與一第三次畫素130，彼此相鄰且沿畫素矩陣的列方向排列。每一次畫素(110、120、130)實質上相等，且具有一列方向的次畫素間距Px與一行方向的次畫素間距Py。而列方向的次畫素間距Px與行方向的次畫素間距Py一起定義出次畫素面積，也就是(Px×Py)。

此外，每一畫素100具有一紅色(次畫素)發光區150、一綠色(次畫素)發光區160與一藍色(次畫素)發光區170，其排列成一三角形，且各次畫素發光區(150、160、170)的幾何中心位於三角形的不同頂點。此三角形的一邊會實質上平行於列方向或行方向。在一實施例中，各發光區(150、160、170)的幾何中心(R、G、B)分別位於畫素100的第一次畫素110、第二次畫素120與第三次畫素130。其中第二次畫素120的發光區在行方向上與第一次畫素110及第三次畫素130的發光區偏移一距離Ly，使得由發光區形成的三角形的一邊實質上平行於列方向。此外，列方向上第一次畫素110與第三次畫素130的兩發光區之間的距離Lx實質上或幾乎相同於Ly。例如，如第1a圖所示，紅色發光區150、綠色發光區160與藍色發光區170的幾何中心(R、G、B)分別位於第一次畫素110、



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第二次畫素 120 與第三次畫素 130。在行方向上，綠色發光區 160 與紅色發光區 150 及藍色發光區 170 偏移 Ly 的距離。在此排列中，由紅色發光區 150 與藍色發光區 170 所形成的三角形的一邊實質上平行於列方向，而紅色發光區 150 與藍色發光區 170 之間的距離 Lx 實質上或幾乎相同於 Ly。

另一實施例中，紅色發光區 150、綠色發光區 160 與藍色發光區 170 其中之一的幾何中心位於畫素 100 的第一次畫素 110 與第三次畫素 130 其中之一，而紅色發光區 150、綠色發光區 160 與藍色發光區 170 其餘的幾何中心則位於畫素 100 中另一(other of)的第一次畫素 110 或第三次畫素 130，使得三角形的一邊實質上平行於行方向。如第 1b 圖所示，綠色發光區 160 的幾何中心 G 位於第一次畫素 110，而紅色發光區 150 與藍色發光區 170 的幾何中心(R、B)位於第三次畫素 130。在第 1c 圖中，綠色發光區 160 的幾何中心 G 位於第三次畫素 130，而紅色發光區 150 與藍色發光區 170 的幾何中心(R、B)位於第一次畫素 110。如第 1b 與 1c 圖所示紅色發光區 150、綠色發光區 160 與藍色發光區 170 的排列中，綠色發光區 160 在列方向上與紅色發光區 150 及藍色發光區 170 偏移一距離 Lx，且由紅色發光區 150 與藍色發光區 170 形成的三角形的一邊實質上平行於行方向。Lx 實質上或幾乎相同於在行方向上定義紅色發光區 150 與藍色發光區 170 間距的 Ly。

每一紅色發光區 150、綠色發光區 160 與藍色發光區 170 可形成任意幾何形狀，例如實質上呈方形、實質上呈



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矩形、實質上呈圓形、實質上呈三角形、實質上呈梯形、多邊形、不規則形、或其組合，其中較佳的幾何形狀為如第 1a~1c 圖所示的實質上呈方形或實質上呈矩形。就矩形發光區而言，每一紅色發光區 150、綠色發光區 160 與藍色發光區 170 在列方向上可具有一例如 Rx、Gx 或 Bx 的寬度以及在行方向上可具有一例如 Ry、Gy 或 By 的長度，且每一紅色發光區 150、綠色發光區 160 與藍色發光區 170 的寬度與長度(如 Rx 與 Ry, Gx 與 Gy, Bx 與 By)可不同或實質上相同。如此一來，每一紅色發光區 150、綠色發光區 160 與藍色發光區 170 的開口率(aperture ratio)可定義為 (Rx × Ry)/(Px × Py) 、 (Gx × Gy)/(Px × Py) 及 (Bx×By)/(Px×Py)，其中(Rx×Ry)、(Gx×Gy)與(Bx×By)為紅色發光區 150、綠色發光區 160 與藍色發光區 170 的面積，(Px×Py)為第一次畫素 110、第二次畫素 120 與第三次畫素 130 的面積。與傳統次畫素發光區的排列作比較，本發明紅、綠及藍色次畫素發光區的排列提供了較大的開口率，此對於延長顯示面板的壽命是必要的。此外，在此排列方式亦可降低製程難度及提供較大的容許度，以避免製作全彩 OLED 顯示面板的過程中產生混色(color mixing)的情形。

較佳地，每一紅色發光區 150、綠色發光區 160 與藍色發光區 170 均對應一可發射紅、藍及綠等不同顏色光線的發光二極體元件。發光二極體元件的型式包括一 OLED 元件或複數個串聯的 OLED 元件，而每一 OLED 元件發光方式包含一上發射(top-emission)型 OLED 元件及一下發射(bottom-emission)型 OLED 元件其中之一。此外，



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OLED 元件的結構包含正常結構及反置結構其中之一。

第 2b 圖為一實施例，一 OLED 顯示面板的彩色畫素排列，其中畫素矩陣的每一畫素 201 均重複如第 2a 圖所示紅色次畫素發光元件(亦稱為紅色發光區)250、綠色次畫素發光元件(亦稱為綠色發光區)260 與藍色次畫素發光元件(亦稱為藍色發光區)270 的排列單元。第 2b 圖的排列 200 中，每一紅色次畫素發光元件 250、綠色次畫素發光元件 260 與藍色次畫素發光元件 270 為一方形幾何形狀，且在列方向上，任意兩相鄰且不同顏色的發光元件間定義出一具有一距離之間隙，例如畫素 201 的紅色發光區 250 與藍色發光區 270 間於列方向上定義出一距離 a1，畫素 201 的藍色發光區 270 與相鄰畫素 201 的紅色發光區 250 間於列方向上定義出一距離 b1，b1 實質上或幾乎相等於 a1。而在行方向上，任意兩相鄰且不同顏色的發光元件間亦定義出一具有一距離之間隙，例如畫素 201 的紅色發光區 250 或藍色發光區 270 與綠色發光區 260 間於行方向上定義出一距離 c1，畫素 201 的綠色發光區 260 與相鄰畫素 201 的紅色發光區 250 或藍色發光區 270 間於行方向上定義出一距離 d1，d1 實質上或幾乎相等於 c1。如第 2b 圖所示，a1 及 b1 之至少一者實質上或幾乎相等於 c1 及 d1 之至少一者。第 2d 圖為第 2b 圖彩色畫素排列 200 畫素陣列延伸的部分，彩色畫素排列 200 顯示此排列方式就 RGB 之某一光色於列方向及/或行方向上之次畫素連線皆呈一直線，則可使得本發明實施例之顯示效果與傳統的條紋(stripe)排列的顯示效果一致。

第 2c 圖為一實施例，一 OLED 顯示面板的彩色畫素



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排列 200A，其中畫素矩陣的每一畫素 201 均重複如第 2a 圖所示紅色次畫素發光元件 250、綠色次畫素發光元件 260 與藍色次畫素發光元件 270 的排列單元。此一實施例中，每一紅色次畫素發光元件 250、綠色次畫素發光元件 260 與藍色次畫素發光元件 270 為一矩形幾何形狀。如第 2c 圖所示，排列 200A 中，紅色發光區 250 及/或藍色發光區 270 在列方向上的寬度 Rx 及/或 Bx 實質上小於紅色發光區 250 及/或藍色發光區 270 在行方向上的長度 Ry 及/或 By，而綠色發光區 260，其寬度 Gx 實質上大於長度 Gy。同樣地，在列方向上，任意兩相鄰且不同顏色的發光元件間亦定義出一具有一距離之間隙，例如 a2 及 b2，其中 a2 實質上或幾乎相等於 b2，以及在行方向上，任意兩相鄰且不同顏色的發光元件間定義出一具有一距離之間隙，例如 c2 及 d2，其中 c2 實質上或幾乎相等於 d2，如第 2c 圖所示。較佳地，a2 及/或 b2 實質上或幾乎相等於 c2 及/或 d2。

在一實施例中，間隙距離(an、bn、cn、dn)，較佳地，要滿足下列關係式，即 20 微米≤an, bn, cn, dn≤60 微米以及 0.2(an+bn+cn+dn) ≤ an, bn, cn, dn≤0.3(an+bn+cn+dn)，n 為 1 或 2。

實際上，一驅動電路是分別驅動每一畫素的紅色發光區 250、綠色發光區 260 與藍色發光區 270，以從發光元件發射出對應顏色的光線。驅動電路可形成於一被動矩陣定址或一主動矩陣定址。被動矩陣定址對應於被動矩陣 OLED 元件，主動矩陣定址則對應於主動矩陣 OLED 元件。

請參閱第 3b~3d 圖，一 OLED 顯示面板彩色畫素排列



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的實施例。其中畫素矩陣的每一畫素 301 均重複如第 3a 圖所示紅色次畫素發光元件 350、綠色次畫素發光元件 360 與藍色次畫素發光元件 370 的排列單元。在這排列方式 300 與 300A 中，分別如第 3b 及 3c 圖所示，每一紅色次畫素發光元件 350、綠色次畫素發光元件 360 與藍色次畫素發光元件 370 為一實質上呈方形幾何形狀(第 3b 圖)或一實質上呈矩形幾何形狀(第 3c 圖)。畫素 301 的綠色發光區 360 與紅色發光區 350 或藍色發光區 370 間定義出一距離 a3(第 3b 圖)或 a4(第 3c 圖)。同時，在列方向上，畫素 301 的紅色發光區 350 或藍色發光區 370 與相鄰畫素 301 的綠色發光區 360 間定義出一距離 b3(第 3b 圖)或 b4(第 3c 圖)，其中 a3 實質上或幾乎相等於 b3(第 3b 圖)，a4 實質上或幾乎相等於 b4(第 3c 圖)。在行方向上，畫素 301 的紅色發光區 350 與藍色發光區 370 間定義出一距離 c3(第 3b 圖)或 c4(第 3c 圖)，畫素 301 的藍色發光區 370 與相鄰畫素 301 的紅色發光區 350 間定義出一距離 d3(第 3b 圖)或 d4(第 3c 圖)，其中 c3 實質上或幾乎相等於 d3 (第 3b 圖)，c4 實質上或幾乎相等於 d4 (第 3c 圖)。更進一步來說，較佳地，所有距離 a3、b3、c3 與 d3 實質上或幾乎相等(第 3b 圖)及所有距離 a4、b4、c4 與 d4 實質上或幾乎相等於(第 3c 圖)。在一實施例中，每一距離(an、bn、cn、dn)，較佳地，實質上介於 20 微米至 60 微米，以及要滿足下列關係式，$0.2(an+bn+cn+dn) \le an, bn, cn, dn \le 0.3(an+bn+cn+dn)$，n 為 3 或 4。

第 3d 圖為第 3b 圖 OLED 顯示面板中彩色畫素排列 300 畫素陣列延伸的部分，彩色畫素排列 300 顯示此排列



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方式就RGB某一光色於列方向及/或行方向上之次畫素連線，皆呈一直線，則可使得本發明實施例之顯示效果與傳統的條紋(stripe)排列的顯示效果一致。

| 畫素型式 | 開口率(%) | | | 容許度(微米) | |
|---|---|---|---|---|---|
| | 紅(R) | 綠(G) | 藍(B) | X(列方向) | Y(行方向) |
| 傳統條紋排列方式 | 17.8 | 13.2 | 26 | ±15 | ±15 |
| 本發明第4a圖排列 | 22.9 | 15.7 | 31.2 | ±17 | ±20 |
| 本發明第4b圖排列 | 22.9 | 14.7 | 31.2 | ±17 | ±20 |

表1傳統條紋型式與本發明紅色次畫素元件、綠色次畫素元件與藍色次畫素元件排列的開口率(aperture ratio)與對準容許度(alignment tolerance)

第4a與4b圖為根據本發明之上述實施例，分別顯示2.4吋OLED顯示面板兩畫素的佈局圖400A及400B。在畫素佈局400A中，一畫素單元401A具有一第一次畫素410A、一第二次畫素420A與一第三次畫素430A，彼此相鄰排列。畫素單元401A亦包括以三角形排列的一紅色OLED元件R、一綠色OLED元件G與一藍色OLED元件B，使R、G、B等三個OLED元件分別位於次畫素410A、420A與430A。同樣地，在畫素佈局400B中，一畫素單元401B具有一第一次畫素410B、一第二次畫素420B與一第三次畫素430B，彼此相鄰排列。畫素單元401B亦包括以三角形排列的一紅色OLED元件R、一綠色OLED元件G與一藍色OLED元件B，使R、G、B等三個OLED元件分別位於次畫素410B、420B與430B。必需說明的



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是，第 4a 圖與第 4b 圖於表 1 所示數值為本發明之實施範例，並不限於此，亦可選擇性的改變畫素佈局之數值。在表 1 是顯示出傳統條紋型式與本發明紅色次畫素元件、綠色次畫素元件與藍色次畫素元件排列的開口率(aperture ratio)與對準容許度(alignment tolerance)之數值。由表 1 中可清楚看出本發明的開口率及容許度均優於傳統條紋排列的結果。例如，與傳統條紋型式相較，本發明畫素佈局 400A 與 400B 的對準容許度在列方向(X)增加約 2 微米，在行方向(Y)增加約 5 微米，因此可降低製程中因遮罩對位誤差所造成的混色現象；而開口率平均增加約 21%，將可使所需次畫素的亮度減小，也就是驅動電位能夠降低，使得次畫素中之元件降低產生劣化現象，並讓本發明顯示面板的壽命因該彩色畫素排列而增加大約 30%。

請參閱第 5a~5d 圖，根據本發明之上述任一實施例之彩色畫素排列方式。第 5a 圖為結合第 1b 與 1c 圖排列方式的彩色畫素排列單元 501。排列單元 501 包括兩沿著行方向排列且相鄰的畫素 501a 與 501b。紅色發光區 550、綠色發光區 560 與藍色發光區 570 以如第 1b 圖所示的三角形排列於畫素 501a 與如第 1c 圖所示的三角形排列於畫素 501b。排列單元 501 沿著畫素矩陣行方向重複排列，即完成一全彩 OLED 顯示面板的彩色畫素排列 500 與 500A，分別如第 5b 及 5c 圖所示。在彩色畫素排列 500 中，每一紅色發光區 550、綠色發光區 560 與藍色發光區 570 為一實質上呈方形幾何形狀，而在彩色畫素排列 500A 中，為一實質上呈矩形幾何形狀。每一紅色發光區 550、綠色發光區 560 與藍色發光區 570 的幾何形狀並不侷限於



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實質上呈方形或實質上呈矩形，且其面積可實質上相同或不同。

如第 5b 與 5c 圖所示，在列方向上任意兩相鄰且不同顏色的發光元件間定義出實質上或幾乎相等的距離，例如綠色發光區 560 與紅色發光區 550 間的 a5 與 a6，以及紅色發光區 550 與相鄰綠色發光區 560 間的 b5 與 b6，其中 a5 實質上或幾乎相等於 b5(第 5b 圖)，a6 實質上或幾乎相等於 b6(第 5c 圖)。而在行方向上，任意兩相鄰且不同顏色的發光元件間亦定義出實質上或幾乎相等距離，例如紅色發光區 550 與藍色發光區 570 間的 c5 或 c6，以及藍色發光區 570 與相鄰綠色發光區 560 間的 d5 或 d6，其中 c5 實質上或幾乎相等 d5 (第 5b 圖)，及/或 c6 實質上或幾乎相等 d6 (第 5c 圖)。更進一步來說，較佳地，例如：所有距離 a5、b5、c5 與 d5 實質上或幾乎相等(第 5b 圖)及/或 a6、b6、c6 與 d6 實質上或幾乎相等(第 5c 圖)。在一實施例中，每一距離(an、bn、cn、dn)，較佳地，實質上介於 20 微米至 60 微米，以及要滿足下列關係式，$0.2(an+bn+cn+dn) \leq an,\ bn,\ cn,\ dn \leq 0.3(an+bn+cn+dn)$，n 為 5 或 6。

第 5d 圖為第 5b 圖 OLED 顯示面板中彩色畫素排列 500 畫素陣列延伸的部分，彩色畫素排列 500 顯示此排列方式就 RGB 某一光色於列方向上之次畫素連線，呈一直線，就 RGB 某一光色於在行方向上之次畫素連線，呈一鋸齒狀折線，則可使得本發明實施例之顯示效果與傳統的三角形(delta)排列的顯示效果一致。

本發明實施例中，OLED 顯示面板的紅、綠及藍色發



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光區是以三角形排列，使得在列方向上任意兩相鄰且不同顏色的發光元件間定義出一具有一第一距離的間隙，而在行方向上任意兩相鄰且不同顏色的發光元件間定義出一具有一第二距離的間隙，第一與第二距離實質上或幾乎相等相等。此一發光元件的次畫素排列方式，除了可增加次畫素發光面積的開口率外，並可降低了遮罩製程的對位困難度，避免全彩 OLED 顯示面板的混色現象。換言之，本發明上述實施例所述之各色發光區之開口率亦增大。

本發明另提供一種在顯示面板中顯示彩色影像的方法。顯示面板由複數個沿一列方向與一行方向排列的畫素所構成，每一畫素包括一第一次畫素、一第二次畫素與一第三次畫素，彼此相鄰且沿畫素矩陣的列方向排列，以及一紅色發光區、一綠色發光區與一藍色發光區。在一實施例中，該方法包括以每一發光區幾何中心位於三角形不同頂點的方式排列畫素中紅、綠及藍色發光區成三角形，使得三角形的一邊實質上或幾乎平行於列方向與行方向其中之一，以便於使複數個畫素中在列方向上任意兩相鄰且不同顏色的發光元件間定義出一具有一距離的間隙，亦在行方向上任意兩相鄰且不同顏色的發光元件間定義出一具有一距離的間隙，兩間隙的距離實質上或幾乎相等。

再者，本發明之實施例，並不限於上述紅色、綠色、藍色等顏色次畫素或發光區，亦可選擇性地使用其它顏色，例如：棕色、黃色、粉紅、紫色、靛色、橘紅色、橘色、青綠色、橙紅色、淡紫色、或其它顏色，來製作出可顯示彩色影像的顯示面板。

雖然本發明已以較佳實施例揭露如上，然其並非用以



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限定本發明，任何熟習此項技藝者，在不脫離本發明之精神和範圍內，當可作更動與潤飾，因此本發明之保護範圍當視後附之申請專利範圍所界定者為準。



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【圖式簡單說明】

第 1a~1c 圖為本發明之實施例，紅、綠及藍色發光區之不同排列單元。

第 2a~2d 圖為本發明之實施例，紅、綠及藍色發光區之排列。第 2a 圖為一排列單元，第 2b~2c 圖為排列之實施例，第 2d 圖為第 2b 圖排列之延伸部分。

第 3a~3d 圖為本發明之實施例，紅、綠及藍色發光區之排列。第 3a 圖為一排列單元，第 3b~3c 圖為排列之實施例，第 3d 圖為第 3b 圖排列之延伸部分。

第 4a 圖為本發明之一實施例，紅、綠及藍色發光區之排列佈局。

第 4b 圖為本發明之一實施例，紅、綠及藍色發光區之排列佈局。

第 5a~5d 圖為本發明之實施例，紅、綠及藍色發光區之排列。第 5a 圖為一排列單元，第 5b~5c 圖為排列之實施例，第 5d 圖為第 5b 圖排列之延伸部分。

第 6 圖為傳統紅、綠及藍色發光區之條紋排列。

【主要元件符號說明】

習知第 6 圖

600~畫素矩陣；　　601~畫素；

610~第一次畫素；　　620~第二次畫素；

630~第三次畫素；　　650~紅色次畫素元件；

660~綠色次畫素元件；　　670~藍色次畫素元件；

Lr~列方向上兩相鄰次畫素元件間之距離；

Lc~行方向上兩相鄰次畫素元件間之距離。

本發明第 1a~1c、2a~2d、3a~3d、4a~4b 及 5a~5d 圖



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100、201、301、401A、401B、501a、501b~畫素；

110、410A、410B~第一次畫素；

120、420A、420B~第二次畫素；

130、430A、430B~第三次畫素；

200、200A、300、300A、400A、400B、500、500A~畫素排列(佈局)；

150、250、350、550~紅色發光區；

160、260、360、560~綠色發光區；

170、270、370、570~藍色發光區；

501~畫素排列單元；

a1、a2、a3、a4、a5、a6~同一畫素於列方向上，相鄰且不同顏色發光元件間之距離；

b1、b2、b3、b4、b5、b6~相鄰畫素於列方向上相鄰且不同顏色發光元件間之距離；

c1、c2、c3、c4、c5、c6~同一畫素於行方向上，相鄰且不同顏色發光元件間之距離；

d1、d2、d3、d4、d5、d6~相鄰畫素於行方向上，相鄰且不同顏色發光元件間之距離；

Lx~列方向上發光區之偏移距離；

Ly~行方向上發光區之偏移距離；

Px~列方向之次畫素間距；

Py~行方向之次畫素間距；

R~紅色發光區之幾何中心(紅色 OLED 區)；

G~綠色發光區之幾何中心(綠色 OLED 區)；

B~藍色發光區之幾何中心(藍色 OLED 區)；

Rx~紅色發光區之列方向寬度；

Gx~綠色發光區之列方向寬度；

Bx~藍色發光區之列方向寬度；

Ry~紅色發光區之行方向寬度；

Gy~綠色發光區之行方向寬度；

By~藍色發光區之行方向寬度。



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## 五、中文發明摘要：

一種彩色顯示面板，具有複數個畫素所排列之一矩陣，每一畫素包括一第一次畫素、一第二次畫素與一第三次畫素，以及一紅色發光區、一綠色發光區與一藍色發光區。該顯示面板包括該紅色發光區、該綠色發光區與該藍色發光區之畫素排列，形成一三角形，每一發光區之幾何中心位於該三角形之不同頂點，使該三角形之一邊實質上平行於一列方向與一行方向其中之一，該列方向上任意兩相鄰且不同顏色之發光區間定義出一具有一距離之間隙，以及於該行方向上任意兩相鄰且不同顏色之發光區間定義出一具有一距離之間隙，該兩間隙之距離實質上或幾乎相等。

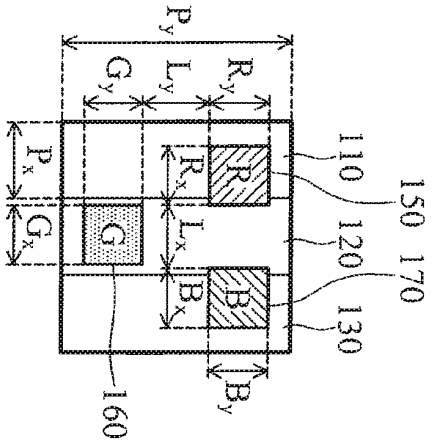
## 六、英文發明摘要：

A color display panel formed with a plurality of pixels in a matrix, each pixel comprising a first sub-pixel, a second sub-pixel and a third sub-pixel, and a red light emission zone, a green light emission zone and a blue light emission zone. The color display panel comprises an arrangement of the red, green and blue light emission zones in a triangle with the geometrical center of each emission zone located at a respective vertex of the triangle such that one side of the triangle is substantially parallel to one of a row direction and a column direction. Any two adjacent light emission zones of different colors in the row direction define a gap having a distance, and any two adjacent light emission zones of different colors in the column direction define a gap having a distance substantially the same as the distance of the gap defined in the row direction.

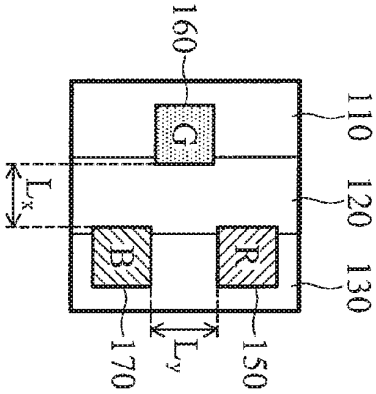


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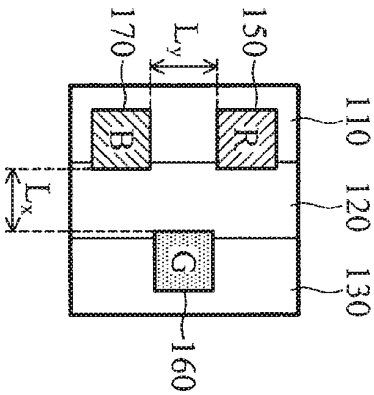
第 1a 圖



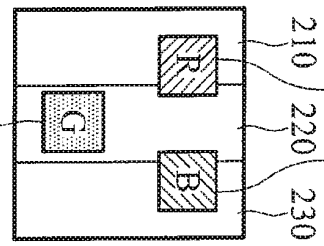

第 1b 圖



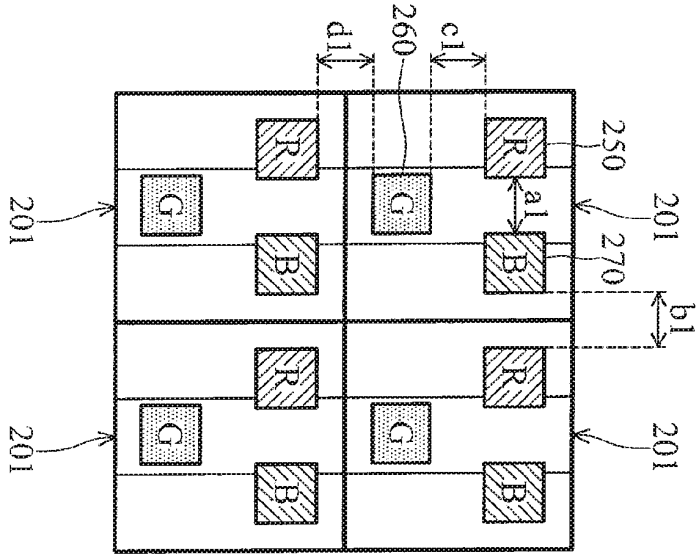

第 1c 圖



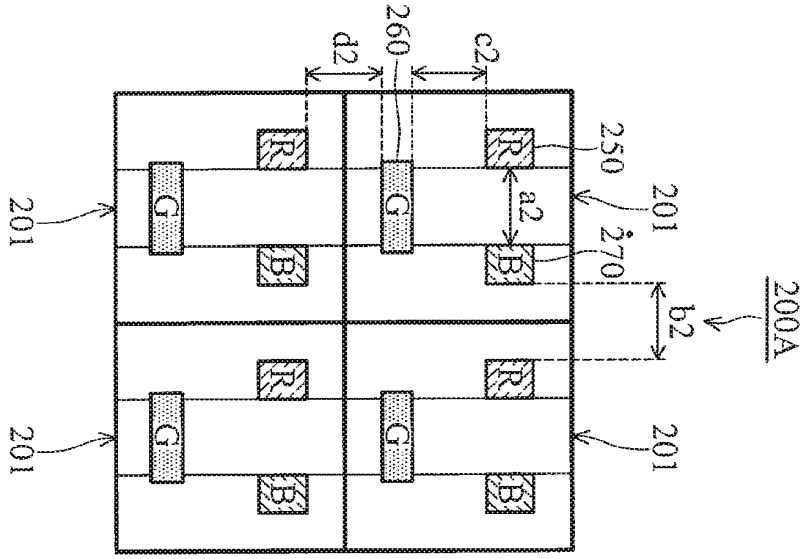
第 2a 圖

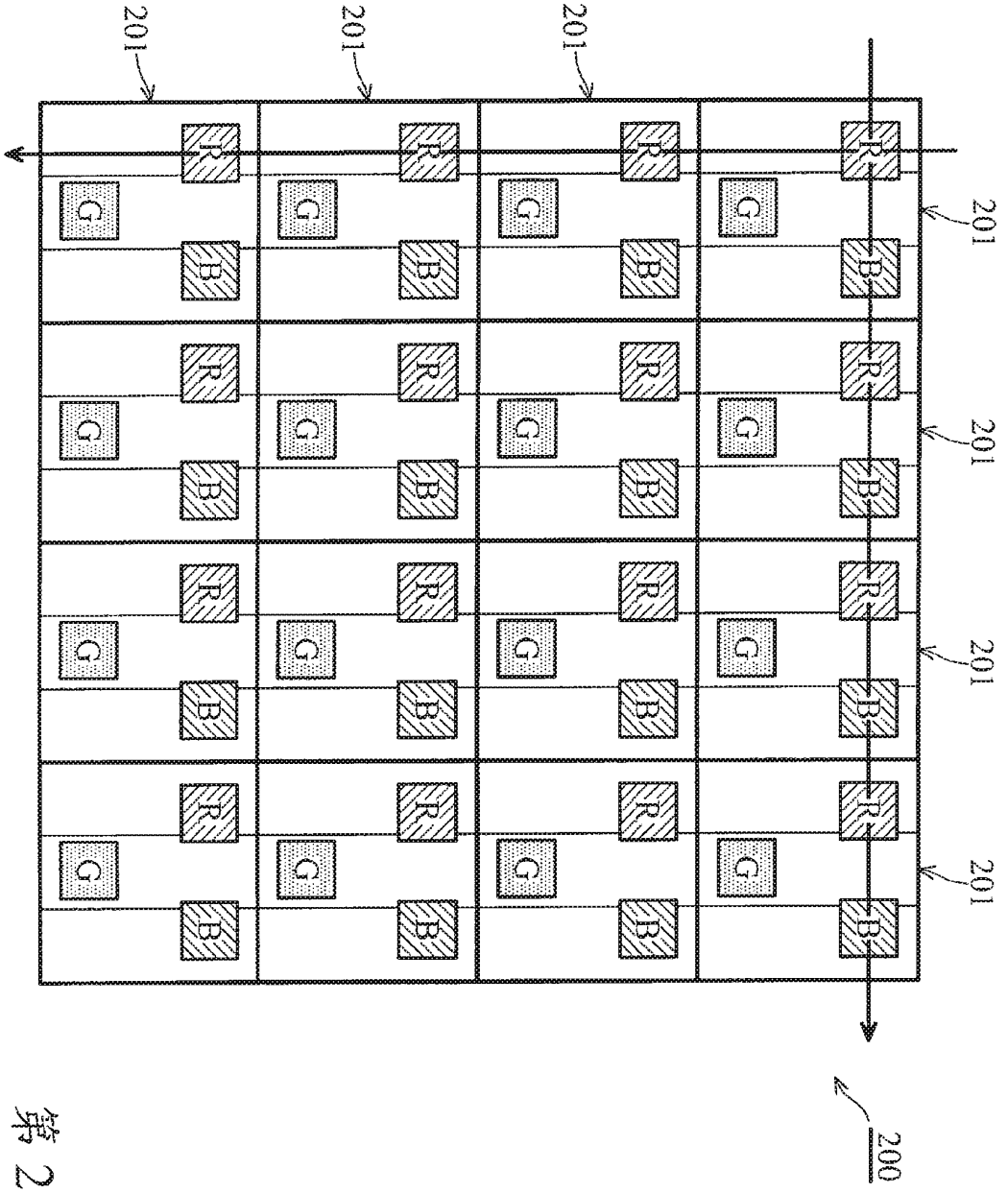



第 2b 圖



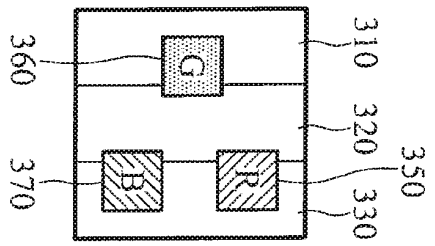

第 2c 圖



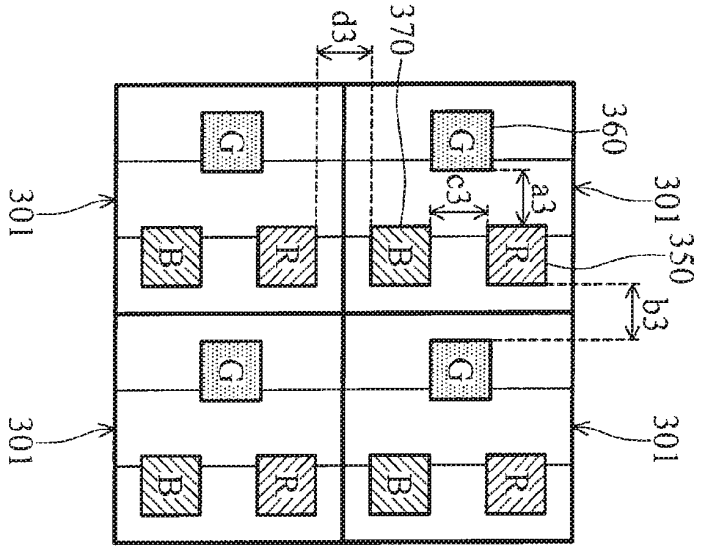



第 2d 圖

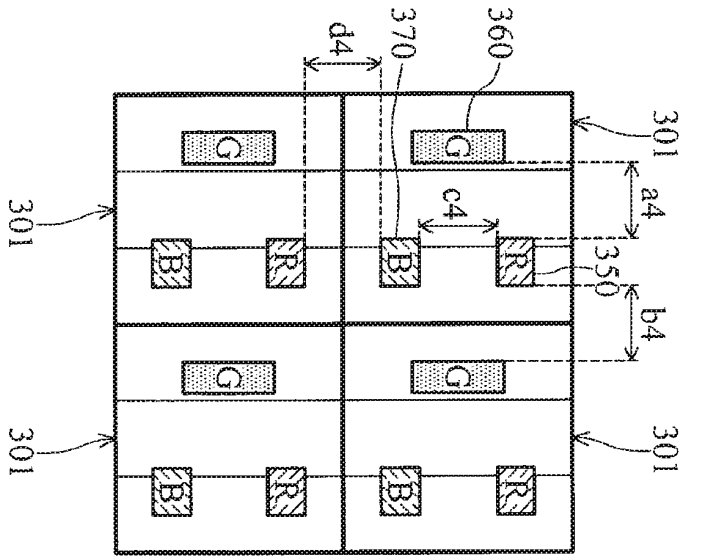
第 3a 圖

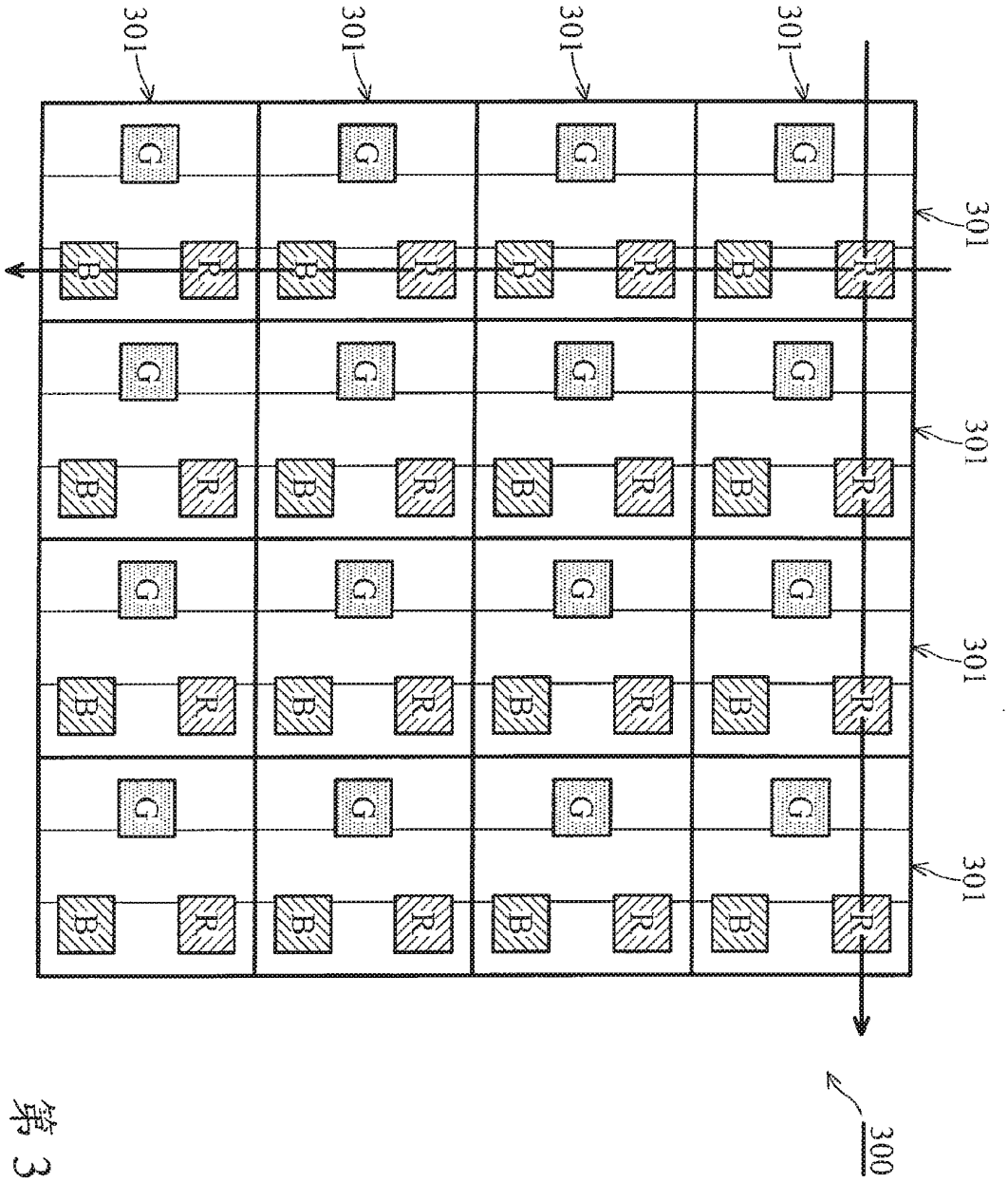



第 3b 圖

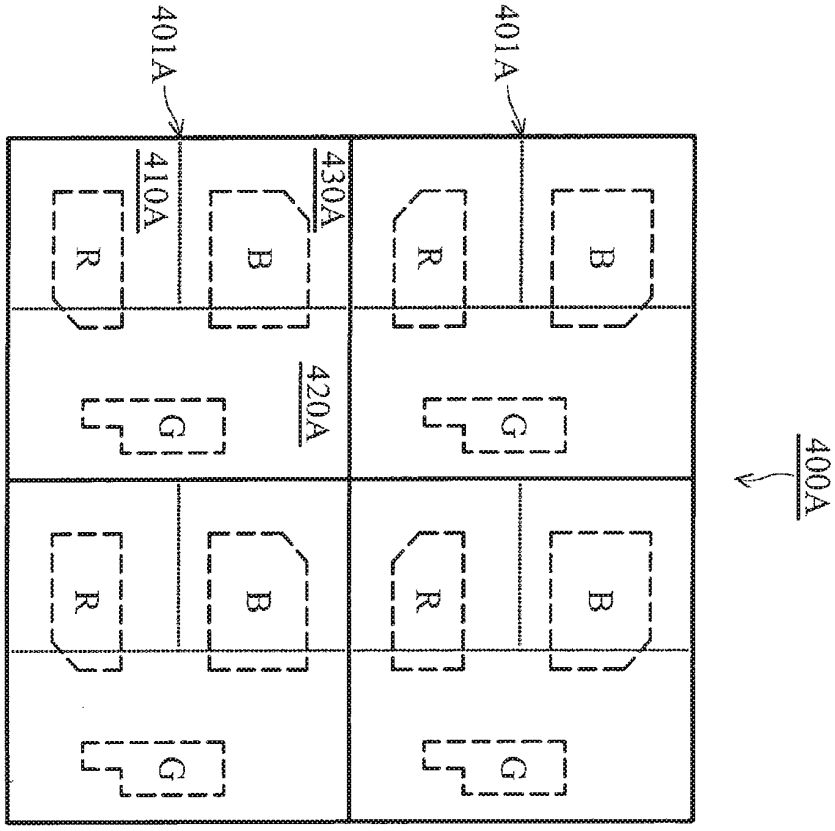



第 3c 圖

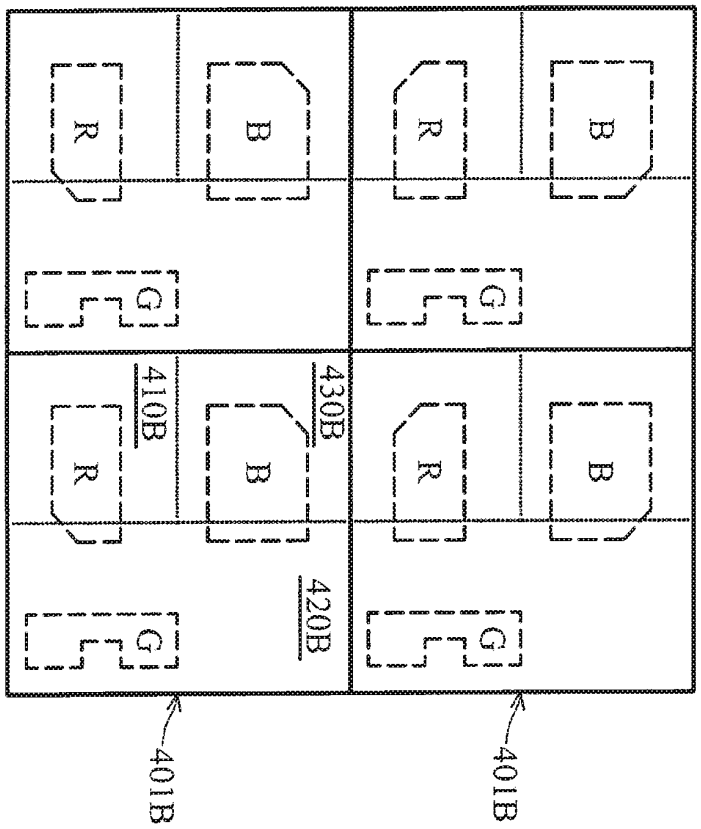




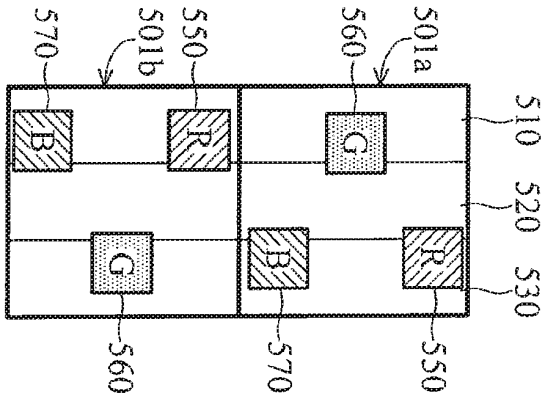

第 3d 圖



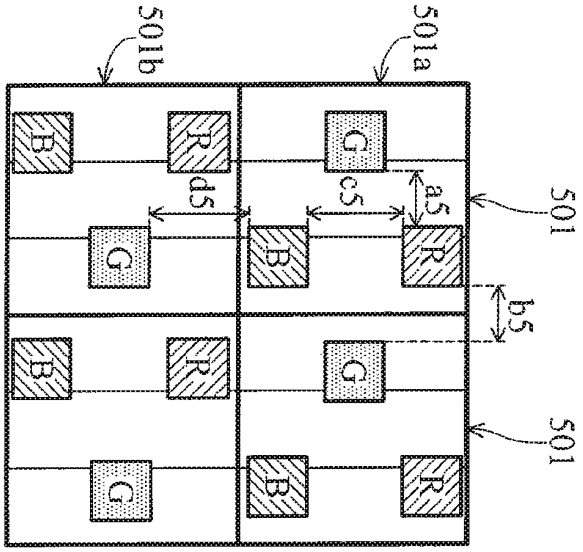

第 4a 圖



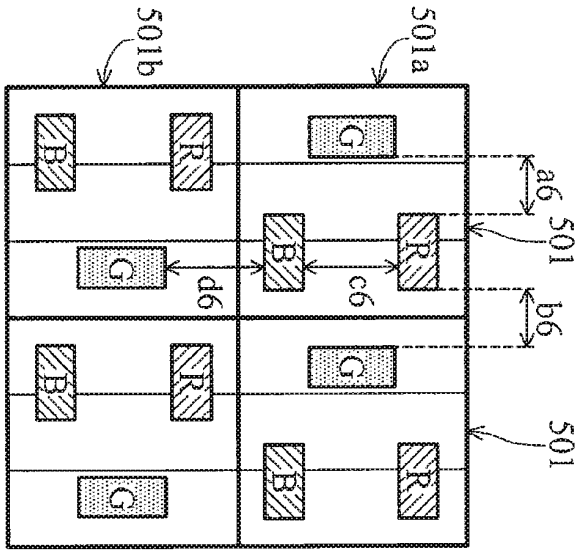

第 4b 圖



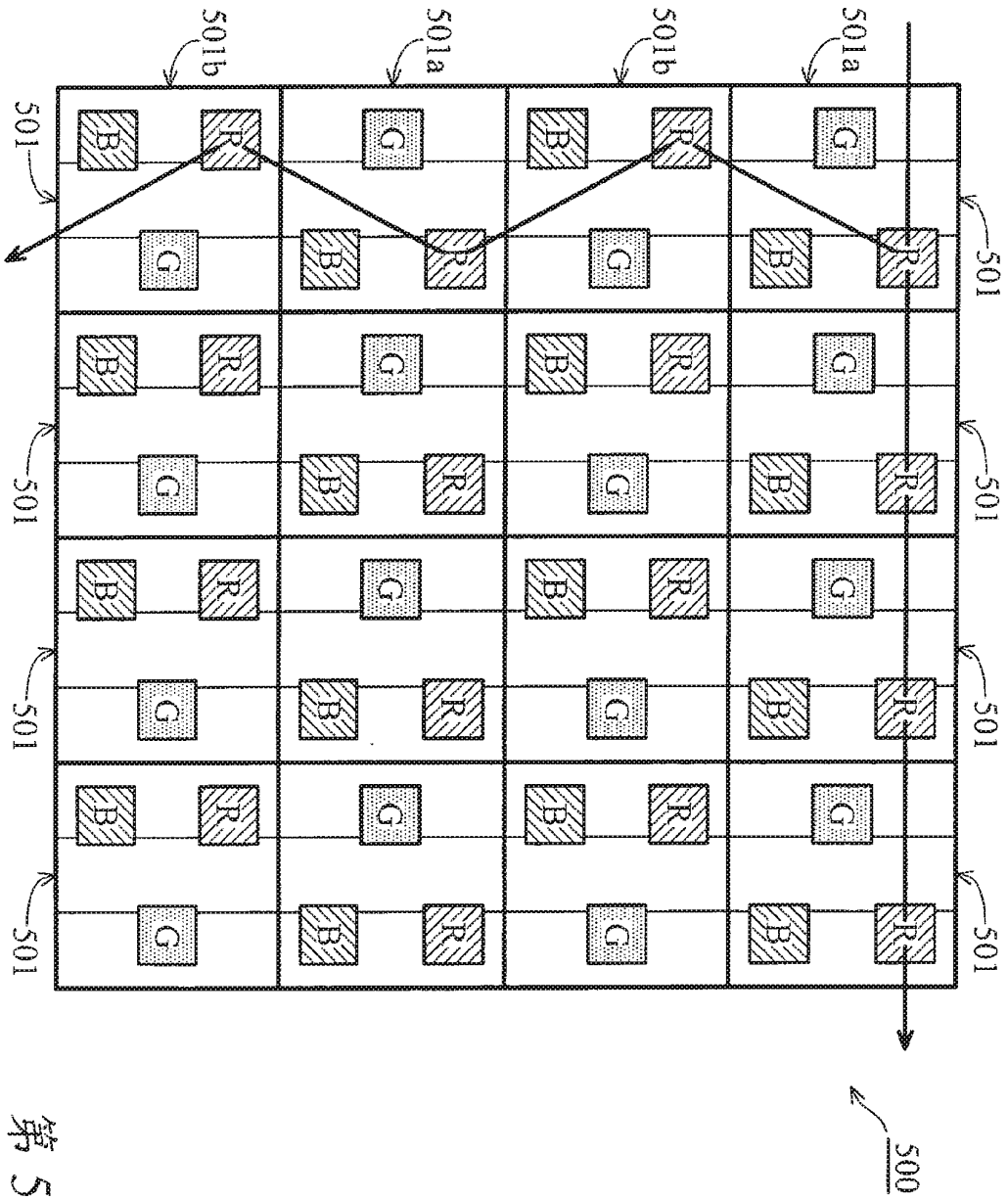

第 5a 圖



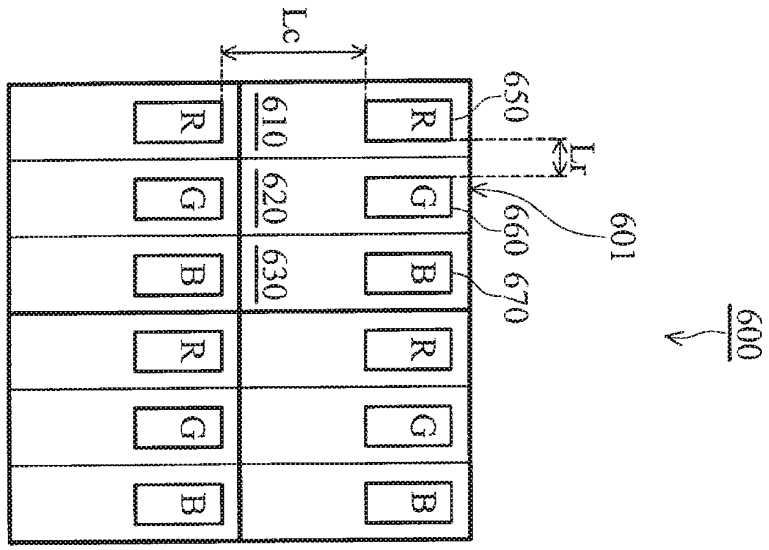

第 5b 圖




第 5c 圖




第 5d 圖




第6圖

七、指定代表圖：

(一)本案指定代表圖為：第 2b 圖。

(二)本代表圖之元件符號簡單說明：

200~畫素排列；

201~畫素；

250~紅色發光區；

260~綠色發光區；

270~藍色發光區；

a1~同一畫素列方向上相鄰、不同顏色發光區間之距離；

b1~相鄰畫素列方向上相鄰、不同顏色發光區間之距離；

c1~同一畫素行方向上相鄰、不同顏色發光區間之距離；

d1~相鄰畫素行方向上相鄰、不同顏色發光區間之距離。

八、本案若有化學式時，請揭示最能顯示發明特徵的化學式：

無。



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第 96114023 號　　修正日期:99.1.15　　修正頁

公告本

# 發明專利說明書

（本說明書格式、順序及粗體字，請勿任意更動，※記號部分請勿填寫）

※ 申請案號：96114023

※ 申請日期：96.4.20　　※IPC 分類：G09F 9/302 (2006.01)
H01J 17/20

## 一、發明名稱：（中文/英文）

可顯示彩色影像之顯示面板及其形成方法以及包含三原色畫素元件之顯示器及全彩顯示器 / DISPLAY PANELS CAPABLE OF DISPLAYING COLOR IMAGES AND METHOD FOR FORMING THE SAME AND DISPLAYS AND FULL COLOR DISPLAYS COMPRISING THREE-COLOR PIXEL ELEMENTS

## 二、申請人：（共 1 人）

姓名或名稱：（中文/英文）
友達光電股份有限公司/AU Optronics Corp.
代表人：（中文/英文）李焜耀/ K. Y. Lee
住居所或營業所地址：（中文/英文）
新竹科學工業園區新竹市力行二路一號
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國　籍：（中文/英文）中華民國/TW

## 三、發明人：（共 2 人）

姓　名：（中文/英文）
1. 趙清煙/Ching-Ian CHAO
2. 吳元均/Yuan-Chun WU

國　籍：（中文/英文）
中華民國/TW



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十、申請專利範圍：

1.一種可顯示彩色影像之顯示面板，包括複數個畫素，以一列方向與一行方向排列成一矩陣，每一畫素包括：

一第一次畫素、一第二次畫素與一第三次畫素，彼此相鄰且沿該矩陣之該列方向排列；以及

一第一發光區、一第二發光區與一第三發光區，排列成一三角形，每一發光區之幾何中心位於該三角形之不同頂點，以使該三角形之一邊實質上平行於該列方向與該行方向其中之一，其中每一第一發光區、第二發光區與第三發光區發出單獨顏色之光線，且該等畫素之排列於該列方向上任意兩相鄰且不同顏色之發光區間定義出一具有一距離之間隙及於該行方向上任意兩相鄰且不同顏色之發光區間定義出一具有一距離之間隙，該兩間隙之距離實質上相等，其中該矩陣之其中一列最多發出兩種顏色之光線，且其相鄰列最多發出一種顏色之光線。

2.如申請專利範圍第 1 項所述之顯示面板，其中每一第一發光區、第二發光區與第三發光區包括對應之一紅色發光區、一綠色發光區與一藍色發光區其中之一。

3.如申請專利範圍第 2 項所述之顯示面板，其中每一紅色發光區、綠色發光區與藍色發光區之幾何中心分別位於對應之該第一次畫素、該第二次畫素與該第三次畫素，以使該三角形之一邊實質上平行於該列方向。

4.如申請專利範圍第 2 項所述之顯示面板，其中該紅色發光區、該綠色發光區與該藍色發光區其中之一之幾何中心位於該畫素之該第一次畫素與該第三次畫素其中之一，且該紅色發光區、該綠色發光區與該藍色發光區其餘



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之幾何中心位於該畫素之另一該第一次畫素及該第三次畫素，以使該三角形之一邊實值上平行於該行方向。

5.如申請專利範圍第 2 項所述之顯示面板，其中每一紅色發光區、綠色發光區與藍色發光區具有一該列方向之寬度與一該行方向之長度。

6.如申請專利範圍第 5 項所述之顯示面板，其中每一紅色發光區、綠色發光區與藍色發光區之該寬度與該長度為不同。

7.如申請專利範圍第 5 項所述之顯示面板，其中每一紅色發光區、綠色發光區與藍色發光區之該寬度與該長度為實質上相同。

8.如申請專利範圍第 2 項所述之顯示面板，其中每一紅色發光區、綠色發光區與藍色發光區包括一可發射紅色、綠色及藍色光色之發光二極體元件。

9.如申請專利範圍第 8 項所述之顯示面板，其中該發光二極體元件包括一有機發光二極體元件或複數個串聯之有機發光二極體元件。

10.如申請專利範圍第 8 項所述之顯示面板，其中每一發光二極體元件包括一上發射(top-emission)型有機發光二極體元件及一下發射(bottom-emission)型有機發光二極體元件其中之一。

11.如申請專利範圍第 8 項所述之顯示面板，其中每一發光二極體元件包括一正常結構及一反置(inverted)結構其中之一。

12.如申請專利範圍第 8 項所述之顯示面板，更包括一驅動電路，分別驅動每一畫素之該紅色發光區、該綠色發



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光區與該藍色發光區，以從該等發光區發射對應顏色之光線。

13.如申請專利範圍第 12 項所述之顯示面板，其中該驅動電路使該顯示面板對應於一被動矩陣與一主動矩陣其中之一。

14.一種可顯示彩色影像之顯示面板，形成有複數個畫素，以一列方向與一行方向排列成一矩陣，每一畫素包括一第一次畫素、一第二次畫素與一第三次畫素，彼此相鄰且沿該矩陣之該列方向排列，以及一紅色發光區、一綠色發光區與一藍色發光區，包括：

該畫素中之該紅色發光區、該綠色發光區與該藍色發光區之排列成一三角形，每一發光區之幾何中心位於該三角形之不同頂點，以使該三角形之一邊實質上平行於該列方向與該行方向其中之一，於該等畫素中，該列方向上任意兩相鄰且不同顏色之發光區間定義出一具有一距離之間隙，以及於該行方向上任意兩相鄰且不同顏色之發光區間定義出一具有一距離之間隙，該兩間隙之距離實質上相等，其中該矩陣之其中一列最多發出兩種顏色之光線，且其相鄰列最多發出一種顏色之光線。

15.如申請專利範圍第 14 項所述之顯示面板，其中每一紅色發光區、綠色發光區與藍色發光區之幾何中心分別位於對應之該第一次畫素、該第二次畫素與該第三次畫素，以使該三角形之一邊實質上平行於該列方向。

16.如申請專利範圍第 14 項所述之顯示面板，其中該紅色發光區、該綠色發光區與該藍色發光區其中之一之幾何中心位於該畫素之該第一次畫素與該第三次畫素其中之



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一，且該紅色發光區、該綠色發光區與該藍色發光區其餘之幾何中心位於該畫素之另一該第一次畫素及該第三次畫素，以使該三角形之一邊實質上平行於該行方向。

17.如申請專利範圍第 14 項所述之顯示面板，其中每一紅色發光區、綠色發光區與藍色發光區具有一該列方向之寬度與一該行方向之長度。

18.如申請專利範圍第 17 項所述之顯示面板，其中每一紅色發光區、綠色發光區與藍色發光區之該寬度與該長度不同。

19.如申請專利範圍第 17 項所述之顯示面板，其中每一紅色發光區、綠色發光區與藍色發光區之該寬度與該長度為實質上相同。

20.如申請專利範圍第 14 項所述之顯示面板，其中每一紅色發光區、綠色發光區與藍色發光區包括一可發射紅色、綠色及藍色光色之發光二極體元件。

21.如申請專利範圍第 20 項所述之顯示面板，其中該發光二極體元件包括一有機發光二極體元件或複數個串聯之有機發光二極體元件。

22.如申請專利範圍第 20 項所述之顯示面板，其中每一有機發光二極體元件包括一上發射(top-emission)型有機發光二極體元件及一下發射(bottom-emission)型有機發光二極體元件其中之一。

23.如申請專利範圍第 20 項所述之顯示面板，其中每一有機發光二極體元件包括一正常結構及一反置(inverted)結構其中之一。

24.一種形成顯示彩色影像之顯示面板之方法，其中該



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顯示面板具有複數個畫素，以一列方向與一行方向排列成一矩陣，每一畫素包括一第一次畫素、一第二次畫素與一第三次畫素，彼此相鄰且沿該矩陣之該列方向排列，以及一紅色發光區、一綠色發光區與一藍色發光區，包括：

排列該畫素之該紅色發光區、該綠色發光區與該藍色發光區成一三角形，每一發光區之幾何中心位於該三角形之不同頂點，以使該三角形之一邊實質上平行於該列方向與該行方向其中之一，以便於該等畫素之該矩陣中，該列方向上任意兩相鄰且不同顏色之發光區間定義一具有一距離之間隙，以及於該行方向上任意兩相鄰且不同顏色之發光區間定義一具有一距離之間隙，該兩間隙之距離實質上相等，其中該矩陣之其中一列最多發出兩種顏色之光線，且其相鄰列最多發出一種顏色之光線。

25.如申請專利範圍第 24 項所述之方法，其中每一紅色發光區、綠色發光區與藍色發光區之幾何中心分別位於對應之該第一次畫素、該第二次畫素與該第三次畫素，使該三角形之一邊實質上平行於該列方向。

26.如申請專利範圍第 24 項所述之方法，其中該紅色發光區、該綠色發光區與該藍色發光區其中之一之幾何中心位於該畫素之該第一次畫素與該第三次畫素其中之一，且該紅色發光區、該綠色發光區與該藍色發光區其餘之幾何中心位於該畫素之另一該第一次畫素及該第三次畫素，以使該三角形之一邊實質上平行於該行方向。

27.如申請專利範圍第 24 項所述之方法，其中每一紅色發光區、綠色發光區與藍色發光區包括一可發射紅色、綠色及藍色光色之發光二極體元件。



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28.如申請專利範圍第 27 項所述方法，其中該發光二極體元件包括一有機發光二極體元件(organic light emitting diode, OLED)或複數個串聯之有機發光二極體元件。

29.如申請專利範圍第 27 項所述之方法，其中每一有機發光二極體元件包含一上發射(top-emission)型有機發光二極體元件及一下發射(bottom-emission)型有機發光二極體元件其中之一。

30.如申請專利範圍第 27 項所述之方法，其中每一有機發光二極體元件包含一正常結構及一反置(inverted)結構其中之一。

31.一種可顯示彩色影像之顯示面板，包括複數個畫素，以一列方向與一行方向排列成一矩陣，每一畫素包括：

一第一次畫素、一第二次畫素與一第三次畫素；以及

一第一發光區、一第二發光區與一第三發光區排列成一三角形，每一發光區之幾何中心位於該三角形之不同頂點，以使該三角形之一邊實質上平行於該列方向與該行方向其中之一，其中每一第一發光區、第二發光區與第三發光區發出單獨顏色之光線，且該等畫素之排列，於該列方向上任意兩相鄰且不同顏色之發光區間定義出一具有一距離之間隙，以及於該行方向上任意兩相鄰且不同顏色之發光區間定義出一具有一距離之間隙，該兩間隙之距離實質上相等，其中該矩陣之其中一列最多發出兩種顏色之光線，且其相鄰列最多發出一種顏色之光線。

32.如申請專利範圍第 31 項所述之顯示面板，其中每一第一發光區、第二發光區與第三發光區包括對應之一紅



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色發光區、一綠色發光區與一藍色發光區其中之一。

33.一種三原色畫素元件之顯示器，包括：

一第一次畫素、一第二次畫素與一第三次畫素，彼此相鄰且以一列方向與一行方向排列成一畫素矩陣；以及

一第一發光區、一第二發光區與一第三發光區，排列成一三角形，每一發光區之幾何中心位於該三角形之不同頂點，以使該三角形之一邊實質上平行於該列方向與垂直該列方向之該行方向其中之一，其中每一第一發光區、第二發光區與第三發光區發出單獨顏色之光線，且於該列方向上任意兩相鄰且不同顏色之發光區間定義出一具有一第一距離之間隙，以及於該行方向上任意兩相鄰且不同顏色之發光區間定義出一具有一第二距離之間隙，該第一距離與該第二距離實質上相等，其中該畫素矩陣之其中一列最多發出兩種顏色之光線，且其相鄰列最多發出一種顏色之光線。

34.一種全彩顯示器，包括：

一第一次畫素、一第二次畫素與一第三次畫素，彼此相鄰且以一列方向與一行方向排列成一畫素矩陣；以及

一第一發光區、一第二發光區與一第三發光區，排列成一三角形，每一發光區之幾何中心位於該三角形之不同頂點，以使該三角形之一邊實質上平行於該列方向與垂直該列方向之該行方向其中之一，其中每一第一發光區、第二發光區與第三發光區發出單獨顏色之光線，且於該列方向上任意兩相鄰且不同顏色之發光區間定義出一具有一第一距離之間隙，以及於該行方向上任意兩相鄰且不同顏色之發光區間定義出一具有一第二距離之間隙，該第一距離



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與該第二距離實質上相等，其中該畫素矩陣之其中一列最多發出兩種顏色之光線，且其相鄰列最多發出一種顏色之光線。



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# Electronic Patent Application Fee Transmittal

| | |
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| **Application Number:** | 13614197 |
| **Filing Date:** | 13-Sep-2012 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Filer:** | Jun-Young E. Jeon/Elizabeth Gomez |
| **Attorney Docket Number:** | 69657/S1437 |

Filed as Large Entity

**Filing Fees for Utility under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
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| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
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| **Miscellaneous:** | | | | |
| Submission- Information Disclosure Stmt | 1806 | 1 | 180 | 180 |
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# Electronic Acknowledgement Receipt

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| **EFS ID:** | 27813296 |
| **Application Number:** | 13614197 |
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| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
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| Submitted with Payment | yes |
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## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 69657_IDS.PDF | 77533<br>85968c15cffe5b404e03955984f3d169b7e05f40 | yes | 3 |
| | **Multipart Description/PDF files in .zip description** | | | | |
| | **Document Description** | | **Start** | **End** | |
| | Transmittal Letter | | 1 | 2 | |
| | Information Disclosure Statement (IDS) Form (SB08) | | 3 | 3 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Foreign Reference | TW_I328207B.pdf | 5698228<br>4fa19c27cdda753b9f91d75454f7fc667873943c | no | 42 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Other Reference-Patent/App/Search documents | TW_OA.pdf | 567120<br>ab3c628a7062c56f3fa245e5edb4e80f9736703f | no | 6 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 4 | Fee Worksheet (SB06) | fee-info.pdf | 30947<br>94afcb1571fc3b74892f7bf0dca53a167a1fdc32 | no | 2 |
| **Warnings:** | | | | | |
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| | | **Total Files Size (in bytes):** | 6373828 | | |

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**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on December 15, 2016 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Elizabeth Gomez

Inventor(s) : Sang-Shin Lee
Application No. : 13/614,197
Filed : September 13, 2012
Title : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

Confirmation No. 4264

Grp./Div. : 2691
Examiner : Kwang-Su Yang

Docket No. : 069657

**SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT WITH FEE UNDER 37 CFR §§ 1.97(d) AND 1.17(p)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
December 15, 2016

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is an information disclosure statement listing the references that are known to applicant. Copies of the listed Foreign Patent Documents and Other Documents references are enclosed.

It is respectfully requested that the listed references be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of the information disclosure statement be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

Applicant's undersigned attorney hereby certifies, in accordance with 37 CFR § 1.97(e)(1), that each item of information contained in the information disclosure statement was first cited in a communication from any foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement.

The processing fee of $180.00 as required by 37 CFR § 1.17(p) is submitted herewith. The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
LEWIS ROCA ROTHGERBER CHRISTIE LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/eg
Enclosures: Information Disclosure Statement, w/references

EG PAS1454413.1-*-12/15/16 2:24 PM



Petitioner Ex 1015, p. 197
BOE et al. v. Samsung, IPR2023-00988

PATENT
RESPONSE UNDER 37 CFR 1.116
EXPEDITED PROCEDURE
EXAMINING GROUP 2691

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on December 5, 2016 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Anna J. O'Connor

| | | |
|---|---|---|
| Appl No. | : 13/614,197 | Confirmation No. 4264 |
| Inventor | : Sang-Shin Lee | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| TC/A.U. | : 2691 | |
| Examiner | : Yang, Kwang-Su | |
| Docket No. | : 069657 | |
| Customer No. | : 23363 | |

**RESPONSE AFTER FINAL ACTION**

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
December 5, 2016

Commissioner:

Applicant responds as follows to the Office action of October 14, 2016, issued in the above-identified application:

**The Listing of Claims begins** on page 2 of this paper.

**Remarks/Arguments** begin on page 6 of this paper.



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BOE et al. v. Samsung, IPR2023-00988

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 27695717 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Yong J. Kwun/Anna O'Connor |
| **Filer Authorized By:** | Yong J. Kwun |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 05-DEC-2016 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 17:43:58 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 069657_Response.PDF | 269299<br>e78e8aa7ac40c9fd121d3378bb85c01bbe0fb384 | yes | 10 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Applicant Arguments/Remarks Made in an Amendment | 6 | 10 |
| | Claims | 2 | 5 |
| | Response After Final Action | 1 | 1 |
| **Warnings:** | | | |
| **Information:** | | | |
| | **Total Files Size (in bytes):** | 269299 | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

## REMARKS/ARGUMENTS

Claims 1-14, and 16-22 are in the present application, of which claim 1 is independent. Claims 6-14 were previously withdrawn, and claim 15 was previously cancelled without prejudice. No claims are amended herein. No new matter has been introduced. Applicant thanks the Examiner for indicating that claims 17-18 and 21 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicant respectfully requests reconsideration and allowance of claims 1-5, 16, 19-20, and 22, while maintaining the allowance/allowability of claims 17-18 and 21. Further, Applicant respectfully requests that claims 6-14 be rejoined and allowed, upon the allowance of claim 1 and any intervening claim(s).

### Claim Rejections Under 35 U.S.C. § 103

Claims 1-5, 19-20, and 22 were rejected under pre-AIA 35 U.S.C. § 103(a) as allegedly being unpatentable over Credelle (U.S. Publication No. 2003/0128179 A1, hereinafter referred to as "Credelle") in view of Kim (U.S. Patent No. 8,354,789 B2, hereinafter referred to as "Kim), and further in view of Louwsma (U.S. Publication No. 2008/0308819 A1, hereinafter referred to as "Louwsma").

Claim 16 was rejected under pre-AIA 35 U.S.C. § 103(a) as allegedly being unpatentable over Credelle, in view of Kim as applied to claim 5 above, in view of Louwsma as applied to claim 5 above, and further in view of Satou (U.S. Publication No. 2010/0171440 A1, hereinafter referred to as "Satou").

Independent claim 1 of the present application recites, in relevant part (***emphasis*** added):

> ***a first pixel*** having ***a center coinciding with a center of a virtual square***;
>
> ***a second pixel*** separated from the first pixel and having ***a center at a first vertex of the virtual square***;



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> another first pixel on a line defined by the center of the virtual square and the first vertex, the first pixel, the second pixel, and the other first pixel being consecutive pixels on the line from among the plurality of pixels; and
>
> ***a third pixel*** separated from the first pixel and the second pixel, and having ***a center at a second vertex neighboring the first vertex of the virtual square***,
>
> ***wherein the second pixel has a larger area than that of the third pixel***, and
>
> wherein the first pixel is configured to emit green light.

In rejecting independent claim 1, page 4 of the Office action concedes that "Credelle and Kim do not expressly teach wherein the second pixel has a larger area than that of the third pixel," but alleges that Louwsma (Figs. 1, 2 and 5) teaches (***emphasis*** added):

> wherein the second pixel has a larger area than that of the third pixel ***(if an intensity in comparison to the blue color, the area of the red color LED element R can be chosen larger than the area size of the blue LED element; [0051], lines 7-16)***.

Applicant respectfully submits that the Office action has failed to establish a *prima facie* case of obviousness with respect to claim 1. The Office bears the initial burden of factually supporting any *prima facie* conclusion of obviousness, and if the Office does not produce a *prima facie* case, the Applicant is under no obligation to submit evidence of nonobviousness. (*See* MPEP § 2142). To establish a *prima facie* case of obviousness, there should be provided some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness demonstrating why one of ordinary skill in the art at the time the invention was made would have combined the disclosures of these references to arrive at the claimed embodiment. *See KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Furthermore, there should be some explanation why any differences between the cited references and the claimed invention would have been obvious to one of ordinary skill in the art. *See* MPEP § 2141.

Here, for example, the Office action appears to equate the blue sub-pixel 102, the red sub-pixel 104, and the green sub-pixel 106 as shown in FIG. 18A of Credelle, reproduced below, with a first pixel, a second pixel, and a third pixel, respectively, as recited in claim 1. However, referring to FIG. 18A of Credelle, if the area of the red sub-pixel 104 (which appears to be equated with the second pixel) is increased to be larger than the area of the green sub-pixel 106 (which appears to be equated with the third pixel), the location of the vertices of the virtual square would be shifted, such that ***the center*** of the green sub-pixel 106 would no longer be at a second vertex neighboring the first vertex of the virtual square (assuming that the first vertex is fixed at the center of the red sub-pixel 104 having the increased area), or ***the center*** of the red sub-pixel 104 having the increased area would no longer be at the first vertex of the virtual square (assuming that the second vertex is fixed at the center of the green sub-pixel 106).

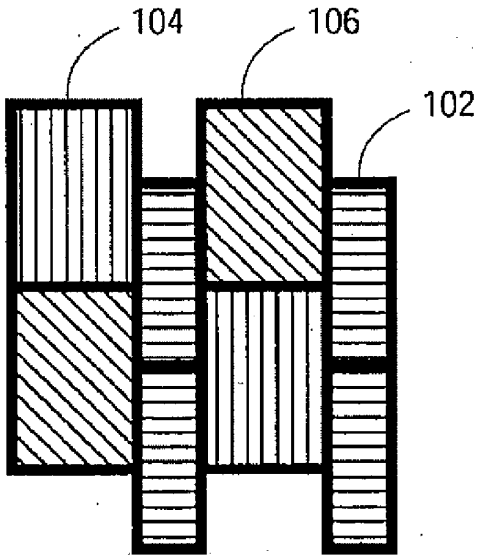



**FIG. 18A**

Accordingly, the cited portions of Credelle, Kim, and Louwsma, alone or in any combination, do not appear to disclose or even suggest at least "***a first pixel*** having ***a center*** coinciding with ***a center of a virtual square***; ***a second pixel*** separated from the first pixel and having ***a center*** at ***a first vertex of the virtual square***; another first pixel on a line defined by the center of the virtual square and the first vertex, the first pixel, the second pixel, and the other first pixel being consecutive pixels on the line from among the plurality of pixels; and ***a third pixel*** separated from the first pixel and the second pixel, and having ***a center*** at ***a second vertex neighboring the first vertex of the virtual square***, wherein ***the second pixel has a larger area than that of the third pixel***," as recited in claim 1 of the present application. (***Emphasis*** added).

Further, Applicant respectfully submits that the other remaining cited references do not appear to cure the deficiencies of Credelle, Kim, and Louwsma to disclose or even suggest at least the above-recited features of claim 1, and there is no apparent reason why a person having ordinary skill in the art at the time of the invention would have combined/modified the cited references to arrive at the embodiment recited in claim 1.

Applicant, therefore, respectfully requests that the rejection of claim 1 be withdrawn, and that claim 1 be allowed. Further, because claims 2-20 depend, directly or indirectly, from claim 1, these claims each incorporate all of the terms and limitations of claim 1, in addition to other limitations, which together further patentably distinguish these claims over the art of record when considered as a whole. Applicant, therefore, respectfully requests that the rejections of claims 2-20 also be withdrawn, and that these claims be allowed as well.

**Rejoinder of Claims 6-14**

Withdrawn claims 6-14 depend, directly or indirectly, from claim 1, and incorporates all of the terms and limitations of claim 1, in addition to other limitations,

which together further patentably distinguish these claims over the art of record when considered as a whole. Applicant, therefore, respectfully requests that claims 6-14 be rejoined and allowed, upon the allowance of claim 1 and any intervening claim(s).

**Allowable Subject Matter**

Applicant thanks the Examiner for indicating that claims 17-18 and 21 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

However, as Applicant believes that the rejection of claim 1 has been overcome herein, Applicant respectfully requests that claims 17-18 and 21 be allowed, upon the allowance of claim 1 and any intervening claim(s).

**Concluding Remarks**

In view of the foregoing amendments and remarks, Applicant earnestly solicits a timely issuance of a Notice of Allowance. If there are any remaining issues that can be addressed over the telephone, the Examiner is cordially invited to call Applicant's attorney at the number listed below.

Respectfully submitted,
LEWIS ROCA ROTHGERBER CHRISTIE LLP

By _____
Jimmy Y. Kwun
Reg. No. 66,490
626/795-9900

JYK/ajo

AJO PAS1447083.1-*-12/5/16 9:27 AM



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**Listing of Claims:**

1. (Previously Presented) A pixel arrangement structure of an organic light emitting diode (OLED) display, comprising:

a plurality of pixels for displaying an image on the OLED display and comprising:

a first pixel having a center coinciding with a center of a virtual square;

a second pixel separated from the first pixel and having a center at a first vertex of the virtual square;

another first pixel on a line defined by the center of the virtual square and the first vertex, the first pixel, the second pixel, and the other first pixel being consecutive pixels on the line from among the plurality of pixels; and

a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square,

wherein the second pixel has a larger area than that of the third pixel, and

wherein the first pixel is configured to emit green light.

2. (Previously Presented) The pixel arrangement structure of claim 1,

wherein the plurality of pixels further comprises another second pixel separated from the first pixel and having a center at a third vertex neighboring the second vertex of the virtual square, and

wherein the second pixels are separated from each other by the first pixel.

3. (Previously Presented) The pixel arrangement structure of claim 2,

wherein the plurality of pixels further comprises another third pixel separated from the first pixel and having a center at a fourth vertex neighboring the third vertex of the virtual square, and

wherein the third pixels are separated from each other by the first pixel.

4. (Original) The pixel arrangement structure of claim 3, wherein the second pixels and the third pixels enclose the first pixel in the virtual square.

5. (Previously presented) The pixel arrangement structure of claim 4, wherein

the first pixel, the second pixels, and the third pixels have polygonal shapes, and

each of the second pixels and each of the third pixels has a larger area than the first pixel.

6. (Withdrawn) The pixel arrangement structure of claim 5, wherein

the first pixel has a quadrilateral shape, and

the second pixels and the third pixels have hexagonal or octagonal shapes.

7. (Withdrawn) The pixel arrangement structure of claim 6, wherein the second pixels and the third pixels have octagonal shapes.

8. (Withdrawn) The pixel arrangement structure of claim 7, wherein a distance between the first pixel and each of the second pixels, a distance between the first pixel and each of the third pixels, and a distance between each of the second pixels and each of the third pixels are a same first length.

9. (Withdrawn) The pixel arrangement structure of claim 8, wherein

the first pixel comprises a plurality of first pixels,

the plurality of first pixels have a same quadrilateral shape, and

a distance between neighboring pixels of the plurality of first pixels is a second length that is longer than the first length.

10. (Withdrawn) The pixel arrangement structure of claim 6, wherein

each of the second pixels has a larger area than each of the third pixels,

a distance between each of the second pixels and each of the third pixels is a same first length, and

a distance between the first pixel and each of the second pixels, and a distance between the first pixel and each of the third pixels are a same second length.

11. (Withdrawn) The pixel arrangement structure of claim 10, wherein

the first pixel comprises a plurality of first pixels,

the plurality of first pixels have a same quadrilateral shape, and

a distance between neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

12. (Withdrawn) The pixel arrangement structure of claim 10, wherein

the first pixel comprises a plurality of first pixels,

neighboring pixels of the plurality of first pixels have quadrilateral shapes that are symmetrical to each other, and

a distance between the neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

13. (Withdrawn) The pixel arrangement structure of claim 6, wherein

the first pixel comprises a plurality of first pixels, and

neighboring pixels of the plurality of first pixels have quadrilateral shapes that are symmetrical to each other.

14. (Withdrawn) The pixel arrangement structure of claim 13, wherein each of the second pixels has a larger area than each of the third pixels.

15. (Canceled)

16. (Previously presented) The pixel arrangement structure of claim 5, wherein

the first pixel has an octagonal shape, and

the second pixels and the third pixels have quadrilateral shapes.



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17. (Previously presented) The pixel arrangement structure of claim 16, wherein

each of the second pixels has a larger area than each of the third pixels,

a shortest distance between each of the second pixels and each of the third pixels is a same first length, and

a shortest distance between the first pixel and each of the second pixels, and a shortest distance between the first pixel and each of the third pixels are a same second length.

18. (Previously presented) The pixel arrangement structure of claim 17, wherein

the first pixel comprises a plurality of first pixels, and

neighboring pixels of the plurality of first pixels have octagonal shapes that are symmetrical to each other.

19. (Original) The pixel arrangement structure of claim 1, wherein the first pixel, the second pixel, and the third pixel are configured to emit different color lights.

20. (Previously presented) The pixel arrangement structure of claim 19, wherein the second pixel and the third pixel are configured to emit blue light and red light, respectively.

21. (Previously presented) The pixel arrangement structure of claim 18, wherein a shortest distance between the neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

22. (Previously presented) The pixel arrangement structure of claim 1, wherein the second pixel has a larger area than that of the first pixel.



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PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

| PATENT APPLICATION FEE DETERMINATION RECORD<br>Substitute for Form PTO-875 | Application or Docket Number<br>13/614,197 | Filing Date<br>09/13/2012 | ☐ To be Mailed |
|---|---|---|---|

**ENTITY:** ☒ LARGE ☐ SMALL ☐ MICRO

## APPLICATION AS FILED – PART I

| FOR | (Column 1) NUMBER FILED | (Column 2) NUMBER EXTRA | RATE ($) | FEE ($) |
|---|---|---|---|---|
| ☐ BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | |
| ☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | |
| ☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | minus 20 = | * | X $ = | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | minus 3 = | * | X $ = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | |

## APPLICATION AS AMENDED – PART II

AMENDMENT **12/05/2016**

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * 21 | Minus | ** 21 | = 0 | X $80 = | 0 |
| Independent (37 CFR 1.16(h)) | * 1 | Minus | ***3 | = 0 | X $420 = | 0 |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | TOTAL ADD'L FEE | 0 |

AMENDMENT

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * | Minus | ** | = | X $ = | |
| Independent (37 CFR 1.16(h)) | * | Minus | *** | = | X $ = | |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
KAREN VESTAL

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

23363 7590 10/14/2016
Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

| EXAMINER | |
|---|---|
| YANG, KWANG-SU | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2691 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 10/14/2016 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pto@lrrc.com
pair_cph@firsttofile.com



Petitioner Ex 1015, p. 211
BOE et al. v. Samsung, IPR2023-00988

| Office Action Summary | Application No. 13/614,197 | Applicant(s) LEE, SANG-SHIN | |
|---|---|---|---|
| | Examiner KWANG-SU YANG | Art Unit 2691 | AIA (First Inventor to File) Status No |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *07/07/2016*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims***

5)☒ Claim(s) *1-14 and 16-22* is/are pending in the application.

5a) Of the above claim(s) *6-14* is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-5,16,19,20 and 22* is/are rejected.

8)☒ Claim(s) *17,18 and 21* is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

**Application Papers**

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.



**Petitioner Ex 1015, p. 212**
**BOE et al. v. Samsung, IPR2023-00988**

## DETAILED ACTION

### *Notice of Pre-AIA or AIA Status*

1. The present application is being examined under the pre-AIA first to invent provisions.

### *Response to Amendment*

2. The amendment filed on 07/07/2016 has been entered and considered by examiner.

### *Claim Rejections - 35 USC § 103*

3. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-5, 19-20 and 22 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Credelle (U.S. Pub. No. US 2003/0128179 A1) in view of Kim (U.S Patent No. US 8,354,789 B2), and further in view of Louwsma (U.S Pub. No. US 2008/0308819 A1).

**As to claim 1,** Credelle (Figs. 1, 18A and 20) teaches **a pixel arrangement structure** (an octal subpixel grouping; Fig. 18A) **of an organic light emitting diode display** (a display technology such as an Organic Light Emitting Diode (OLED); [0047], lines 8-14)**, comprising:**

- **a plurality of pixels for displaying an image on the OLED display** (blue subpixel 102, red subpixel 104, and green subpixel 106; a display technology such as an Organic Light Emitting Diode (OLED); [0047], lines 8-14; Fig. 18A) **and comprising:**

  - **a first pixel** (a blue subpixel 102 in a first row and a second column) **having a center coinciding with a center of a virtual square** (a virtual square consisting of centers of two red subpixels and two green subpixels; Fig. 18A)**;**

  - **a second pixel** (a red subpixel 104 in a second row and a third column) **separated** (Fig. 1 show separation among subpixels) **from the first pixel** (the blue subpixels in a first row and a second column) **and having a center at a first vertex of the virtual square** (the center of the red subpixel 104 in the second row and the third column) (Figs. 1 and 18A)**;**

  - **another first pixel** (a blue subpixel 104 in a second row and a fourth column) **on a line defined by the center of the virtual square and the first vertex** (a line defined by the center of the virtual square, i.e., the center of the blue subpixel 102 in the first row and the second column, and the red subpixel 104 in the second row and the third column)**, the first pixel** (the blue subpixel 102 in the first row and the second column)**, the second pixel** (the red subpixel 104 in the second row and the third column)**, and the other first pixel** (the blue subpixel 102 in the second row and the fourth column) **being consecutive pixels on the line from among the plurality of pixels** (Fig. 18A)**; and**

  - **a third pixel** (a green subpixel 106 in a first row and a third column) **separated** (Fig. 1 show separation among subpixels) **from the first pixel** (the blue subpixel 102 in the first row and the second column) **and the second pixel** (the red subpixel 104 in the second row and the third column)**, and having a**

**center at a second vertex neighboring the first vertex of the virtual square** (a center of the green subpixel 106 coincides with a second vertex neighboring the first vertex, i.e., the center of the red subpixel 104 in the second row and the third column in the virtual square; Figs. 1 and 18A)**.**

Credelle does not expressly teach **wherein the second pixel has a larger area than that of the third pixel, and wherein the first pixel is configured to emit green light.**

Kim (Figs. 1-2) teaches

- **wherein the first pixel is configured to emit green light** (the third subpixel 14 may be set up as the green sub-pixel G; col. 3, lines 58-59; Figs. 1-2)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used a pixel arrangement of an organic light emitting display device as taught by Kim in a subpixel grouping of Credelle because the pixel arrangement increases the number of red sub-pixels and blue sub-pixels, comparing with the conventional pentile matrix color pixel arrangement, and the aperture ratio and the expression ability of the high resolution may be improved, comparing with a conventional stripe configuration.

Credelle and Kim do not expressly teach **wherein the second pixel has a larger area than that of the third pixel.**

Louwsma (Figs. 1, 2 and 5) teaches

- **wherein the second pixel has a larger area than that of the third pixel** (if an intensity in comparison to the blue color, the area of the red color LED element R can be chosen larger than the area size of the blue LED element; [0051], lines 7-16)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used different area sizes as taught by Louwsma in a subpixel grouping of Credelle as modified by Kim and because the pixel size of the blue component relative to the red or green may be larger to cause the pixel elements to age at a common rate.

**As to claim 2,** Credelle teaches

- **wherein the plurality of pixels further comprises another second pixel** (a red subpixel 104 in a first row and a first column) **separated** (Fig. 1 show separation among subpixels) **from the first pixel** (the blue subpixels in the first row and the second column) **and having a center at a third vertex neighboring the second vertex of the virtual square** (the center of the red subpixel 104 in the first row and the first column neighboring the center of the green subpixel 106, i.e., the second vertex) (Figs. 1 and 18A)**, and**
- **wherein the second pixels** (the red subpixel 104 in the second row and the third column and the red subpixel 104 in the first row and the first column) **are separated from each other by the first pixel** (the blue subpixel 102 in the first row and the second column) (Fig. 18A)**.**

**As to claim 3,** Credelle teaches

- **wherein the plurality of pixels further comprises another third pixel** (a green subpixel 106 in a second row and a first column) **separated** (Fig. 1 show separation among subpixels) **from the first pixel** (the blue subpixels in the first row and the second column) **and having a center at a fourth vertex neighboring the third vertex of the**

**virtual square** (the center of the green subpixel 106 in a second row and a first column neighboring the center of the red subpixel 104, i.e., the third vertex) (Figs. 1 and 18A)**, and**

- **wherein the third pixels** (the green subpixel 106 in the first row and the third column and the green subpixel 106 in the second row and the first column) **are separated from each other by the first pixel** (the blue subpixel 102 in the first row and the second column) (Fig. 18A)**.**

**As to claim 4,** Credelle teaches

- **wherein the second pixels and the third pixels enclose the first pixel in the virtual square** (two red subpixels 104 and two green subpixels 106 enclose a blue subpixel; Fig. 18A)**.**

**As to claim 5,** Credelle teaches **wherein**

- **the first pixel, the second pixels, and the third pixels have polygonal shapes** (rectangular shapes; Fig. 18A)**, and**
- **each of the second pixels and each of the third pixels has a larger area than the first pixel** (the red subpixel 104 and the green subpixel 106 have larger area than the blue subpixel 102; Fig. 18A)**.**

**As to claim 19,** Credelle teaches

- **wherein the first pixel, the second pixel, and the third pixel are configured to emit different color lights** (blue, red and green) (Fig. 18A)**.**

**As to claim 20,** Kim teaches

- **wherein the second pixel and the third pixel are configured to emit blue light and red light, respectively** (the second sub-pixel 12 may be set up as the blue sub-pixel B and the first sub-pixel 10 may be set up as the red sub-pixel R; col. 3, lines 56-58; Fig. 2)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used a pixel arrangement of an organic light emitting display device as taught by Kim in a subpixel grouping of Credelle as modified by Louwsma because the pixel arrangement increases the number of red sub-pixels and blue sub-pixels, comparing with the conventional pentile matrix color pixel arrangement, and the aperture ratio and the expression ability of the high resolution may be improved, comparing with a conventional stripe configuration.

**As to claim 22,** Credelle teaches

- **wherein the second pixel has a larger area than that of the first pixel** (the red subpixel 104 has a larger area than that of the blue subpixel 102; Fig. 18A)**.**

5. Claim 16 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Credelle, in view of Kim as applied to claim 5 above, in view of Louwsma as applied to claim 5 above, and further in view of Satou (U.S Pub. No. US 2010/0171440 A1).

**As to claim 16,** Credelle, Kim, and Louwsma teach **the pixel arrangement structure of claim 5.**

Credelle also teaches **wherein**

- **the second pixels and the third pixels have quadrilateral shapes** (rectangular shapes; Fig. 18A)**.**

Credelle, Kim, and Louwsma do not expressly teach **wherein the first pixel has an octagonal shape.**

Satou (Fig. 6(a)) teaches **wherein**

- **the first pixel has an octagonal shape** (G in the point (2,2) has an octagonal shape; Fig. 6(a))**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used an octagonal shape of sub-pixel as taught by Satou in a subpixel grouping of Credelle as modified by Kim and Louwsma because the octagonal shape of subpixel provides a user with visually pleasing shape.

### *Allowable Subject Matter*

6. Claims 17-18 and 21 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

### *Response to Arguments*

7. Applicants' arguments with respect to claims 1-5, 16, 19-20 and 22 have been considered but are moot in view of the new grounds of rejection.

In view of amendment, references of Credelle, Kim, Louwsma, and Satou have been used for the new grounds of rejection.

Therefore, the Office maintains the rejections as recited above.

***Conclusion***

8. Applicant's amendment necessitated the new grounds of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

***Inquiry***

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kwang-Su Yang whose telephone number is 571-270-7307. The examiner can normally be reached on Mon-Fri during 9:00am-6:00pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chanh Nguyen can be reached on 571-272-7772. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status

information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/KWANG-SU YANG/
Primary Examiner, Art Unit 2629

| Notice of References Cited | Application/Control No. 13/614,197 | Applicant(s)/Patent Under Reexamination LEE, SANG-SHIN | |
|---|---|---|---|
| | Examiner KWANG-SU YANG | Art Unit 2691 | Page 1 of 1 |

**U.S. PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Name | CPC Classification | US Classification |
|---|---|---|---|---|---|---|
| * | A | US-2003/0128179 A1 | 07-2003 | Credelle, Thomas Lloyd | G02F1/133514 | 345/88 |
| * | B | US-8,354,789 B2 | 01-2013 | Kim; Gun-Shik | H01L27/3218 | 313/504 |
| | C | US- | | | | |
| | D | US- | | | | |
| | E | US- | | | | |
| | F | US- | | | | |
| | G | US- | | | | |
| | H | US- | | | | |
| | I | US- | | | | |
| | J | US- | | | | |
| | K | US- | | | | |
| | L | US- | | | | |
| | M | US- | | | | |

**FOREIGN PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Country | Name | CPC Classification |
|---|---|---|---|---|---|---|
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**NON-PATENT DOCUMENTS**

| * | | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|---|---|
| | U | |
| | V | |
| | W | |
| | X | |

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.



Petitioner Ex 1015, p. 222
BOE et al. v. Samsung, IPR2023-00988

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 069657 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
| | | 2011/0291550 A1 | 12-01-2011 | Kim et al. |
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**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
| | | KR 10-2011-0129531 | 12-02-2011 | Kim et al. | Corresponds to U.S. Publication 2011/0291550 listed above |
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**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | KIPO Office action dated July 11, 2016, with English translation, for corresponding Korean Patent application 10-2016-0047800, (11 pages) |
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| EXAMINER SIGNATURE | /KWANG-SU YANG/ | DATE CONSIDERED | 10/08/2016 |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KY/

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 069657 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
| | | 2003/0128179 A1 | 07-10-2003 | Credelle |
| | | | | |

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| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
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**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | U.S. Office Action dated September 2, 2016 for Application No. 13/872,018 (15 sheets) |
| | | |

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| EXAMINER SIGNATURE | /KWANG-SU YANG/ | DATE CONSIDERED | 10/08/2016 |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 069657 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
| | | 2015/0192834 A1 | 07-09-2015 | Morinaga et al. |
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**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
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**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | U.S. Office action dated August 05, 2016, for related U.S. Patent Application No. 15/090,591 (11 pages) |
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| EXAMINER SIGNATURE | /KWANG-SU YANG/ | DATE CONSIDERED | 10/08/2016 |
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Petitioner Ex 1015, p. 225
BOE et al. v. Samsung, IPR2023-00988

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | Examiner | Art Unit |
| | KWANG-SU YANG | 2691 |

| CPC- SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
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| CPC COMBINATION SETS - SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| US CLASSIFICATION SEARCHED | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
| 345 | 82 419 | 10/24/2014 | KY |

| SEARCH NOTES | | |
|---|---|---|
| Search Notes | Date | Examiner |
| EAST: Inventor Search | 10/24/2014 | KY |
| EAST: Text Search | 10/24/2014; 10/27/2014 | KY |
| EAST: Updated Text Search | 02/27/2015 | KY |
| EAST: IDS Search | 03/07/2015 | KY |
| EAST: IDS Search | 07/09/2015 | KY |
| EAST: Updated Text Search | 07/09/2015 | KY |
| EAST: Updated Text Search | 11/25/2015; 11/27/2015 | KY |
| EAST: IDS Search | 04/02/2016 | KY |
| EAST: Updated Text Search | 04/02/2016 | KY |
| EAST: IDS Search | 10/08/2016 | KY |
| EAST: Updated Text Search | 10/08/2016; 10/11/2016 | KY |

| INTERFERENCE SEARCH |
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| | /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691 |

| US Class/ CPC Symbol | US Subclass / CPC Group | Date | Examiner |
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| | /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691 |

**EAST Search History**

**EAST Search History (Prior Art)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| S85 | 2 | "20030128179".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 14:59 |
| S86 | 2 | "20150192834".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 15:01 |
| S87 | 2 | "20110291550".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 15:17 |
| S88 | 3 | "20020070909".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 15:27 |
| S89 | 2 | "6882364".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 16:49 |
| S90 | 92 | ("6882364").URPN. | USPAT | OR | ON | 2016/10/08 16:51 |
| S91 | 22 | ("8933898" \| "7898518" \| "8970517" \| "20130088477" \| "7948465" \| "8330699" \| "20140160066" \| "8792062").PN. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 16:52 |
| S92 | 3 | "20100133994".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; | OR | ON | 2016/10/08 17:11 |



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BOE et al. v. Samsung, IPR2023-00988

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| | | | IBM_TDB | | | |
| S93 | 1 | (OLED organic adj light OELD) and (pixel sub$1pixel) near (arrangment structure) same honey$1comb same red same green same blue | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 17:22 |
| S94 | 4 | ("2008/0170188").URPN. | USPAT | OR | ON | 2016/10/08 17:24 |
| S95 | 766 | (OLED organic adj light OELD) and (pixel sub$1pixel) near (arrangment structure) same red same green same blue | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 17:25 |
| S96 | 52 | (OLED organic adj light OELD) and (pixel sub$1pixel) near (arrangment structure) same red with green with blue same blue with (larger greater smaller less) with red | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 17:26 |
| S97 | 0 | (OLED organic adj light OELD) and (pixel sub$1pixel) near (arrangment structure) same red with green with blue same honey adj comb | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 17:53 |
| S98 | 0 | (OLED organic adj light OELD) and (pixel sub$1pixel) near (arrangment structure) same honey adj comb | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 17:53 |
| S99 | 1 | (OLED organic adj light OELD) and (pixel sub$1pixel) near (arrangment structure) same honeycomb | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 17:53 |
| S100 | 45 | (OLED organic adj light OELD) and (pixel sub$1pixel) near (arrangment structure) and honeycomb | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 17:53 |
| S101 | 0 | CCD same OLED same honeycomb | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 18:08 |
| S102 | 930 | CCD same OLED | US-PGPUB; | OR | ON | 2016/10/08 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | 18:08 |
| S103 | 0 | CCD same OLED same (pixel sub$1pixel) near (structure arrangement) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 18:09 |
| S104 | 27 | CCD same OLED and (pixel sub$1pixel) near (structure arrangement) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 18:09 |
| S105 | 92 | ("6882364").URPN. | USPAT | OR | ON | 2016/10/08 18:32 |
| S106 | 92 | ("6882364").URPN. | USPAT | OR | ON | 2016/10/08 18:32 |
| S107 | 0 | S106 and (organic adj light OLED OELD) | USPAT | OR | ON | 2016/10/08 18:33 |
| S108 | 102 | CCD with (organic adj light OLED OELD) | USPAT | OR | ON | 2016/10/08 18:33 |
| S109 | 355 | CCD with (organic adj light OLED OELD) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 18:34 |
| S110 | 511 | (organic adj light OLED OELD) and honeycomb same (size area region) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 18:46 |
| S111 | 7 | (organic adj light OLED OELD) and honeycomb same (size area region) with blue with red | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 18:46 |
| S112 | 9 | (organic adj light OLED OELD) and honeycomb same (size area region) with blue | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 18:48 |
| S113 | 413 | (organic adj light OLED OELD) and (arrangement structure) near3 (pixel sub$1pixel) same red with blue with (area region size) | US-PGPUB; USPAT; USOCR; FPRS; | OR | ON | 2016/10/08 18:50 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | EPO; JPO; DERWENT; IBM_TDB | | | |
| S114 | 245 | (organic adj light OLED OELD) and arrangement near3 (pixel sub$1pixel) same red with blue with (area region size) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 18:51 |
| S115 | 36 | (organic adj light OLED OELD) and arrangement near3 (pixel sub$1pixel) same red with blue with (area region size) with (greater larger smaller less) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 18:52 |
| S116 | 232 | (organic adj light OLED OELD) and arrangement near3 (pixel sub$1pixel) and red with blue with (area region size) with (greater larger smaller less) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/08 19:05 |
| S117 | 42 | (US-20130234917-$ or US-20120313844-$ or US-20080001525-$ or US-20050001542-$ or US-20090302331-$ or US-20110012820-$ or US-20020140833-$ or US-20020070909-$ or US-20040113922-$ or US-20120019529-$ or US-20070230818-$ or US-20130002911-$ or US-20080273793-$ or US-20070164335-$ or US-20010048477-$ or US-20020113195-$ or US-20090303228-$ or US-20100033084-$ or US-20110316764-$ or US-20100171440-$ or US-20030128179-$ or US-20110291550-$ or US-20100133994-$).did. or (US-8350468-$ or US-8115216-$ or US-8552635-$ or US-8477160-$ or US-8026669-$ or US-7236196-$ or US-6882364-$ or US-7728881-$ or US-8598784-$ or US-8354789-$ or US-6867549-$ or US-8330352-$ or US-7728802-$ or US-7274383-$ or US-8405692-$).did. or (US-20020015110-$ or US-20020070909-$ or US-20040108818-$ or JP-2007017477-$).did. | US-PGPUB; USPAT; DERWENT | OR | ON | 2016/10/11 11:17 |
| S118 | 25 | S117 and (organic adj light OLED OELD) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/11 11:17 |
| S119 | 9 | ("20020015110" \| "20090121983" \| "6867549" \| "7525526" \| "7646430").PN. OR ("8354789").URPN. | US-PGPUB; USPAT; USOCR | OR | ON | 2016/10/11 11:35 |
| S120 | 8 | ("7525526").URPN. | USPAT | OR | ON | 2016/10/11 11:47 |
| S121 | 371 | (organic adj light OLED OELD) and pentile | US-PGPUB; | OR | ON | 2016/10/11 |



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| | | | | | | |
|---|---|---|---|---|---|---|
| | | | USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | 11:57 |
| S122 | 133 | S121 and red with (greater larger less smaller) with blue | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/11 12:25 |
| S123 | 2 | "20080308819".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/10/11 15:56 |

**EAST Search History (Interference)**

< This search history is empty>

**10/ 11/ 2016 6:02:50 PM**
**C:\ Users\ kyang\ Documents\ EAST\ Workspaces\ 13614197.wsp**



Petitioner Ex 1015, p. 232
BOE et al. v. Samsung, IPR2023-00988

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | **Examiner** | **Art Unit** |
| | KWANG-SU YANG | 2691 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 10/27/2014 | 03/07/2015 | 07/09/2015 | 11/27/2015 | 04/02/2016 | 10/11/2016 | | | |
| | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| | 2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| | 3 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| | 4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| | 5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| | 6 | N | N | N | N | N | N | | | |
| | 7 | N | N | N | N | N | N | | | |
| | 8 | N | N | N | N | N | N | | | |
| | 9 | N | N | N | N | N | N | | | |
| | 10 | N | N | N | N | N | N | | | |
| | 11 | N | N | N | N | N | N | | | |
| | 12 | N | N | N | N | N | N | | | |
| | 13 | N | N | N | N | N | N | | | |
| | 14 | N | N | N | N | N | N | | | |
| | 15 | N | - | - | - | - | - | | | |
| | 16 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| | 17 | O | ✓ | O | O | O | O | | | |
| | 18 | O | O | O | O | O | O | | | |
| | 19 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| | 20 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| | 21 | | | | O | O | O | | | |
| | 22 | | | | ✓ | ✓ | ✓ | | | |



Petitioner Ex 1015, p. 233
BOE et al. v. Samsung, IPR2023-00988

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 069657 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
| | | 2003/0128179 A1 | 07-10-2003 | Credelle |
| | | | | |

**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
| | | | | | |

**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | U.S. Office Action dated September 2, 2016 for Application No. 13/872,018 (15 sheets) |
| | | |

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| EXAMINER SIGNATURE | | DATE CONSIDERED | |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

JEJ/eg

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 13614197 |
| **Filing Date:** | 13-Sep-2012 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Filer:** | Jun-Young E. Jeon/Elizabeth Gomez |
| **Attorney Docket Number:** | 69657/S1437 |

Filed as Large Entity

**Filing Fees for Utility under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| Submission- Information Disclosure Stmt | 1806 | 1 | 180 | 180 |
| | | **Total in USD ($)** | | **180** |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 26899015 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Young E. Jeon |
| **Filer Authorized By:** | |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 12-SEP-2016 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 18:28:11 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | $180 |
| RAM confirmation Number | 5925 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 69657_IDS.PDF | 65318<br>aef6083d141e04f18bc584236e68b5f5bd13b9ee | yes | 3 |
| | **Multipart Description/PDF files in .zip description** | | | | |
| | **Document Description** | | **Start** | **End** | |
| | Transmittal Letter | | 1 | 2 | |
| | Information Disclosure Statement (IDS) Form (SB08) | | 3 | 3 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Non Patent Literature | 72827_09_02_2016.pdf | 478834<br>ca8515f7dac40d6854ed431b2792c0c881b911b2 | no | 15 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Fee Worksheet (SB06) | fee-info.pdf | 30947<br>7115d3d6dd65ed426a38cd232c084ca9d055840e | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 575099 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on September 12, 2016 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Elizabeth Gomez

Inventor(s) : Sang-Shin Lee Confirmation No. 4264
Application No. : 13/614,197
Filed : September 13, 2012
Title : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

Grp./Div. : 2691
Examiner : Kwang-Su Yang

Docket No. : 069657

**SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT WITH FEE UNDER 37 CFR §§ 1.97(c) AND 1.17(p)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
September 12, 2016

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is an information disclosure statement listing a reference that is known to applicant. Copies of each of the listed Foreign Patent Documents and Other Documents references are enclosed.

It is respectfully requested that the listed reference be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of the information disclosure statement be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

The processing fee of $180.00 as required by 37 CFR § 1.17(p) is submitted herewith. The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
LEWIS ROCA ROTHGERBER CHRISTIE LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/eg
Enclosures: Information Disclosure Statement, w/reference

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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 069657 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

| U.S. PATENT DOCUMENTS | | | | |
|---|---|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
| | | 2015/0192834 A1 | 07-09-2015 | Morinaga et al. |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| FOREIGN PATENT DOCUMENTS | | | | | |
|---|---|---|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
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| OTHER DOCUMENTS | | |
|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
| | | U.S. Office action dated August 05, 2016, for related U.S. Patent Application No. 15/090,591 (11 pages) |
| | | |
| | | |
| | | |

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| EXAMINER SIGNATURE | | DATE CONSIDERED | |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

JEJ/eg



Petitioner Ex 1015, p. 242
BOE et al. v. Samsung, IPR2023-00988

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 13614197 |
| **Filing Date:** | 13-Sep-2012 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Filer:** | Jun-Young E. Jeon/Elizabeth Gomez |
| **Attorney Docket Number:** | 69657/S1437 |

Filed as Large Entity

**Filing Fees for Utility under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| Submission- Information Disclosure Stmt | 1806 | 1 | 180 | 180 |
| | | **Total in USD ($)** | | **180** |

# Electronic Acknowledgement Receipt

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|---|---|
| **EFS ID:** | 26752981 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Young E. Jeon |
| **Filer Authorized By:** | |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 25-AUG-2016 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 18:45:34 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | $180 |
| RAM confirmation Number | 5221 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 69657_IDS.PDF | 65592<br>c05b430e136df9ab75eaa5366110c54cb3164382 | yes | 3 |
| | **Multipart Description/PDF files in .zip description** | | | | |
| | **Document Description** | | **Start** | **End** | |
| | Transmittal Letter | | 1 | 2 | |
| | Information Disclosure Statement (IDS) Form (SB08) | | 3 | 3 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Other Reference-Patent/App/Search documents | 79922_OA.pdf | 549169<br>d995b8aad3d5f7a37cd4ccf6314bc7efbba1ae4d | no | 11 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Fee Worksheet (SB06) | fee-info.pdf | 30948<br>95c6753b7a99a55e696189241e854a3e4ca004e8 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 645709 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on August 25, 2016 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Elizabeth Gomez

Inventor(s) : Sang-Shin Lee Confirmation No. 4264
Application No. : 13/614,197
Filed : September 13, 2012
Title : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

Grp./Div. : 2691
Examiner : Kwang-Su Yang

Docket No. : 069657

**SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT WITH FEE UNDER 37 CFR §§ 1.97(c) AND 1.17(p)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
August 25, 2016

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is an information disclosure statement listing a reference that is known to applicant.

It is respectfully requested that the listed reference be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of the information disclosure statement be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

The processing fee of $180.00 as required by 37 CFR § 1.17(p) is submitted herewith. The Commissioner is hereby authorized to charge any fees which may be

required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
LEWIS ROCA ROTHGERBER CHRISTIE LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/eg
Enclosures: Information Disclosure Statement, w/reference

EG PAS1436705.1-*-08/25/16 10:41 AM

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

23363 7590 08/01/2016

Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

| EXAMINER | |
|---|---|
| YANG, KWANG-SU | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2691 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 08/01/2016 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pto@lrrc.com
pair_cph@firsttofile.com



Petitioner Ex 1015, p. 250
BOE et al. v. Samsung, IPR2023-00988

| Applicant-Initiated Interview Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 13/614,197 | LEE, SANG-SHIN | |
| | Examiner | Art Unit | |
| | KWANG-SU YANG | 2691 | |

All participants (applicant, applicant's representative, PTO personnel):

(1) *KWANG-SU YANG*. (3)_____.

(2) *BRUCE WAGER (Reg. No. 72,186)* . (4)_____.

Date of Interview: *26 July 2016*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☒103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *1*.

Identification of prior art discussed: *Satou (U.S. Pub. No. US 2010/0171440 A1)*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

*Applicant's representative explains the difference between the amended claim and the reference Satou.. Examiner agrees that the added limitation "a plurality of pixels for displaying an image on the OLED display" overcomes the reference Satou. Examiner needs further search for determining whether the claimed application is placed in condition for allowance*.

**Applicant recordation instructions:** The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

**Examiner recordation instructions**: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

| /KWANG-SU YANG/<br>Primary Examiner, Art Unit 2691 | |
|---|---|



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# Summary of Record of Interview Requirements

**Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record**
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

**Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews**
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

———

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

**Examiner to Check for Accuracy**

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 069657 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
| | | 2011/0291550 A1 | 12-01-2011 | Kim et al. |
| | | | | |
| | | | | |
| | | | | |

**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
| | | KR 10-2011-0129531 | 12-02-2011 | Kim et al. | Corresponds to U.S. Publication 2011/0291550 listed above |
| | | | | | |
| | | | | | |
| | | | | | |

**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | KIPO Office action dated July 11, 2016, with English translation, for corresponding Korean Patent application 10-2016-0047800, (11 pages) |
| | | |
| | | |
| | | |

DLG PAS1430723.1-*-07/21/16 9:22 AM

| EXAMINER SIGNATURE | | DATE CONSIDERED | |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

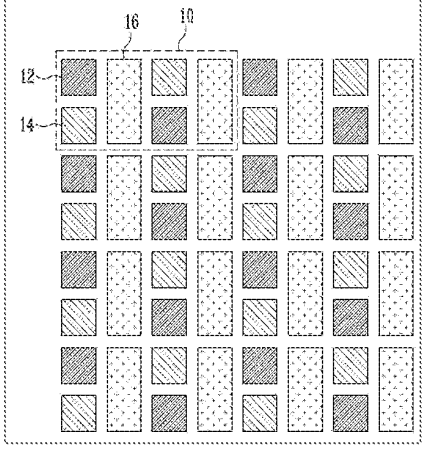
JEJ/dg

# 유기전계발광 표시장치의 화소배열구조

Pixel Array for Organic Light Emitting Display Device

| | |
|---|---|
| (51) Int. CL | H01L 51/52(2006.01) |
| (52) CPC | H01L 27/3216(2013.01) H01L 27/3218 (2013.01) G09G 3/2003(2013.01) G09G 3/3208(2013.01) H01L 27/326(2013.01) G09G 2300/0452(2013.01) G09G 2300/0465 (2013.01) |
| (21) Application No.(Date) | 1020100048942 (2010.05.26) |
| (71) Applicant | Samsung Display Co., Ltd. |
| (11) Registration No.(Date) | |
| (65) Unex. Pub. No.(Date) | 1020110129531 (2011.12.02) |
| (11) Publication No.(Date) | |
| (86) Int'l Application No.(Date) | |
| (87) Int'l Unex. Pub. No.(Date) | |
| (30) Priority info.<br>(Country / No. / Date) | |
| Legal Status | Rejected |
| Examination Status | Decision to refuse (Reexamination) |
| Trial Info | Trial Info |
| Kind/Right of Org. Application | New Application / |
| Right of Org. Application No.(Date) | |
| Related Application No. | 1020120001004 |
| Request for an examination(Date) | Y(2010.05.26) |
| Number of examination claims | 4 |

Zoom






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PURPOSE: A pixel array structure of an organic electroluminescence display apparatus is provided to arrange a third sub-pixel in two columns in order to be adjacent to a first sub-pixel and second sub-pixel which are arranged in the same column, thereby improving an aperture ratio.

CONSTITUTION: A sub-pixel group comprises two first sub-pixels(12), two second sub-pixels(14), and two third sub-pixels (16). The first sub-pixel is arranged in i and i+2 rows where the i is a natural number and emits light with a first color. The second sub-pixel is arranged in a column of the i and i+2 rows different to the first sub-pixels and emits light with a second color. The third sub-pixel is arranged in two columns of i+1 and i+3 rows in order to be adjacent to the first sub-pixel and second sub-pixel. The third sub-pixel is arranged with a height two times higher than the first sub-pixel.

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(19) 대한민국특허청(KR)
(12) 공개특허공보(A)

(11) 공개번호 10-2011-0129531
(43) 공개일자 2011년12월02일

(51) Int. Cl.
*H01L 51/52* (2006.01)
(21) 출원번호 10-2010-0048942
(22) 출원일자 2010년05월26일
심사청구일자 2010년05월26일

(71) 출원인
**삼성모바일디스플레이주식회사**
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**오준식**
경기도 용인시 기흥구 농서동 산24번지
**김재신**
경기도 용인시 기흥구 농서동 산24번지
(74) 대리인
**신영무**

전체 청구항 수 : 총 14 항

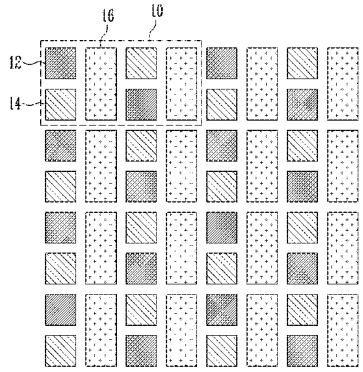
# (54) 유기전계발광 표시장치의 화소배열구조

*(57) 요 약*

본 발명은 고해상도를 표현하면서 개구율을 확보할 수 있도록 한 유기전계발광 표시장치의 화소배열구조에 관한 것이다.

본 발명의 복수의 부화소 그룹이 반복적으로 배열되는 유기전계발광 표시장치의 화소배열구조에 있어서 상기 부화소 그룹은 제 i(i는 자연수) 및 제 i+2열에 형성되며, 제 1색의 빛을 방출하는 두 개의 제 1부화소와; 상기 제 i 및 제 i+2열에서 상기 제 1부화소들과 서로 다른 행에 형성되며, 제 2색의 빛을 방출하는 두 개의 제 2부화소와; 제 i+1 및 제 i+3열에 형성되며, 상기 제 1부화소 및 제 2부화소와 인접되도록 두 개의 행에 형성되는 두 개의 제 3부화소를 구비한다.

*대 표 도* - 도1






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*특허청구의 범위*

**청구항 1**

복수의 부화소 그룹이 반복적으로 배열되는 유기전계발광 표시장치의 화소배열구조에 있어서;

상기 부화소 그룹은

제 i(i는 자연수) 및 제 i+2열에 형성되며, 제 1색의 빛을 방출하는 두 개의 제 1부화소와;

상기 제 i 및 제 i+2열에서 상기 제 1부화소들과 서로 다른 행에 형성되며, 제 2색의 빛을 방출하는 두 개의 제 2부화소와;

제 i+1 및 제 i+3열에 형성되며, 상기 제 1부화소 및 제 2부화소와 인접되도록 두 개의 행에 형성되는 두 개의 제 3부화소를 구비하는 것을 특징으로 하는 유기전계발광 표시장치의 화소배열구조.

**청구항 2**

제 1항에 있어서,

상기 제 3부화소는 상기 제 1부화소보다 2배 이상의 높이로 갖도록 형성되는 것을 특징으로 하는 유기전계발광 표시장치의 화소배열구조.

**청구항 3**

제 1항에 있어서,

상기 제 3부화소는 상기 제 1부화소보다 넓은 면적으로 형성되는 것을 특징으로 하는 유기전계발광 표시장치의 화소배열구조.

**청구항 4**

제 1항에 있어서,

상기 제 3부화소는 적색 부화소, 녹색 부화소 및 청색 부화소 중 가장 짧은 수명을 갖는 부화소로 설정되는 것을 특징으로 하는 유기전계발광 표시장치의 화소배열구조.

**청구항 5**

제 1항에 있어서,

상기 제 3부화소는 청색 부화소로 설정되고, 제 1부화소 및 제 2부화소는 각각 적색 부화소 및 녹색 부화소로 설정되는 것을 특징으로 하는 유기전계발광 표시장치의 화소배열구조.

**청구항 6**

제 1항에 있어서,

상기 제 1부화소 및 제 2부화소는 동일한 행라인에서 서로 교번적으로 배열되도록 형성되는 것을 특징으로 하는 유기전계발광 표시장치의 화소배열구조.

**청구항 7**

제 1항에 있어서,

상기 제 1부화소들 및 제 2부화소들 각각은 동일한 행라인에 형성되는 것을 특징으로 하는 유기전계발광 표시장치의 화소배열구조.

**청구항 8**

제 i(i는 1, 3, 5, 7, ...)열에 형성되며, 제 1색의 빛을 방출하는 제 1부화소와;



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상기 제 j열에서 상기 제 1부화소와 행마다 교번적으로 형성되며, 제 2색의 빛을 방출하는 제 2부화소와;

제 j열(j는 2, 6, 10, ...) 및 제 j+2열에서 네 개의 행라인에 형성되며, 제 3색의 빛을 방출하는 제 3부화소를 구비하는 것을 특징으로 하는 유기전계발광 표시장치의 화소배열구조.

**청구항 9**

제 8항에 있어서,

상기 제 j열에 형성된 제 3부화소와 상기 제 j+2열에 형성된 제 3부화소는 형성위치가 두 개의 행라인에서 중첩되는 것을 특징으로 하는 유기전계발광 표시장치의 화소배열구조.

**청구항 10**

제 8항에 있어서,

상기 제 3부화소는 상기 제 1부화소보다 넓은 면적으로 형성되는 것을 특징으로 하는 유기전계발광 표시장치의 화소배열구조.

**청구항 11**

제 8항에 있어서,

상기 제 3부화소는 적색 부화소, 녹색 부화소 및 청색 부화소 중 가장 짧은 수명을 갖는 부화소로 설정되는 것을 특징으로 하는 유기전계발광 표시장치의 화소배열구조.

**청구항 12**

제 8항에 있어서,

상기 제 3부화소는 청색 부화소로 설정되고, 제 1부화소 및 제 2부화소는 각각 적색 부화소 및 녹색 부화소로 설정되는 것을 특징으로 하는 유기전계발광 표시장치의 화소배열구조.

**청구항 13**

제 8항에 있어서,

상기 제 1부화소 및 제 2부화소는 동일한 행라인에서 서로 교번적으로 배열되도록 형성되는 것을 특징으로 하는 유기전계발광 표시장치의 화소배열구조.

**청구항 14**

제 8항에 있어서,

상기 제 1부화소들 및 제 2부화소들 각각은 동일한 행라인에 형성되는 것을 특징으로 하는 유기전계발광 표시장치의 화소배열구조.

## *명 세 서*

### *기 술 분 야*

[0001] 본 발명은 유기전계발광 표시장치의 화소배열구조에 관한 것으로, 특히 고해상도를 표현하면서 개구율을 확보할 수 있도록 한 유기전계발광 표시장치의 화소배열구조에 관한 것이다.

### *배 경 기 술*

[0002] 유기전계발광 표시장치는 자발광소자인 유기 발광 다이오드를 이용하여 영상을 표시하는 것으로, 휘도 및 색순도가 뛰어나 차세대 표시장치로 주목받고 있다.

[0003] 이와 같은 유기전계발광 표시장치는 적색 부화소들, 녹색 부화소들 및 청색 부화소들을 이용하여 다수의 화소들을 구성하며, 이를 통해 다양한 컬러영상을 표시한다.



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[0004] 적색 부화소들, 녹색 부화소들 및 청색 부화소들은 다양한 형태로 배열될 수 있는데, 일반적으로 스트라이프형으로 배열된다. 스트라이프형은 동일한 색의 부화소들을 열 단위로 배열하는 형태이다.

[0005] 하지만, 부화소들이 스트라이프형으로 배열되는 경우 각각의 부화소들 사이에 위치된 블랙 매트릭스에 의하여 개구율이 저하되고, 고해상도의 표현능력이 저하되는 문제점이 있다.

## 발명의 내용

### 해결하려는 과제

[0006] 따라서, 본 발명의 목적은 고해상도를 표현하면서 개구율을 확보할 수 있도록 한 유기전계발광 표시장치의 화소배열구조에 관한 것이다.

### 과제의 해결 수단

[0007] 본 발명의 실시예에 의한 복수의 부화소 그룹이 반복적으로 배열되는 유기전계발광 표시장치의 화소배열구조에 있어서 상기 부화소 그룹은 제 i(i는 자연수) 및 제 i+2열에 형성되며, 제 1색의 빛을 방출하는 두 개의 제 1부화소와; 상기 제 i 및 제 i+2열에서 상기 제 1부화소들과 서로 다른 행에 형성되며, 제 2색의 빛을 방출하는 두 개의 제 2부화소와; 제 i+1 및 제 i+3열에 형성되며, 상기 제 1부화소 및 제 2부화소와 인접되도록 두 개의 행에 형성되는 두 개의 제 3부화소를 구비한다.

[0008] 상기 상기 제 3부화소는 상기 제 1부화소보다 2배 이상의 높이로 갖도록 형성된다. 상기 제 3부화소는 상기 제 1부화소보다 넓은 면적으로 형성된다. 상기 제 3부화소는 적색 부화소, 녹색 부화소 및 청색 부화소 중 가장 짧은 수명을 갖는 부화소로 설정된다. 상기 제 3부화소는 청색 부화소로 설정되고, 제 1부화소 및 제 2부화소는 각각 적색 부화소 및 녹색 부화소로 설정된다. 상기 제 1부화소 및 제 2부화소는 동일한 행라인에서 서로 교번적으로 배열되도록 형성된다. 상기 제 1부화소들 및 제 2부화소들 각각은 동일한 행라인에 형성된다.

[0009] 본 발명의 다른 실시예에 의한 유기전계발광 표시장치의 화소배열구조는 제 i(i는 1, 3, 5, 7, ...)열에 형성되며, 제 1색의 빛을 방출하는 제 1부화소와; 상기 제 i열에서 상기 제 1부화소와 행마다 교번적으로 형성되며, 제 2색의 빛을 방출하는 제 2부화소와; 제 j열(j는 2, 6, 10, ...) 및 제 j+2열에서 네 개의 행라인에 형성되며, 제 3색의 빛을 방출하는 제 3부화소를 구비한다.

[0010] 바람직하게, 상기 제 j열에 형성된 제 3부화소와 상기 제 j+2열에 형성된 제 3부화소는 형성위치가 두 개의 행라인에서 중첩된다. 상기 제 3부화소는 상기 제 1부화소보다 넓은 면적으로 형성된다. 상기 제 3부화소는 적색 부화소, 녹색 부화소 및 청색 부화소 중 가장 짧은 수명을 갖는 부화소로 설정된다. 상기 제 3부화소는 청색 부화소로 설정되고, 제 1부화소 및 제 2부화소는 각각 적색 부화소 및 녹색 부화소로 설정된다. 상기 제 1부화소 및 제 2부화소는 동일한 행라인에서 서로 교번적으로 배열되도록 형성된다. 상기 제 1부화소들 및 제 2부화소들 각각은 동일한 행라인에 형성된다.

### 발명의 효과

[0011] 본 발명의 유기전계발광 표시장치의 화소배열구조는 동일열에 제 1부화소 및 제 2부화소에 형성되고, 제 1부화소 및 제 2부화소와 인접되도록 두개의 행에 제 3부화소를 형성함으로써 개구율을 향상시킬 수 있다. 또한, 본 원 발명과 같이 제 1부화소 내지 제 3부화소가 배열되는 경우 고해상도 표현능력이 향상되는 장점이 있다.

### 도면의 간단한 설명

[0012] 도 1은 본 발명의 제 1실시예에 의한 유기전계발광 표시장치의 화소배열구조를 나타내는 평면도이다.

도 2는 도 1에 도시된 부화소 그룹에 적용가능한 색상배열의 일례를 나타내는 평면도이다.

도 3은 본 발명의 제 2실시예에 의한 유기전계발광 표시장치의 화소배열구조를 나타내는 평면도이다.



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도 4는 도 3에 도시된 부화소 그룹에 적용가능한 색상배열의 일례를 나타내는 평면도이다.

도 5는 본 발명의 제 3실시예에 의한 유기전계발광 표시장치의 화소배열구조를 나타내는 평면도이다.

도 6은 도 5에 도시된 부화소 그룹에 적용가능한 색상배열의 일례를 나타내는 평면도이다.

도 7은 본 발명의 제 4실시예에 의한 유기전계발광 표시장치의 화소배열구조를 나타내는 평면도이다.

도 8은 도 7에 도시된 부화소 그룹에 적용가능한 색상배열의 일례를 나타내는 평면도이다.

도 9 및 도 10은 부화소들이 스트라이프 형태로 배열된 종래의 구조와 본원 발명의 화소배열구조 간의 개구율을 나타내는 그래프이다.

## *발명을 실시하기 위한 구체적인 내용*

[0013] 이하, 본 발명이 속하는 기술분야에서 통상의 지식을 가진 자가 본 발명을 용이하게 실시할 수 있는 바람직한 실시 예가 첨부된 도 1 내지 도 10을 참조하여 자세히 설명하면 다음과 같다.

[0014] 도 1은 본 발명의 제 1실시예에 의한 유기전계발광 표시장치의 화소배열구조를 나타내는 평면도이다.

[0015] 도 1을 참조하면, 본 발명의 제 1실시예에 의한 유기전계발광 표시장치의 화소배열구조는 부화소들(12, 14, 16)로 구성된 복수의 부화소그룹(10)이 반복적으로 배열되는 구조를 가진다.

[0016] 제 1부화소(12)는 제 1색의 빛을 방출하고, 제 2부화소(14)는 제 2색의 빛을 방출한다. 그리고 제 3부화소(16)는 제 3색의 빛을 방출한다. 이와 같은 제 1부화소(12), 제 2부화소(14) 및 제 3부화소(16)는 부화소그룹(10) 내에 두 개씩 구비되며, 일정한 패턴으로 반복적으로 배열된다.

[0017] 제 1부화소(12) 및 제 2부화소(14)는 동일한 열 라인에 교번적으로 배열되고, 제 3부화소(16)는 제 1부화소들(12) 및 제 2부화소들(14)이 배열된 열 라인과 인접한 열 라인에 배치된다.

[0018] 제 1부화소들(12) 및 제 2부화소들(14)은 제 3부화소들(16)이 배열된 열라인을 중심으로 제 1부화소들(12)끼리, 그리고 제 2부화소들(14)끼리 대각선 방향에 위치되어 체크무늬 형태로 배열된다. 즉, 제 1부화소들(12) 및 제 2부화소들(14)은 동일한 행에서 교번적으로 배치된다.

[0019] 제 3부화소들(16) 각각은 제 1부화소(12) 및 제 2부화소(14)와 인접되도록 두 개의 행라인에서 형성된다. 이 경우, 제 3부화소들(16)은 열방향을 따라 제 1부화소(12)(또는 제 2부화소(14))의 2배 이상의 높이를 갖는다.

[0020] 하나의 부화소그룹(10) 내에서 제 1부화소들(12), 제 2부화소들(14) 및 제 3부화소들(16)의 배치를 보다 상세히 설명하면, 부화소그룹(10)은 두개의 행과 네개의 열에 배치되는 두개의 제 1부화소들(12), 두개의 제 2부화소들(14) 및 두개의 제 3부화소들(16)로 구성된다.

[0021] 보다 구체적으로, 아웃하는 행에서 제 i(i는 자연수)열에는 하나의 제 1부화소(12)와 하나의 제 2부화소(14)가 순차적으로 배열되고, 제 i+1열에는 두 개의 행에 걸쳐서 제 3부화소(16)가 배열된다. 그리고, 제 i+2열에는 제 2부화소(14) 및 제 1부화소(12)가 순차적으로 배열되며, 제 i+3열에는 두 개의 행에 걸쳐서 제 3부화소(16)가 배열된다.

[0022] 이와 같은 화소배열구조를 채용하면 "서브픽셀 랜더링"(Subpixel rendering) 기법에 의하여 부화소들(12, 14, 16) 대비 고해상도를 표현할 수 있다. 또한, 상기와 같은 화소배열구조를 채용하면 종래의 스트라이트형에 비하여 블랙 매트릭스 면적이 줄어들고, 이에 따라 높은 개구율을 확보할 수 있는 장점이 있다.

[0023] 도 2는 도 1에 도시된 부화소 그룹에 적용가능한 색상배열의 일례를 나타내는 평면도이다.

[0024] 도 2를 참조하면, 제 1부화소(12)는 적색 부화소(R)로 설정되고, 제 2부화소(14)는 녹색 부화소(G)로 설정된다. 그리고, 제 1부화소(12) 및 제 2부화소(14)에 비하여 넓은 면적을 가지는 제 3부화소(16)는 청색 부화소(B)로 설정된다.

[0025] 일반적으로, 유기 발광 다이오드에서 청색 부화소(B)가 가장 짧은 수명특성을 갖는다. 따라서, 본원 발명에서



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는 가장 넓은 면적을 가지는 제 3부화소(16)를 청색 부화소(B)로 설정함으로써 수명 특성을 향상시킬 수 있다.

[0026] 도 3은 본 발명의 제 2실시예에 의한 유기전계발광 표시장치의 화소배열구조를 나타내는 평면도이다. 도 3을 설명할 때 도 1과의 차이점을 가지는 구성을 중점으로 설명하기로 한다.

[0027] 도 3을 참조하면, 본 발명의 제 2실시예에 의한 유기전계발광 표시장치의 화소배열구조는 부화소들(22, 24, 26)로 구성된 복수의 부화소그룹(20)이 반복적으로 배열되는 구조를 가진다.

[0028] 제 1부화소(22), 제 2부화소(24) 및 제 3부화소(26)는 부화소그룹(10) 내에 두 개씩 구비되며, 일정한 패턴으로 반복적으로 배열된다.

[0029] 제 1부화소(22) 및 제 2부화소(24)는 동일한 열 라인에 교번적으로 배열되고, 제 3부화소(26)는 제 1부화소들(22) 및 제 2부화소들(24)이 배열된 열 라인과 인접된 열 라인에 배치된다.

[0030] 제 1부화소들(22)은 제 3부화소(26)들을 사이에 두고 동일한 행라인에 반복적으로 형성되고, 제 2부화소들(24)은 제 1부화소들(22)과 인접된 행라인에 제 3부화소(26)들을 사이에 두고 반복적으로 형성된다.

[0031] 제 3부화소들(26) 각각은 두 개의 행라인에서 제 1부화소(22) 및 제 2부화소(24)와 인접되도록 형성된다. 이 경우, 제 3부화소들(26)은 열방향을 따라 제 1부화소(22)(또는 제 2부화소(24))의 2배 이상의 높이를 갖는다.

[0032] 하나의 부화소그룹(20) 내에서 제 1부화소들(22), 제 2부화소들(24) 및 제 3부화소들(26)의 배치를 보다 상세히 설명하면, 부화소그룹(20)은 두개의 행과 네개의 열에 배치되는 두개의 제 1부화소들(22), 두개의 제 2부화소들(24) 및 두개의 제 3부화소들(26)로 구성된다.

[0033] 보다 구체적으로, 이웃하는 행에서 제 i열에는 하나의 제 1부화소(22)와 하나의 제 2부화소(24)가 순차적으로 배열되고, 제 i+1열는 두 개의 행에 걸쳐서 제 3부화소(26)가 배열된다. 그리고, 제 i+2열에는 제 1부화소(22) 및 제 2부화소(24)가 순차적으로 배열되고, 제 i+3열에는 두 개의 행에 걸쳐서 제 3부화소(26)가 배열된다.

[0034] 도 4는 도 2에 도시된 부화소 그룹에 적용가능한 색상배열의 일례를 나타내는 평면도이다.

[0035] 도 4를 참조하면, 제 1부화소(22)는 적색 부화소(R)로 설정되고, 제 2부화소(24)는 녹색 부화소(G)로 설정된다. 그리고, 제 1부화소(22) 및 제 2부화소(24)에 비하여 넓은 면적을 가지는 제 3부화소(26)는 청색 부화소(B)로 설정된다.

[0036] 일반적으로, 유기 발광 다이오드에서 청색 부화소(B)가 가장 짧은 수명특성을 갖는다. 따라서, 본원 발명에서는 가장 넓은 면적을 가지는 제 3부화소(26)를 청색 부화소(B)로 설정함으로써 수명 특성을 향상시킨다.

[0037] 도 5는 본 발명의 제 3실시예에 의한 유기전계발광 표시장치의 화소배열구조를 나타내는 평면도이다.

[0038] 도 5를 참조하면, 본 발명의 제 3실시예에 의한 유기전계발광 표시장치의 화소배열구조는 부화소들(32, 34, 36)을 구비한다.

[0039] 제 1부화소(32)는 제 1색의 빛을 방출하고, 제 2부화소(34)는 제 2색의 빛을 방출한다. 그리고, 제 3부화소(36)는 제 3색의 빛을 방출한다. 이와 같은 제 1부화소(32), 제 2부화소(34) 및 제 3부화소(36)는 일정한 패턴으로 반복적으로 배열된다.

[0040] 제 1부화소(32) 및 제 2부화소(34)는 동일한 열 라인에 교번적으로 배열되고, 제 3부화소(36)는 제 1부화소들(32) 및 제 2부화소들(34)이 배열된 열 라인과 인접된 열 라인에 배치된다.

[0041] 제 1부화소들(32) 및 제 2부화소들(34)은 제 3부화소들(36)이 배열된 열라인을 중심으로 제 1부화소들(32)끼리, 그리고 제 2부화소들(34)끼리 대각선 방향에 위치되어 체크무늬 형태로 배열된다. 즉, 제 1부화소들(32) 및 제 2부화소들(34)은 동일한 행에서 교번적으로 배치된다.

[0042] 제 3부화소들(36) 각각은 네 개의 행라인에서 제 1부화소(32) 및 제 2부화소(34)와 인접되도록 형성된다. 이 경우, 제 3부화소들(36)은 열방향을 따라 제 1부화소(32)(또는 제 2부화소(34))의 4배 이상의 높이를 갖는다.



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또한, 제 j(j는 2, 6, 10,...)열에 위치된 제 3부화소들(36)은 제 j+2열에 위치된 제 3부화소들(36)과 두 개의 행라인을 공유하도록 형성된다. 다시 말하여, 제 j열에 형성된 제 3부화소(36)와 제 j+2열에 형성된 제 3부화소는 형성위치가 두 개의 행라인에서 중첩된다.

[0043] 보다 상세히 설명하면, 이웃하는 행에서 제 k(k는 1, 3, 5, 7, ...)열에는 하나의 제 1부화소(32)와 하나의 제 2부화소(34)가 순차적으로 배열되고, k열과 이웃하는 제 j열에는 네 개의 행에 걸쳐서 제 3부화소(36)가 배열된다. 그리고, k+2열에는 이웃하는 행에서 제 2부화소(34) 및 제 1부화소(32)가 순차적으로 배열되며, 제 j+2열에는 네 개의 행에 걸쳐서 제 3부화소(36)가 배열된다. 여기서, 제 j열 및 제 j+2열에 형성된 제 3부화소들(36)은 두 개의 행라인을 공유하도록 형성된다.

[0044] 한편, 본원 발명에서는 2개의 제 1부화소(32)(또는 제 2부화소(34))에 대응하여 하나의 제 3부화소(36)가 형성된다. 이 경우, 제 1부화소(32)로 두 번의 데이터신호가 공급되는 기간 동안 제 3부화소(36)로는 한 번의 데이터신호가 공급된다. 이와 같은 본원 발명에서는 현재 공지된 다양한 형태로 데이터신호를 공급할 수 있다.

[0045] 예를 들어, 제 3부화소(36)로 공급될 2개의 데이터의 계조값을 평균화하여 하나의 데이터신호를 생성하고, 생성된 데이터신호를 제 3부화소(36)로 공급할 수 있다. 실제로, 서로 인접된 데이터는 대부분 동일한 계조값으로 설정된다. 따라서, 2개의 데이터의 계조값을 평균화하여 데이터신호를 생성하여도 원하는 영상을 표시할 수 있다. 또한, "ClairVoyante Laboratories"사에서 제시한 "The Pentile Matrix color pixle arrangement"와 유사 또는 동일한 방법으로 데이터신호를 공급할 수도 있다.

[0046] 도 6은 도 5에 도시된 부화소들에 적용 가능한 색상배열의 일례를 나타내는 평면도이다.

[0047] 도 6을 참조하면, 제 1부화소(32)는 적색 부화소(R)로 설정되고, 제 2부화소(34)는 녹색 부화소(G)로 설정된다. 그리고, 제 1부화소(32) 및 제 2부화소(34)에 비하여 넓은 면적을 가지는 제 3부화소(36)는 청색 부화소(B)로 설정된다.

[0048] 일반적으로, 유기 발광 다이오드에서 청색 부화소(B)가 가장 짧은 수명특성을 갖는다. 따라서, 본원 발명에서는 가장 넓은 면적을 가지는 제 3부화소(36)를 청색 부화소(B)로 설정함으로써 수명 특성을 향상시킨다.

[0049] 도 7은 본 발명의 제 4실시예에 의한 유기전계발광 표시장치의 화소배열구조를 나타내는 평면도이다. 도 7을 설명할 때 도 5와 차이점을 가지는 구성을 중점으로 설명하기로 한다.

[0050] 도 7을 참조하면, 제 1부화소(42)는 제 1색의 빛을 방출하고, 제 2부화소(44)는 제 2색의 빛을 방출한다. 그리고, 제 3부화소(46)는 제 3색의 빛을 방출한다. 이와 같은 제 1부화소(42), 제 2부화소(44) 및 제 3부화소(46)는 일정한 패턴으로 반복적으로 배열된다.

[0051] 제 1부화소(42) 및 제 2부화소(44)는 동일한 열 라인에 교번적으로 배열되고, 제 3부화소(46)는 제 1부화소들(42) 및 제 2부화소들(44)이 배열된 열 라인과 인접된 열 라인에 배치된다.

[0052] 제 1부화소들(42)은 제 3부화소들(46)을 사이에 두고 동일한 행라인에 반복적으로 형성되고, 제 2부화소들(44)은 제 1부화소들(42)과 인접된 행라인에서 제 3부화소들(46)을 사이에 두고 반복적으로 형성된다.

[0053] 제 3부화소들(46) 각각은 네 개의 행라인에서 제 1부화소(42) 및 제 2부화소(44)와 인접되도록 형성된다. 이 경우, 제 3부화소들(46)은 열방향을 따라 제 1부화소(42)(또는 제 2부화소(44))의 4배 이상의 높이를 갖는다. 또한, 제 j열에 위치된 제 3부화소들(46)은 제 j+2열에 위치된 제 3부화소들(46)과 두 개의 행라인을 공유하도록 형성된다.

[0054] 도 8은 도 7에 도시된 부화소들에 적용 가능한 색상배열의 일례를 나타내는 평면도이다.

[0055] 도 8을 참조하면, 제 1부화소(42)는 적색 부화소(R)로 설정되고, 제 2부화소(44)는 녹색 부화소(G)로 설정된다. 그리고, 제 1부화소(42) 및 제 2부화소(44)에 비하여 넓은 면적을 가지는 제 3부화소(46)는 청색 부화소(B)로 설정된다.

[0056] 일반적으로, 유기 발광 다이오드에서 청색 부화소(B)가 가장 짧은 수명특성을 갖는다. 따라서, 본원 발명에서



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는 가장 넓은 면적을 가지는 제 3부화소(46)를 청색 부화소(B)로 설정함으로써 수명 특성을 향상시킨다.

[0057] 도 9 및 도 10은 부화소들이 스트라이프 형태로 배열된 종래의 구조와 본원 발명의 화소배열구조 간의 개구율을 나타내는 그래프이다. 도 9는 도 1에 도시된 본원 발명의 제 1실시예를 나타내고, 도 10은 도 5에 도시된 본원 발명의 제 3실시예를 나타낸다.

[0058] 도 9 및 도 10을 참조하면, 본원 발명의 제 1 및 제 3실시예의 화소배열구조로 부화소들이 배열되는 경우 종래의 스트라이프 형태로 배열되는 경우보다 높은 개구율을 확보할 수 있다. 특히, 해상도가 높을수록 더욱 더 높은 개구율을 확보할 수 있어 보다 향상된 화질을 구현할 수 있다.

[0059] 본 발명의 기술 사상은 상기 바람직한 실시예에 따라 구체적으로 기술되었으나, 상기한 실시예는 그 설명을 위한 것이며 그 제한을 위한 것이 아님을 주의하여야 한다. 또한, 본 발명의 기술 분야의 통상의 지식을 가진 자라면 본 발명의 기술 사상의 범위 내에서 다양한 변형예가 가능함을 이해할 수 있을 것이다.

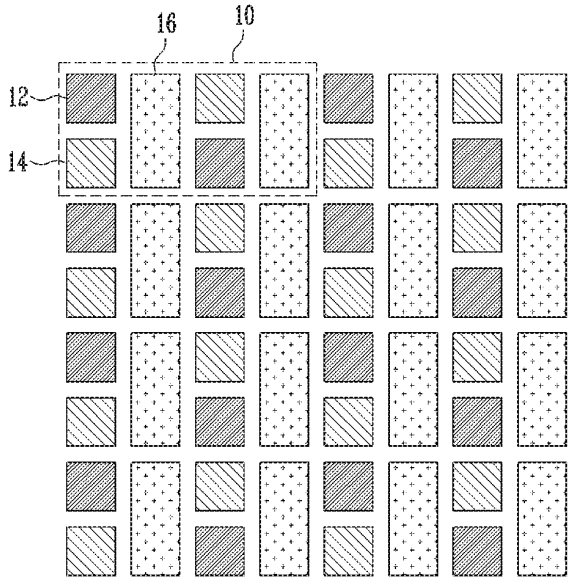
## 부호의 설명

[0060] 10,20 : 부화소그룹

12,14,16,22,24,26,32,34,36,42,44,46 : 부화소

## 도면

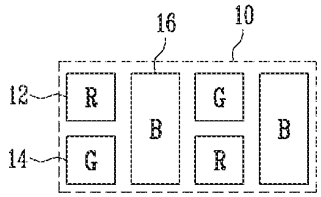
### 도면1



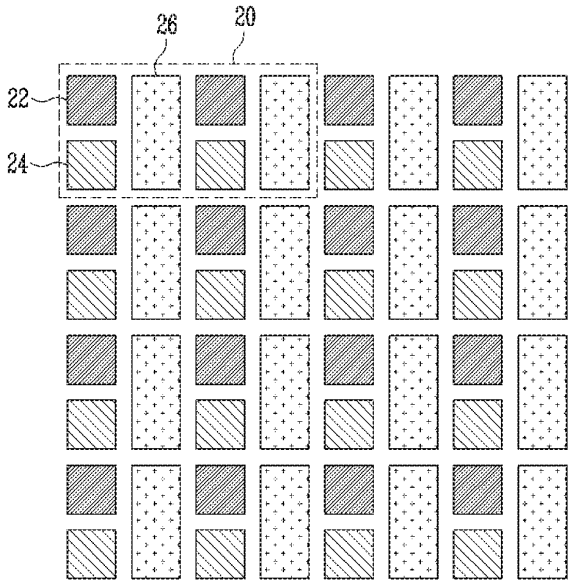



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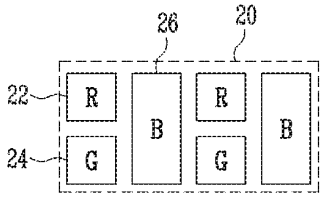
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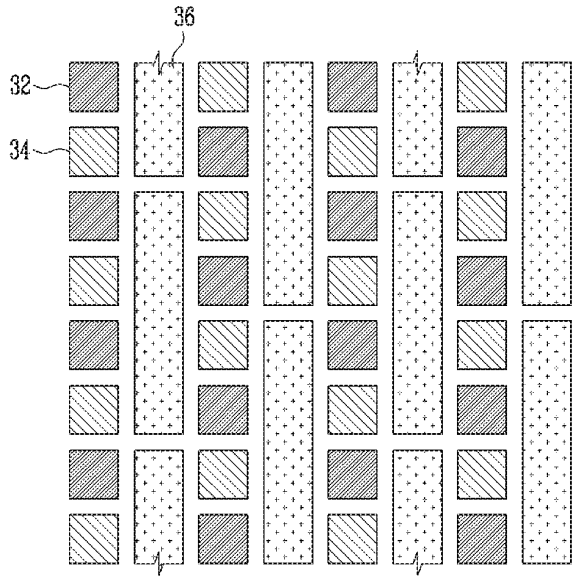

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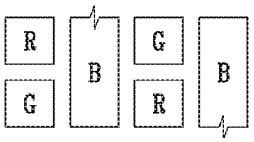



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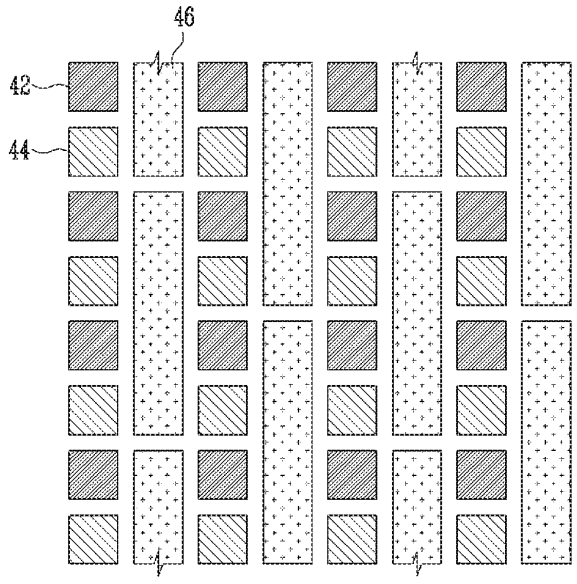
도면5




도면6



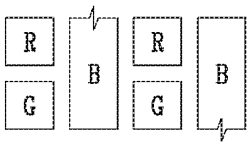

도면7



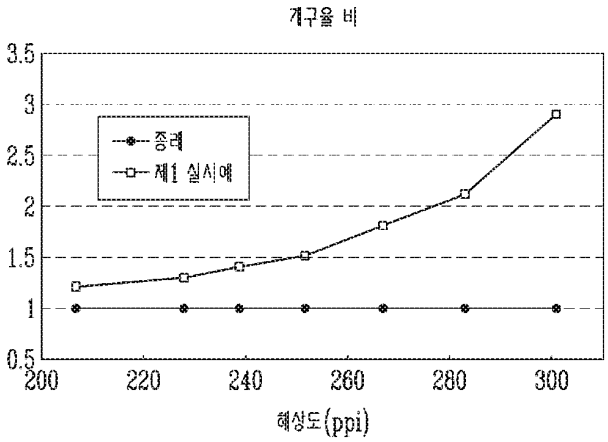



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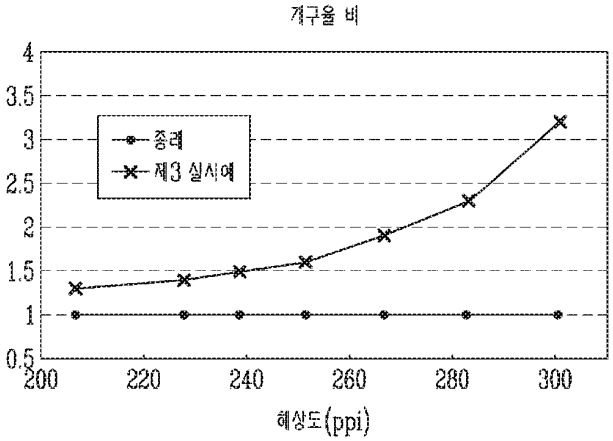
도면8




도면9




도면10






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# Electronic Acknowledgement Receipt

| | |
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| **EFS ID:** | 26420256 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Young E. Jeon/Diane Goss |
| **Filer Authorized By:** | Jun-Young E. Jeon |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 21-JUL-2016 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 16:30:45 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 69657ids.pdf | 114241<br>8628932ec68db71d578d5820f6e1268564b7a16a | yes | 3 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Transmittal Letter | 1 | 2 |
| | Information Disclosure Statement (IDS) Form (SB08) | 3 | 3 |

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|---|---|---|---|---|---|
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Foreign Reference | KR1020110129531.pdf | 1140434<br>0e4c84294fd2edc8578e4917aa3f5dfec39311c2 | no | 13 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | | KR_OfficAction-EnglishTrans.pdf | 1715875<br>f306ba81c0f7bcbb78d6a3c39793b54ed1e6cbf4 | yes | 11 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Non Patent Literature | 1 | 5 |
| | Other Reference-Patent/App/Search documents | 6 | 11 |

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|---|---|
| **Warnings:** | |
| **Information:** | |
| **Total Files Size (in bytes):** | 2970550 |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on July 21, 2016 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Diane L. Goss

| | | |
|---|---|---|
| Inventor(s) | : Sang-Shin Lee | Confirmation No. 4264 |
| Application No. | : 13/614,197 | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| Grp./Div. | : 2691 | |
| Examiner | : Kwang-Su Yang | |
| Docket No. | : 069657 | |

**INFORMATION DISCLOSURE STATEMENT AND CERTIFICATION UNDER § 1.97(e)(1)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
July 21, 2016

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is an information disclosure statement with a listing of references that are known to applicant. Copies of each of the listed Foreign Patent Documents and Other Documents references are enclosed.

It is respectfully requested that these references be considered in the examination of this application and identified on the list of references cited on the patent issuing on this application. Applicant also requests that an initialed copy of the information disclosure statement be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

Applicant's undersigned attorney hereby certifies, in accordance with 37 CFR § 1.97(e)(1), that each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement.

The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
LEWIS ROCA ROTHGERBER CHRISTIE LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/dg
Enclosures: Information Disclosure Statement w/references

DLG PAS1430827.1-*-07/21/16 9:25 AM

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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Debra Thomas

Debra Thomas

| | | |
|---|---|---|
| Appl No. | : 13/614,197 | Confirmation No. 4264 |
| Inventor | : Sang-Shin Lee | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| TC/A.U. | : 2691 | |
| Examiner | : Kwang-Su Yang | |
| Docket No. | : 069657 | |
| Customer No. | : 23363 | |

**AMENDMENT**

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
July 7, 2016

Commissioner:

In response to the non-final Office action of April 7, 2016 (hereinafter "the Office action"), please amend the above-identified application as follows:

**Amendments to the Claims** are reflected in the listing of claims, which begins on page 2 of this paper.

**Remarks/Arguments** begin on page 7 of this paper.



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**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. (Currently amended) A pixel arrangement structure of an organic light emitting diode (OLED) display, comprising:

a plurality of pixels for displaying an image on the OLED display and comprising:

a first pixel having a center coinciding with a center of a virtual square;

a second pixel separated from the first pixel and having a center at a first vertex of the virtual square;

another first pixel on a line defined by the center of the virtual square and the first vertex, the first pixel, the second pixel, and the other first pixel being consecutive pixels on the line from among the plurality of pixels; and

a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square,

wherein the second pixel has a larger area than that of the third pixel, and

wherein the first pixel is configured to emit green light.

2. (Currently amended) The pixel arrangement structure of claim 1,

wherein the plurality of pixels further ~~comprising~~ comprises another second pixel separated from the first pixel and having a center at a third vertex neighboring the second vertex of the virtual square, and

wherein the second pixels are separated from each other by the first pixel.



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3. (Currently amended) The pixel arrangement structure of claim 2, wherein the plurality of pixels further ~~comprising~~ comprises another third pixel separated from the first pixel and having a center at a fourth vertex neighboring the third vertex of the virtual square, and

wherein the third pixels are separated from each other by the first pixel.

4. (Original) The pixel arrangement structure of claim 3, wherein the second pixels and the third pixels enclose the first pixel in the virtual square.

5. (Previously presented) The pixel arrangement structure of claim 4, wherein

the first pixel, the second pixels, and the third pixels have polygonal shapes, and

each of the second pixels and each of the third pixels has a larger area than the first pixel.

6. (Withdrawn) The pixel arrangement structure of claim 5, wherein

the first pixel has a quadrilateral shape, and

the second pixels and the third pixels have hexagonal or octagonal shapes.

7. (Withdrawn) The pixel arrangement structure of claim 6, wherein the second pixels and the third pixels have octagonal shapes.

8. (Withdrawn) The pixel arrangement structure of claim 7, wherein a distance between the first pixel and each of the second pixels, a distance between the first pixel and each of the third pixels, and a distance between each of the second pixels and each of the third pixels are a same first length.

9. (Withdrawn) The pixel arrangement structure of claim 8, wherein

the first pixel comprises a plurality of first pixels,

the plurality of first pixels have a same quadrilateral shape, and

a distance between neighboring pixels of the plurality of first pixels is a second length that is longer than the first length.

10. (Withdrawn) The pixel arrangement structure of claim 6, wherein

each of the second pixels has a larger area than each of the third pixels,

a distance between each of the second pixels and each of the third pixels is a same first length, and

a distance between the first pixel and each of the second pixels, and a distance between the first pixel and each of the third pixels are a same second length.

11. (Withdrawn) The pixel arrangement structure of claim 10, wherein

the first pixel comprises a plurality of first pixels,

the plurality of first pixels have a same quadrilateral shape, and

a distance between neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

12. (Withdrawn) The pixel arrangement structure of claim 10, wherein

the first pixel comprises a plurality of first pixels,

neighboring pixels of the plurality of first pixels have quadrilateral shapes that are symmetrical to each other, and

a distance between the neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

13. (Withdrawn) The pixel arrangement structure of claim 6, wherein

the first pixel comprises a plurality of first pixels, and

neighboring pixels of the plurality of first pixels have quadrilateral shapes that are symmetrical to each other.

14. (Withdrawn) The pixel arrangement structure of claim 13, wherein each of the second pixels has a larger area than each of the third pixels.



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15. (Canceled)

16. (Previously presented) The pixel arrangement structure of claim 5, wherein

the first pixel has an octagonal shape, and

the second pixels and the third pixels have quadrilateral shapes.

17. (Previously presented) The pixel arrangement structure of claim 16, wherein

each of the second pixels has a larger area than each of the third pixels,

a shortest distance between each of the second pixels and each of the third pixels is a same first length, and

a shortest distance between the first pixel and each of the second pixels, and a shortest distance between the first pixel and each of the third pixels are a same second length.

18. (Previously presented) The pixel arrangement structure of claim 17, wherein

the first pixel comprises a plurality of first pixels, and

neighboring pixels of the plurality of first pixels have octagonal shapes that are symmetrical to each other.

19. (Original) The pixel arrangement structure of claim 1, wherein the first pixel, the second pixel, and the third pixel are configured to emit different color lights.

20. (Previously presented) The pixel arrangement structure of claim 19, wherein the second pixel and the third pixel are configured to emit blue light and red light, respectively.



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21. (Previously presented) The pixel arrangement structure of claim 18, wherein a shortest distance between the neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

22. (Previously presented) The pixel arrangement structure of claim 1, wherein the second pixel has a larger area than that of the first pixel.



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## REMARKS/ARGUMENTS

Claims 1–14 and 16–22 are pending in the present application, of which claim 1 is independent. Claims 6–14 were previously withdrawn. Claims 17–18 and 21 are allowable. Claims 1–3 are amended herein and find support in at least ¶ [0036] of the specification as filed. The Applicant respectfully requests continued allowability of claims 17–18 and 21, reconsideration and allowance of claims 1–5, 16, 19–20, and 22, and upon allowance of claim 1, rejoinder and allowance of withdrawn claims 6-14, which depend from claim 1.

---

**Rejection of claims 1–4, 19–20, and 22 under 35 U.S.C. § 103(a) over Satou/Song**
**Rejection of claim 5 and 16 under 35 U.S.C. § 103(a) over Satou/Song/Lin**

According to page 2 of the Office action, "Claims 1-4, 19-20 and 22 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Satou (U.S. Pub. No. US 2010/0171440 A1) in view of Song (U.S[.] Pub. No. US 2010/0133994 A1)." According to page 6 of the Office action, "Claims 5 and 16 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Satou, in view of Song as applied to claim 4 above, and further in view of Lin (U.S[.] Pub. No. US 2006/0152531 A1)." The Applicant amends claim 1 and respectfully argues as follows.

Independent claim 1 now recites:

> 1. A pixel arrangement structure of an organic light emitting diode (OLED) display, comprising:
> a plurality of pixels for displaying an image on the OLED display and comprising:
> a first pixel having a center coinciding with a center of a virtual square;
> a second pixel separated from the first pixel and having a center at a first vertex of the virtual square;
> another first pixel on a line defined by the center of the virtual square and the first vertex, the first pixel, the second pixel, and the other first pixel being consecutive pixels on the line from among the plurality of pixels; and
> a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square,
> wherein the second pixel has a larger area than that of the third pixel, and
> wherein the first pixel is configured to emit green light. (Emphasis added.)



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**BOE et al. v. Samsung, IPR2023-00988**

Satou in view of Song or in view of Song and Lin does not disclose or suggest at least the claim 1 limitation, "a plurality of pixels for displaying an image on the OLED display." By way of example, Satou is directed to an illuminating device having a plurality of solid light-emitting elements capable of providing 150 lux or more illumination at a distance of 30 cm from the light-emitting part. (Satou abstract). However, Satou appears to be silent about the illuminating device being capable of displaying images. For at least these reasons, Satou does not disclose the claim 1 limitation, "a plurality of pixels for displaying an image on the OLED display."

Further, the addition of Song or Lin cannot cure this deficiency of Satou to support a § 103(a) rejection of claim 1. Satou is directed to a high output illuminating device, not an OLED display. There would be no motivation for someone of ordinary skill in the art at the time of the present invention to modify the illuminating device of Satou to display images through pixels as that is such a completely different function than the illuminating device and corresponding objectives disclosed in Satou. For at least these reasons, Satou in view of Song or in view of Song and Lin does not disclose at least the claim 1 limitation, "a plurality of pixels for displaying an image on the OLED display."

Consequently, claim 1 is patentably distinguishable over Satou in view of Song and in view of Song and Lin. Furthermore, claims 2–5, 16, 19–20, and 22 depend from claim 1, such that they incorporate all of the terms and limitations of claim 1 in addition to other limitations, which together further patentably distinguish these claims over the art of record. Accordingly, the Applicant respectfully requests that the § 103(a) rejections of claims 2–5, 16, 19–20, and 22 be withdrawn and that these claims be allowed.

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**Concluding remarks**

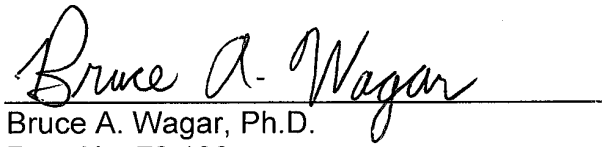
In view of the foregoing amendments and remarks, the Applicant earnestly solicits a timely issuance of a Notice of Allowance for claims 1–14 and 16–22. If there



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**BOE et al. v. Samsung, IPR2023-00988**

are any remaining issues that can be addressed over the telephone, the Examiner is cordially invited to call the Applicant's attorney at the number listed below.

Respectfully submitted,
LEWIS ROCA ROTHGERBER CHRISTIE LLP

By 
Bruce A. Wagar, Ph.D.
Reg. No. 72,186
626/795-9900

BAW/dst

DST PAS1418109.3-*-07/7/16 7:45 PM

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 26290280 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Bruce A. Wagar/Debra Thomas |
| **Filer Authorized By:** | Bruce A. Wagar |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 07-JUL-2016 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 23:23:49 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Transmittal Letter | 069657_Transmittal.pdf | 64095<br>8de6b2c66660067fe31cfd1623988ef9caa99c5e | no | 2 |
| **Warnings:** | | | | | |

| Information: | | | | | |
|---|---|---|---|---|---|
| 2 | | 069657_Amendment.pdf | 299497<br>7d8112fa89dcbace010542f7cb8a1b070dd11f24 | yes | 9 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Amendment/Req. Reconsideration-After Non-Final Reject | 1 | 1 |
| | Claims | 2 | 6 |
| | Applicant Arguments/Remarks Made in an Amendment | 7 | 9 |

| Warnings: | |
|---|---|
| **Information:** | |
| **Total Files Size (in bytes):** | 363592 |

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**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
# AMENDMENT TRANSMITTAL LETTER

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on July 7, 2016 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Debra Thomas

Inventor : Sang-Shin Lee — Confirmation No. 4264
Application No. : 13/614,197
Filed : September 13, 2012
Title : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

Grp./Div. : 2691
Examiner : Kwang-Su Yang

Docket No. : 069657

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
July 7, 2016

Commissioner:

Enclosed is an amendment to the above-identified application.

| CLAIMS AS AMENDED | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Claims Remaining After Amendment | Highest Number Previously Paid For | Number Extra Claims | Large Entity Rate | Small Entity Rate | Micro Entity Rate | FEE |
| Total Claims | 21 - | * 21 | = 0 | 0 x $80.00 | $40.00 | $20.00 | $0.00 |
| Independent Claims | 1 - | ** 3 | = 0 | 0 x $420.00 | $210.00 | $105.00 | $0.00 |
| Multiple Dependent Claims*** | | | | $780.00 | $390.00 | $195.00 | $0.00 |
| | | | | | | Total Additional Fee | $0.00 |
| List Independent Claims: 1 | | | | | | | |

* If the "Highest Number of Total Claims Previously Paid For" is less than 20, enter "20" in this space
** If the "Highest Number of Independent Claims Previously Paid For" is less than 3, enter "3" in this space
*** Pay this fee only when "Multiple Dependent Claims" are added for the first time

__X__ No additional fee is required.

_____ A Petition for Extension of Time and the required fee are enclosed.

_____ Other enclosures: _____

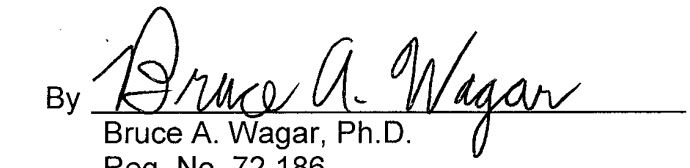


Petitioner Ex 1015, p. 282
BOE et al. v. Samsung, IPR2023-00988

The Commissioner is hereby authorized to charge any fees under 37 CFR 1.16 and 1.17 which may be required by or to give effect to this paper to Deposit Account No. 03-1728. Please show our docket number with any charge or credit to our Deposit Account.

Respectfully submitted,

LEWIS ROCA ROTHGERBER CHRISTIE LLP

By 

Bruce A. Wagar, Ph.D.
Reg. No. 72,186
626/795-9900

BAW/dst

DST PAS1428711.1-*-07/7/16 7:52 PM

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

23363 7590 04/07/2016
Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

| EXAMINER | |
|---|---|
| YANG, KWANG-SU | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2691 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 04/07/2016 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pair_cph@firsttofile.com
pto@lrrc.com



Petitioner Ex 1015, p. 284
BOE et al. v. Samsung, IPR2023-00988

| Office Action Summary | Application No. 13/614,197 | Applicant(s) LEE, SANG-SHIN | |
|---|---|---|---|
| | Examiner KWANG-SU YANG | Art Unit 2691 | AIA (First Inventor to File) Status No |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *02/18/2016*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims***

5)☒ Claim(s) *1-14 and 16-21* is/are pending in the application.

5a) Of the above claim(s) *6-14* is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-5,16,19,20 and 22* is/are rejected.

8)☒ Claim(s) *17,18 and 21* is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

**Application Papers**

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.



**Petitioner Ex 1015, p. 285**
**BOE et al. v. Samsung, IPR2023-00988**

## DETAILED ACTION

### *Notice of Pre-AIA or AIA Status*

1. The present application is being examined under the pre-AIA first to invent provisions.

### *Continued Examination Under 37 CFR 1.114*

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 02/18/2016 has been entered.

### *Claim Rejections - 35 USC § 103*

3. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-4, 19-20 and 22 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Satou (U.S. Pub. No. US 2010/0171440 A1) in view of Song (U.S Pub. No. US 2010/0133994 A1).

**As to claim 1,** Satou (Figs. 1-3 and 6) teaches **a pixel arrangement structure** (a honeycomb structure, which Is a repeating pattern; Fig. 6(a)) **of an organic light emitting diode display** (OLEDs; [0002], lines 5-6; an image display; [0253], lines 7-9)**, comprising:**

- **a first pixel** (G in a point (2, 2) where an origin (0, 0) is a top, left point, increasing in the right direction and downward in coordinate) **having a center coinciding with a center of a virtual square** (a virtual square consisting of points (1, 1), (3, 1), (1, 3) and (3, 3)) (Fig. 6(a))**;**
- **a second pixel** (B in the point (3, 3)) **separated from the first pixel** (G's in the point (2, 2)) **and having a center at a first vertex** (a point (3,3)) **of the virtual square** (the virtual square consisting of points (1, 1), (3, 1), (1, 3) and (3, 3)) (Fig. 6(a))**;**
- **another first pixel** (G in a point (4, 4) **on a line defined by the center of the virtual square** (the point (2,2)) **and the first vertex** (the point (3, 3)) (Fig. 6(a))**, the first pixel** (G in the point (2,2))**, the second pixel** (B in the point (3,3))**, and the other first pixel** (G in the point ((4,4)) **being consecutive pixels on the line** (Fig. 6(a))**; and**
- **a third pixel** (R in the point (3,1)) **separated from the first pixel** (G in a point (2, 2)) **and the second pixel** (B in the point (3, 3)) (Fig. 6(a))**, and having a center at a second vertex** (a point (3,1)) **neighboring the first vertex** (the point (3,3)) **of the virtual square** (the virtual square consisting of points (1, 1), (3, 1), (1, 3) and (3, 3) (Fig. 6(a))**,**
- **wherein the first pixel is configured to emit green light** (G in a point (2, 2)) (Fig. 6(a))**.**

Satou does not teach **wherein the second pixel has a larger area than that of the third pixel.**

Song (Figs. 1-3) teaches

- **wherein the second pixel has a larger area than that of the third pixel** (the area of the blue pixel B may be larger than each pixel of the red pixels R; [0035], lines 1-4)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used large area of blue pixel, comparing with each area of red pixels and green pixels, as taught by Song for a pixel arrangement of OLED of Satou because the larger area of blue pixel can control a balance of the luminances of the red pixel, green pixel and blue pixel even when the emitting efficiency and lifetime of the blue emission layer are deteriorated.

**As to claim 2,** Satou teaches **further comprising**

- **another second pixel** (B in the point (1, 1)) **separated from the first pixel** (B in the point (2,2)) **and having a center at a third vertex** (a point (1,1)) **neighboring the second vertex** (the point (3,1)) **of the virtual square** (the virtual square consisting of points (1, 1), (3, 1), (1, 3) and (3, 3) (Fig. 6(a))**,**
- **wherein the second pixels** (B's in the points (3,3) and (1,1)) **are separated from each other by the first pixel** (G in the point (2,2)) (Fig. 6(a))**.**

**As to claim 3,** Satou teaches **further comprising**

- **another third pixel** (R in the point (1,3)) **separated from the first pixel** (B in the point (2,2)) **and having a center at a fourth vertex** (a point (1,3)) **neighboring the third vertex** (the point (1,1)) **of the virtual square** (the virtual square consisting of points (1, 1), (3, 1), (1, 3) and (3, 3) (Fig. 6(a))**,**

- **wherein the third pixels** (R's in the points (3,1) and (1,3)) **are separated from each other by the first pixel** (G in the point (2,2)) (Fig. 6(a))**.**

**As to claim 4,** Satou teaches

- **wherein the second pixels** (B's in the points (3,3) and (1,1)) **and the third pixels** (R's in the points (3,1) and (1,3)) **enclose the first pixel** (B in the point (2,2)) **in the virtual square** (the virtual square consisting of points (1, 1), (3, 1), (1, 3) and (3, 3) (Fig. 6(a))**.**

**As to claim 19,** Satou teaches

- **wherein the first pixel, the second pixel, and the third pixel are configured to emit different color lights** (green, blue and red) (Fig. 6(a))**.**

**As to claim 20,** Satou teaches

- **wherein the second pixel and the third pixel are configured to emit blue light and red light, respectively** (B in the point (3, 3) and R in the point (3,1)) (Fig. 6(a))**.**

**As to claim 22,** Song teaches

- **wherein the second pixel has a larger area than that of the first pixel** (the area of the blue pixel B may be larger than each pixel of the green pixels G; [0035], lines 1-4)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used large area of blue pixel, comparing with each

area of red pixels and green pixels, as taught by Song for a pixel arrangement of OLED of Satou because the larger area of blue pixel can control a balance of the luminances of the red pixel, green pixel and blue pixel even when the emitting efficiency and lifetime of the blue emission layer are deteriorated.

5. Claims 5 and 16 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Satou, in view of Song as applied to claim 4 above, and further in view of Lin (U.S Pub. No. US 2006/0152531 A1).

**As to claim 5,** Satou and Song teach **the pixel arrangement structure of claim 4.**

Satou also teaches **wherein**

- **the first pixel, the second pixels, and the third pixels have polygonal shapes** (Fig. 6(a))**.**

Satou and Song do not expressly teach **wherein each of the second pixels and each of the third pixels has a larger area than the first pixel.**

Lin (Fig. 2) teaches **wherein**

- **each of the second pixels and each of the third pixels has a larger area than the first pixel** (the blue sub-pixel 23 and the red sub-pixel 21 have larger area than the green sub-pixel 22; Fig. 2)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used different sizes of sub-pixels as taught by Lin in a pixel arrangement of OLED of Satou as modified by Song because the different sizes of sub-pixels can adjust the brightness of the sub-pixels based on the luminance efficacy of the sub-pixels.

**As to claim 16,** Satou, Song and Lin teach **the pixel arrangement structure of claim 5.**

Satou also teaches **wherein**

- **the first pixel has an octagonal shape** (G in the point (2,2) has an octagonal shape; Fig. 6(a))**.**

Lin also teaches **wherein**

- **the second pixels and the third pixels have quadrilateral shapes** (the blue sub-pixel 23 and the red sub-pixel 21 have a rectangular shape; Fig. 2)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used rectangular shape of sub-pixels as taught by Lin in a pixel arrangement of OLED of Satou as modified by Song because the rectangular shaped sub-pixels are simple to design and manufacture.

### ***Allowable Subject Matter***

6. Claims 17-18 and 21 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

### ***Response to Arguments***

7. Applicants' arguments with respect to claims 1-5, 16, 19-20 and 22 have been considered but are moot in view of the new grounds of rejection.

In view of amendment, references of Satou, Song and Lin have been used for the new grounds of rejection.

Therefore, the Office maintains the rejections as recited above.

***Conclusion***

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Gollier (U.S. Pub. No. US 2013/0127689 A1) is cited to teach pixelated displays for sparkle reduction technology for use therein.
- Chen (U.S. Pub. No. US 2012/0287605 A1) is cited to teach techniques for controlling colors displayed by display devices, in which the green pixel has the size smaller than that of the red pixel and the blue pixel.

***Inquiry***

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kwang-Su Yang whose telephone number is 571-270-7307. The examiner can normally be reached on Mon-Fri during 9:00am-6:00pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chanh Nguyen can be reached on 571-272-7772. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For

more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/KWANG-SU YANG/
Primary Examiner, Art Unit 2691

| Notice of References Cited | Application/Control No. 13/614,197 | Applicant(s)/Patent Under Reexamination LEE, SANG-SHIN | |
|---|---|---|---|
| | Examiner KWANG-SU YANG | Art Unit 2691 | Page 1 of 1 |

**U.S. PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Name | CPC Classification | US Classification |
|---|---|---|---|---|---|---|
| * | A | US-2010/0133994 A1 | 06-2010 | SONG; Jung-Bae | H01L27/3211 | 313/504 |
| * | B | US-2006/0152531 A1 | 07-2006 | Lin; Lichi | G09G3/3225 | 345/613 |
| * | C | US-2013/0127689 A1 | 05-2013 | Gollier; Jacques | G02F1/133504 | 345/32 |
| * | D | US-2012/0287605 A1 | 11-2012 | Chen; Cheng | H01L27/322 | 362/97.1 |
| | E | US- | | | | |
| | F | US- | | | | |
| | G | US- | | | | |
| | H | US- | | | | |
| | I | US- | | | | |
| | J | US- | | | | |
| | K | US- | | | | |
| | L | US- | | | | |
| | M | US- | | | | |

**FOREIGN PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Country | Name | CPC Classification |
|---|---|---|---|---|---|---|
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**NON-PATENT DOCUMENTS**

| * | | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|---|---|
| | U | |
| | V | |
| | W | |
| | X | |

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 69657/S1437 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
| | | 2008/0001527 A1 | 01-03-2008 | Koo et al. |
| | | 2008/0273793 A1 | 11-06-2008 | Oishi |
| | | 2008/0308819 A1 | 12-18-2008 | Louwsma et al. |

**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
| | | JP 2004-507773 | 03-11-2004 | Brown Elliott | Corresponds to U.S. Publication 2002/0015110 previously filed in an IDS dated August 29, 2013 |
| | | WO 2004/073356 A1 | 08-26-2004 | Sakamoto | Corresponds to U.S. Publication 2005/0162079 previously filed in an IDS dated May 14, 2015 |

**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | JPO Office action dated February 16, 2016, for corresponding Japanese Patent application 2012-108855, (5 pages) |
| | | U.S. Office action dated February 29, 2016, for cross reference U.S. Patent application 13/872,018, (15 pages) |

DLG PAS1407349.1-*-03/7/16 9:11 AM

| EXAMINER SIGNATURE | /KWANG-SU YANG/ | DATE CONSIDERED | 04/01/2016 |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

JEJ/dg

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | Examiner | Art Unit |
| | KWANG-SU YANG | 2691 |

| CPC- SEARCHED | | |
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| Symbol | Date | Examiner |
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| CPC COMBINATION SETS - SEARCHED | | |
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| US CLASSIFICATION SEARCHED | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
| 345 | 82 419 | 10/24/2014 | KY |

| SEARCH NOTES | | |
|---|---|---|
| Search Notes | Date | Examiner |
| EAST: Inventor Search | 10/24/2014 | KY |
| EAST: Text Search | 10/24/2014; 10/27/2014 | KY |
| EAST: Updated Text Search | 02/27/2015 | KY |
| EAST: IDS Search | 03/07/2015 | KY |
| EAST: IDS Search | 07/09/2015 | KY |
| EAST: Updated Text Search | 07/09/2015 | KY |
| EAST: Updated Text Search | 11/25/2015; 11/27/2015 | KY |
| EAST: IDS Search | 04/02/2016 | KY |
| EAST: Updated Text Search | 04/02/2016 | KY |

| INTERFERENCE SEARCH | | | |
|---|---|---|---|
| US Class/ CPC Symbol | US Subclass / CPC Group | Date | Examiner |
| | | | |

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| | /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691 |

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | **Examiner** | **Art Unit** |
| | KWANG-SU YANG | 2691 |

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|---|---|---|---|---|---|---|---|
| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 10/27/2014 | 03/07/2015 | 07/09/2015 | 11/27/2015 | 04/02/2016 | | | | |
| | 1 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| | 2 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| | 3 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| | 4 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| | 5 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| | 6 | N | N | N | N | N | | | | |
| | 7 | N | N | N | N | N | | | | |
| | 8 | N | N | N | N | N | | | | |
| | 9 | N | N | N | N | N | | | | |
| | 10 | N | N | N | N | N | | | | |
| | 11 | N | N | N | N | N | | | | |
| | 12 | N | N | N | N | N | | | | |
| | 13 | N | N | N | N | N | | | | |
| | 14 | N | N | N | N | N | | | | |
| | 15 | N | - | - | - | - | | | | |
| | 16 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| | 17 | O | ✓ | O | O | O | | | | |
| | 18 | O | O | O | O | O | | | | |
| | 19 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| | 20 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| | 21 | | | | O | O | | | | |
| | 22 | | | | ✓ | ✓ | | | | |



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**EAST Search History**

**EAST Search History (Prior Art)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L1 | 7 | (OLED organic adj light) same blue adj (pixel sub$1pixel) adj3 (larg$2 great$2) adj red adj (pixel sub$1pixel) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/04/02 14:10 |
| L2 | 3 | ("20040036421" \| "20050242712" \| "7365488").PN. OR ("8253323").URPN. | US-PGPUB; USPAT; USOCR | OR | ON | 2016/04/02 14:14 |
| L3 | 21 | (OLED organic adj light) and blue adj (pixel sub$1pixel) adj3 (larg$2 great$2) adj red adj (pixel sub$1pixel) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/04/02 14:15 |
| L4 | 31 | ("5113274" \| "20050207676" \| "8130293" \| "7855740" \| "20110025723" \| "5311337" \| "7821553" \| "8289428" \| "20070034884" \| "20110043500" \| "7397455").PN. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/04/02 14:20 |
| L5 | 5 | (OLED organic adj light) and blue adj (pixel sub$1pixel) adj3 (larg$2 great$2) adj red adj (pixel sub$1pixel) same red adj (pixel sub$1pixel) with small$3 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/04/02 15:14 |
| L6 | 5 | (OLED organic adj light) and blue adj (pixel sub$1pixel) adj3 (larg$2 great$2) adj red adj (pixel sub$1pixel) same green adj (pixel sub$1pixel) with small$3 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/04/02 15:15 |
| L7 | 167 | (OLED organic adj light) and green adj (pixel sub$1pixel) with small$3 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/04/02 15:16 |
| L8 | 30 | (OLED organic adj light) and green adj (pixel sub$1pixel) with smallest | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/04/02 15:16 |
| L11 | 167 | (OLED organic adj light) and green adj (pixel sub$1pixel) with small$3 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/04/02 15:35 |
| L12 | 105 | (OLED organic adj light) and green adj (pixel sub$1pixel) with small$3 same red adj (pixel sub$1pixel) same blue adj (pixel sub$1pixel) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/04/02 15:36 |



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|---|---|---|---|---|---|---|
| L16 | 8 | ("20080001527" "20080273793" "20080308819").pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2016/04/02 17:05 |

**EAST Search History (Interference)**

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Petitioner Ex 1015, p. 299
BOE et al. v. Samsung, IPR2023-00988

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 69657/S1437 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
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**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
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**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | U.S. Office action dated October 16, 2015, for cross reference U.S. Patent application 13/872,018, (16 pages) |
| | | |
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| EXAMINER SIGNATURE | /KWANG-SU YANG/ | DATE CONSIDERED | 04/01/2016 |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

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Sheet 1 of 1

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KY/

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 69657/S1437 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
| | | 2008/0001527 A1 | 01-03-2008 | Koo et al. |
| | | 2008/0273793 A1 | 11-06-2008 | Oishi |
| | | 2008/0308819 A1 | 12-18-2008 | Louwsma et al. |

**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
| | | JP 2004-507773 | 03-11-2004 | Brown Elliott | Corresponds to U.S. Publication 2002/0015110 previously filed in an IDS dated August 29, 2013 |
| | | WO 2004/073356 A1 | 08-26-2004 | Sakamoto | Corresponds to U.S. Publication 2005/0162079 previously filed in an IDS dated May 14, 2015 |

**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | JPO Office action dated February 16, 2016, for corresponding Japanese Patent application 2012-108855, (5 pages) |
| | | U.S. Office action dated February 29, 2016, for cross reference U.S. Patent application 13/872,018, (15 pages) |

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# Bibliographic data: JP2004507773 (A) — 2004-03-11

**Arrangement of color pixels for full color imaging devices with simplified addressing**

**Inventor(s):**

**Applicant(s):**

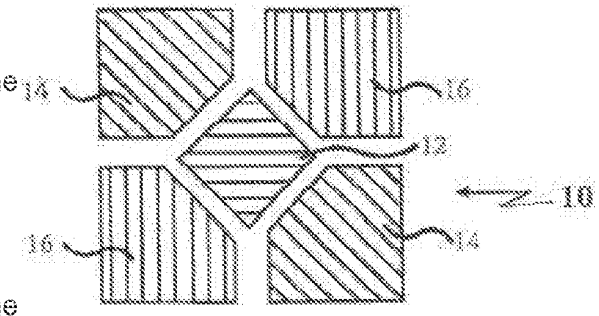
**Classification:** - **international:** ***G02F1/133; G02F1/1335; G02F1/1343; G09F9/30; G09G3/36;*** (IPC1-7): G02F1/133; G02F1/1335; G02F1/1343; G09F9/30
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**Abstract not available for JP2004507773 (A)**
**Abstract of corresponding document: US2002015110 (A1)**




An array and row and column line architecture for a display is disclosed. The array consists of a plurality of row and column positions and a plurality of three-color pixel elements. A three-color pixel element can comprise a blue emitter, a pair of red emitters, and a pair of green emitters. Several designs for the three-color pixel element are contemplated. The drive matrix consists of a plurality of row and column drivers to drive the individual emitters. The row drivers drive the red, green and blue emitters in each row. The red and green emitters in each column are driven by a single column driver. However, a single column driver can drive two column lines of blue emitters, a first column line and a second column line of the next nearest neighboring three-color pixel element. Methods of driving a three-color pixel element are also disclosed.



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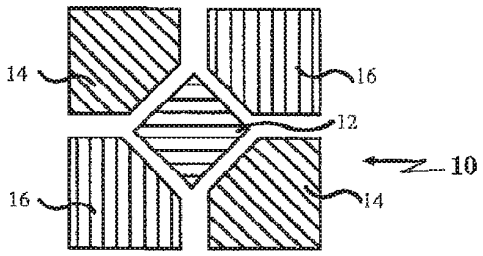
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(54)【発明の名称】簡易アドレッシング方式によるフルカラー画像装置用カラー・ピクセル配置

(57)【要約】
ディスプレイ用の行および列ライン構造のアレイが開示されている。アレイは複数の行および列位置と、複数の三色ピクセル要素を含む。三色ピクセル要素は１個の青エミッタ、１対の赤エミッタ、および１対の緑エミッタを含むことができる。三色ピクセル要素のデザインはいくつかのものが考えられる。駆動マトリックスは個々のエミッタを駆動するための複数の行および列ドライバを含む。行ドライバは各行の赤、緑、および青エミッタを駆動する。各列の赤および緑エミッタは単一の列ドライバによって駆動される。しかし、単一の列ドライバは２つの列ライン青エミッタ、すなわち、１つおきに隣接する三色ピクセル要素の第１列ラインおよび第２列ラインを駆動できる。三色ピクセル要素を駆動する方法についても開示されている。



【特許請求の範囲】
【請求項１】
ディスプレイ用アレイであって：
複数の行位置および複数の列位置；
複数の三色ピクセル要素であって、前記三色ピクセル要素の１つが前記行位置および前記列位置の各々に配置されており、前記三色ピクセル要素の各々が：
第１、第２、第３、および第４象限を有するＸ、Ｙ座標系の原点に配置された正方形の中心に配置された青エミッタであって、前記青エミッタが正方形をしている、青エミッタ；
前記青エミッタから間隔を置いて、前記第２および第４象限中に前記青エミッタ回りに対称に配置された一対の赤エミッタであって、ここで前記赤エミッタは前記青エミッタによって占有されない前記第２および第４象限の部分を占めており、ここで前記赤エミッタは前記青エミッタの側辺に平行な端部を形成するように切り詰めた、内側を向く隅を有する一般に正方形をしている、一対の赤エミッタ；
前記青エミッタから間隔を置いて、前記第１および第３象限中に前記青エミッタ回りに対称に配置された一対の緑エミッタであって、ここで前記緑エミッタは前記青エミッタによって占有されない前記第１および第３象限の部分を占めており、ここで前記緑エミッタは前記青エミッタの側辺に平行な端部を形成するように切り詰めた、内側を向く隅を有する一般に正方形をしている、一対の緑エミッタ；
前記アレイ中の前記行位置の各々に付随する一対の行ラインであって、前記行ラインの第１のものは前記三色ピクセル要素の各々の中の前記座標系の前記原点の上に配置された前記行位置にある前記赤エミッタおよび前記緑エミッタへつながれ、また前記行位置にある隣接する前記三色ピクセル要素の偶数番目ごとの対の前記青エミッタへつながれており、また前記行ラインの第２のものは前記三色ピクセル要素の各々の中の前記座標系の前記原点の下に配置された前記行位置にある前記赤エミッタおよび前記緑エミッタへつながれ、また前記行位置にある隣接する前記三色ピクセル要素の奇数番目ごとの対の前記青エミッタへつながれている、一対の行ライン；
前記アレイ中の前記列位置の各々に付随する３本の列ラインであって、前記列ラインの第１のものは前記三色ピクセル要素の各々の中の前記直交座標系の前記原点の左側に配置された前記列位置にある前記赤エミッタおよび前記緑エミッタへつながれており、前記列ラインの第２のものは前記三色ピクセル要素の各々の中の前記直交座標系の前記原点に配置された前記列位置にある前記青エミッタへつながれており、また前記列ラインの第３のものは前記三色ピクセル要素の各々の中の前記直交座標系の前記原点の右側に配置された前記列位置にある前記赤エミッタおよび前記緑エミッタへつながれており、ここで前記第２列ラインは二番目に近い隣接する前記三色ピクセル要素の前記第２列ラインへつながれている、３本の列ライン；
を含んでいる複数の三色ピクセル要素；
を含む用アレイ。
【請求項２】
請求項１に記載のアレイであって、前記三色ピクセル要素の各々が行方向において列方向よりも高い空間周波数を持つアレイ。
【請求項３】
請求項１に記載のアレイであって、前記三色ピクセル要素の各々が列方向において行方向よりも高い空間周波数を持つアレイ。
【請求項４】
請求項１に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記行ラインの各々が選択トランジスタのゲートへつながれているアレイ。
【請求項５】
請求項１に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記列ラインの各々が選択トランジスタのソース／ドレイン端子

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へつながれているアレイ。
【請求項６】
請求項１に記載のアレイであって、前記アレイがドット・インバージョンによって駆動されるアレイ。
【請求項７】
ディスプレイ用アレイであって：
複数の行位置および複数の列位置；
複数の三色ピクセル要素であって、前記要素の１つが前記行位置および前記列位置の各々に配置されており、前記三色ピクセル要素の各々が：
第１、第２、第３、および第４象限を有するＸ、Ｙ座標系の原点に配置された正方形の中心に配置された青エミッタであって、前記青エミッタが正方形をしている、青エミッタ；
前記青エミッタから間隔を置いて、前記第２および第４象限中に前記青エミッタ回りに対称に配置された一対の赤エミッタであって、ここで前記赤エミッタは前記青エミッタによって占有されない前記第２および第４象限の部分を占めており、ここで前記赤エミッタはＬ字形をしている、一対の赤エミッタ；
前記青エミッタから間隔を置いて、前記第１および第３象限中に前記青エミッタ回りに対称に配置された一対の緑エミッタであって、ここで前記緑エミッタは前記青エミッタによって占有されない前記第１および第３象限の部分を占めており、ここで前記緑エミッタはＬ字形をしている、一対の緑エミッタ；
前記アレイ中の前記行位置の各々に付随する一対の行ラインであって、前記行ラインの第１のものは前記三色ピクセル要素の各々の中の前記座標系の前記原点の上に配置された前記行位置にある前記赤エミッタおよび前記緑エミッタへつながれ、また前記行位置にある隣接する前記三色ピクセル要素の偶数番目ごとの対の前記青エミッタへつながれており、また前記行ラインの第２のものは前記三色ピクセル要素の各々の中の前記座標系の前記原点の下に配置された前記行位置にある前記赤エミッタおよび前記緑エミッタへつながれ、また前記行位置にある隣接する前記三色ピクセル要素の奇数番目ごとの対の前記青エミッタへつながれている、一対の行ライン；
前記アレイ中の前記列位置の各々に付随する３本の列ラインであって、前記列ラインの第１のものは前記三色ピクセル要素の各々の中の前記正方形の前記中心の左側に配置された前記列位置にある前記赤エミッタおよび前記緑エミッタへつながれており、前記列ラインの第２のものは前記三色ピクセル要素の各々の中の前記正方形の前記中心に配置された前記列位置にある前記青エミッタへつながれており、また前記列ラインの第３のものは前記三色ピクセル要素の各々の中の前記正方形の前記中心の右側に配置された前記列位置にある前記赤エミッタおよび前記緑エミッタへつながれており、ここで前記第２列ラインは二番目に近い隣接する前記三色ピクセル要素の前記第２列ラインへつながれている、３本の列ライン；
を含んでいる複数の三色ピクセル要素；
を含むアレイ。
【請求項８】
請求項７に記載のアレイであって、前記三色ピクセル要素の各々が行方向において列方向よりも高い空間周波数を持つアレイ。
【請求項９】
請求項７に記載のアレイであって、前記三色ピクセル要素の各々が列方向において行方向よりも高い空間周波数を持つアレイ。
【請求項１０】
請求項７に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記行ラインの各々が選択トランジスタのゲートへつながれているアレイ。
【請求項１１】
請求項７に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミ

ッタの各々へつながれた前記列ラインの各々が選択トランジスタのソース／ドレイン端子へつながれているアレイ。

【請求項１２】

請求項７に記載のアレイであって、前記アレイがドット・インバージョンによって駆動されるアレイ。

【請求項１３】

三色ピクセル要素のアレイであって：

第１、第２、第３、および第４三色ピクセル要素を含む１つの行であって、各三色ピクセル要素が、第１、第２、第３、および第４象限を有するＸ、Ｙ座標系の原点に配置された正方形の中心に配置された青エミッタ、ここで前記青エミッタは正方形をしている、前記青エミッタから間隔を置いて前記第２および第４象限中に前記青エミッタ回りに対称に配置された一対の赤エミッタ、ここで前記赤エミッタは前記青エミッタによって占有されない前記第２および第４象限の部分を占めており、ここで前記赤エミッタは前記青エミッタの側辺に平行な端部を形成するように切り詰めた、内側を向く隅を有する一般に正方形をしている、および前記青エミッタから間隔を置いて前記第１および第３象限中に前記青エミッタ回りに対称に配置された一対の緑エミッタ、ここで前記緑エミッタは前記青エミッタによって占有されない前記第１および第３象限の部分を占めており、ここで前記緑エミッタは前記青エミッタの側辺に平行な端部を形成するように切り詰めた、内側を向く隅を有する一般に正方形をしている、を含んでいる三色ピクセル要素の行；

前記三色ピクセル要素の各々へつながれた第１および第２行ラインドライバ；

前記第１行ラインドライバへつながれた第１行ラインであって、前記第１行ラインが前記第３および前記第４三色ピクセル要素の前記青エミッタへつながれ、また前記第１、第２、第３、および第４三色ピクセル要素の第１赤エミッタおよび第１緑エミッタへつながれている、第１行ライン；

前記第２行ラインドライバへつながれた第２行ラインであって、前記第２行ラインが前記第１および前記第２三色ピクセル要素の前記青エミッタへつながれ、また前記第１、第２、第３、および第４三色ピクセル要素の第２赤エミッタおよび前記１つの緑エミッタへつながれている、第２行ライン；

前記三色ピクセル要素の各々へつながれた第１ないし第１０列ラインドライバ；

前記第１列ラインドライバへつながれた第１列ラインであって、前記第１列ラインが前記第１三色ピクセル要素の前記第１赤エミッタおよび前記第２緑エミッタへつながれている、第１列ライン；

前記第２列ラインドライバへつながれた第２列ラインであって、前記第２列ラインが前記第１三色ピクセル要素の前記青エミッタへつながれ、また前記第３三色ピクセル要素の前記青エミッタへつながれた第８列ラインへつながれている、第２列ライン；

前記第３列ラインドライバへつながれた第３列ラインであって、前記第３列ラインが前記第１三色ピクセル要素の前記第２赤エミッタおよび前記第１緑エミッタへつながれている、第３列ライン；

前記第４列ラインドライバへつながれた第４列ラインであって、前記第４列ラインが前記第２三色ピクセル要素の前記第１赤エミッタおよび前記第２緑エミッタへつながれている、第４列ライン；

前記第５列ラインドライバへつながれた第５列ラインであって、前記第５列ラインが前記第２三色ピクセル要素の前記青エミッタへつながれ、また前記第４三色ピクセル要素の前記青エミッタへつながれた第１１列ラインへつながれている、第５列ライン；

前記第６列ラインドライバへつながれた第６列ラインであって、前記第６列ラインが前記第２三色ピクセル要素の前記第２赤エミッタおよび前記第１緑エミッタへつながれている、第６列ライン；

前記第７列ラインドライバへつながれた第７列ラインであって、前記第７列ラインが前記第３三色ピクセル要素の前記第１赤エミッタおよび前記第２緑エミッタへつながれている、第７列ライン；

前記第８列ラインドライバへつながれた第９列ラインであって、前記第９列ラインが前記第４三色ピクセル要素の前記第２赤エミッタおよび前記第１緑エミッタへつながれている、第９列ライン；
前記第９列ラインドライバへつながれた第１０列ラインであって、前記第１０列ラインが前記第４三色ピクセル要素の前記第１赤エミッタおよび前記第２緑エミッタへつながれている、第１０列ライン；および
前記第１０列ラインドライバへつながれた第１２列ラインであって、前記第１０列ラインが前記第４三色ピクセル要素の前記第２赤エミッタおよび前記第１緑エミッタへつながれている、第１２列ライン；
を含むアレイ。

【請求項１４】
請求項１３に記載のアレイであって、前記アレイがドット・インバージョンによって駆動されるアレイ。

【請求項１５】
請求項１３に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記行ラインの各々が選択トランジスタのゲートへつながれているアレイ。

【請求項１６】
請求項１３に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記列ラインの各々が選択トランジスタのソース／ドレイン端子へつながれているアレイ。

【請求項１７】
請求項１３に記載のアレイであって、更に、前記三色ピクセル要素の各々に別の青エミッタを含むアレイ。

【請求項１８】
三色ピクセル要素のアレイであって：
第１、第２、第３、および第４三色ピクセル要素を含む１つの行であって、各三色ピクセル要素が、第１、第２、第３、および第４象限を有するＸ、Ｙ座標系の原点に配置された正方形の中心に配置された青エミッタ、ここで前記青エミッタは正方形をしている、前記青エミッタから間隔を置いて前記第２および第４象限中に前記青エミッタ回りに対称に配置された一対の赤エミッタ、ここで前記赤エミッタは前記青エミッタによって占有されない前記第２および第４象限の部分を占めており、ここで前記赤エミッタはＬ字形をしている、および前記青エミッタから間隔を置いて前記第１および第３象限中に前記青エミッタ回りに対称に配置された一対の緑エミッタ、ここで前記緑エミッタは前記青エミッタによって占有されない前記第１および第３象限の部分を占めており、ここで前記緑エミッタはＬ字形をしている、を含んでいる三色ピクセル要素の行；
前記三色ピクセル要素の各々へつながれた第１および第２行ラインドライバ；
前記第１行ラインドライバへつながれた第１行ラインであって、前記第１行ラインが前記第３および前記第４三色ピクセル要素の前記青エミッタへつながれ、また前記第１、第２、第３、および第４三色ピクセル要素の第１赤エミッタおよび第１緑エミッタへつながれている、第１行ライン；
前記第２行ラインドライバへつながれた第２行ラインであって、前記第２行ラインが前記第１および前記第２三色ピクセル要素の前記青エミッタへつながれ、また前記第１、第２、第３、および第４三色ピクセル要素の第２赤エミッタおよび第２緑エミッタへつながれている、第２行ライン；
前記三色ピクセル要素の各々へつながれた第１ないし第１０列ラインドライバ；
前記第１列ラインドライバへつながれた第１列ラインであって、前記第１列ラインが前記第１三色ピクセル要素の前記第１赤エミッタおよび前記第２緑エミッタへつながれている、第１列ライン；
前記第２列ラインドライバへつながれた第２列ラインであって、前記第２列ラインが前記

第１三色ピクセル要素の前記青エミッタへつながれ、また前記第３三色ピクセル要素の前記青エミッタへつながれた第８列ラインへつながれている、第２列ライン；
前記第３列ラインドライバへつながれた第３列ラインであって、前記第３列ラインが前記第１三色ピクセル要素の前記第２赤エミッタおよび前記第１緑エミッタへつながれている、第３列ライン；
前記第４列ラインドライバへつながれた第４列ラインであって、前記第４列ラインが前記第２三色ピクセル要素の前記第１赤エミッタおよび前記第２緑エミッタへつながれている、第４列ライン；
前記第５列ラインドライバへつながれた第５列ラインであって、前記第５列ラインが前記第２三色ピクセル要素の前記青エミッタへつながれ、また前記第４三色ピクセル要素の前記青エミッタへつながれた第１１列ラインへつながれている、第５列ライン；
前記第６列ラインドライバへつながれた第６列ラインであって、前記第６列ラインが前記第２三色ピクセル要素の前記第２赤エミッタおよび前記第１緑エミッタへつながれている、第６列ライン；
前記第７列ラインドライバへつながれた第７列ラインであって、前記第７列ラインが前記第３三色ピクセル要素の前記第１赤エミッタおよび前記第２緑エミッタへつながれている、第７列ライン；
前記第８列ラインドライバへつながれた第９列ラインであって、前記第９列ラインが前記第３三色ピクセル要素の前記第２赤エミッタおよび前記第１緑エミッタへつながれている、第９列ライン；
前記第９列ラインドライバへつながれた第１０列ラインであって、前記第１０列ラインが前記第４三色ピクセル要素の前記第１赤エミッタおよび前記第２緑エミッタへつながれている、第１０列ライン；
前記第１０列ラインドライバへつながれた第１２列ラインであって、前記第１０列ラインが前記第４三色ピクセル要素の前記第２赤エミッタおよび前記第１緑エミッタへつながれている、第１２列ライン；
を含むアレイ。

【請求項１９】
請求項１８に記載のアレイであって、前記アレイがドット・インバージョンによって駆動されるアレイ。

【請求項２０】
請求項１８に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記行ラインの各々が選択トランジスタのゲートへつながれているアレイ。

【請求項２１】
請求項１８に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記列ラインの各々が選択トランジスタのソース／ドレイン端子へつながれているアレイ。

【請求項２２】
請求項１８に記載のアレイであって、更に、前記三色ピクセル要素の各々に別の青エミッタを含むアレイ。

【請求項２３】
ディスプレイ用三色ピクセル要素であって：
第１および第２ピクセル行であって、各ピクセル行が３つの単位面積多角形を含み、各々の前記単位面積多角形を１つのエミッタが占めている、第１および第２ピクセル行；
ここで、赤エミッタが前記第１ピクセル行中の左側単位面積多角形を占め、緑エミッタが前記第１ピクセル行中の右側単位面積多角形を占めており；
ここで、緑エミッタが前記第２ピクセル行中の左側単位面積多角形を占め、赤エミッタが前記第２ピクセル行中の右側単位面積多角形を占めており；更に
ここで、青エミッタが前記第１および第２の両ピクセル行中の中央単位面積多角形を占め

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ている；
を含む三色ピクセル要素。
【請求項２４】
請求項２３に記載の三色ピクセル要素であって、ここで前記緑エミッタが前記第１ピクセル行中の前記左側単位面積多角形を占め、また前記赤エミッタが前記第１ピクセル行中の前記右側単位面積多角形を占めており；またここで前記赤エミッタが前記第２ピクセル行中の前記左側単位面積多角形を占め、また前記緑エミッタが前記第２ピクセル行中の前記右側単位面積多角形を占めている、三色ピクセル要素。
【請求項２５】
請求項２３に記載の三色ピクセル要素であって、ここで前記単位面積多角形が正方形である三色ピクセル要素。
【請求項２６】
請求項２３に記載の三色ピクセル要素であって、ここで前記単位面積多角形が長方形である三色ピクセル要素。
【請求項２７】
請求項２３に記載の三色ピクセル要素であって、ここで前記第１および第２の両ピクセル行中の前記中央単位面積多角形を占める前記青エミッタが互いに配線でつながれている、三色ピクセル要素。
【請求項２８】
ディスプレイ用アレイであって：
複数のアレイ行位置および複数の列位置；
複数の三色ピクセル要素であって、前記三色ピクセル要素の１つが前記行位置および前記列位置の各々に配置されており、前記三色ピクセル要素の各々が：
第１および第２ピクセル行であって、各ピクセル行が３つの単位面積多角形を含み、ここで各々の前記単位面積多角形を１つのエミッタが占めており、ここで赤エミッタが前記第１ピクセル行中の左側単位面積多角形を占め、緑エミッタが前記第１ピクセル行中の右側単位面積多角形を占めており、ここで緑エミッタが前記第２ピクセル行中の左側単位面積多角形を占め、赤エミッタが前記第２ピクセル行中の右側単位面積多角形を占めており、またここで青エミッタが前記第１および前記第２の両ピクセル行中の中央単位面積多角形を占めている、第１および第２ピクセル行；
前記アレイ中の各前記行位置に付随する複数の行ラインであって、前記行ラインの第１のものは前記アレイ行位置にある前記三色ピクセル要素の各々の中の前記第１ピクセル行の前記青エミッタ、前記第１ピクセル行の前記赤エミッタ、および前記第１ピクセル行の前記緑エミッタへつながれており、ここで前記行ラインの前記第１のものは隣接する前記三色ピクセル要素の偶数番目ごとの対の前記第１ピクセル行中の前記青エミッタへつながれており、また前記行ラインの第２のものは前記アレイ行位置にある前記三色ピクセル要素の各々の中の前記第２ピクセル行の前記青エミッタ、前記第２ピクセル行の前記赤エミッタ、および前記第２ピクセル行の前記緑エミッタへつながれており、ここで前記行ラインの前記第２のものは隣接する前記三色ピクセル要素の奇数番目ごとの対の前記第２ピクセル行中の前記青エミッタへつながれている、複数の行ライン；および
前記各列位置に付随する複数の列ラインであって、前記列ラインの第１のものは前記三色ピクセル要素の各々の中の前記青エミッタの左側に配置された前記列位置にある前記赤エミッタおよび前記緑エミッタへつながれており、前記列ラインの第２のものは前記三色ピクセル要素の各々の中の正方形の前記中心に配置された前記列位置にある前記青エミッタへつながれており、また前記列ラインの第３のものは前記三色ピクセル要素の各々の中の前記青エミッタの右側に配置された前記列位置にある前記赤エミッタおよび前記緑エミッタへつながれており、ここで前記第２列ラインは二番目に近い隣接する前記三色ピクセル要素の前記第２列ラインへつながれている、複数の列ライン；
を含んでいる三色ピクセル要素；
を含むアレイ。

【請求項２９】
請求項２８に記載のアレイであって、前記三色ピクセル要素の各々が行方向において列方向よりも高い空間周波数を持つアレイ。
【請求項３０】
請求項２８に記載のアレイであって、前記三色ピクセル要素の各々が列方向において行方向よりも高い空間周波数を持つアレイ。
【請求項３１】
請求項２８に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記行ラインの各々が選択トランジスタのゲートへつながれているアレイ。
【請求項３２】
請求項２８に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記列ラインの各々が選択トランジスタのソース／ドレイン端子へつながれているアレイ。
【請求項３３】
請求項２８に記載のアレイであって、前記アレイがドット・インバージョンによって駆動されるアレイ。
【請求項３４】
請求項２８に記載のアレイであって、ここで前記緑エミッタが前記第１ピクセル行中の前記左側単位面積多角形を占め、また前記赤エミッタが前記第１ピクセル行中の前記右側単位面積多角形を占めており；またここで前記赤エミッタが前記第２ピクセル行中の前記左側単位面積多角形を占め、また前記緑エミッタが前記第２ピクセル行中の前記右側単位面積多角形を占めている、アレイ。
【請求項３５】
請求項２８に記載のアレイであって、ここで前記単位面積多角形が正方形であるアレイ。
【請求項３６】
請求項２８に記載のアレイであって、ここで前記単位面積多角形が長方形であるアレイ。
【請求項３７】
請求項２８に記載のアレイであって、ここで前記第１および前記第２の両ピクセル行中の前記中央単位面積多角形を占める前記青エミッタが互いに配線でつながれている、アレイ。
【請求項３８】
三色ピクセル要素のアレイであって：
第１、第２、第３、および第４三色ピクセル要素を含む１つのアレイ行であって、各三色ピクセル要素が第１および第２ピクセル行を含んでおり、各ピクセル行が３つの単位面積多角形を含んでおり、ここで前記単位面積多角形の各々を１つのエミッタが占有しており、ここで赤エミッタが前記第１ピクセル行中の左側単位面積多角形を占め、緑エミッタが前記第１ピクセル行中の右側単位面積多角形を占めており、ここで緑エミッタが前記第２ピクセル行中の左側単位面積多角形を占め、赤エミッタが前記第２ピクセル行中の右側単位面積多角形を占めており、またここで青エミッタが前記第１および前記第２の両ピクセル行中の中央単位面積多角形を占めている、アレイ行；
前記三色ピクセル要素の各々へつながれた第１および第２行ラインドライバ；
前記第１行ラインドライバへつながれた第１行ラインであって、前記第１行ラインが前記第３および前記第４三色ピクセル要素の前記第１ピクセル行中の前記青エミッタへつながれ、また前記第１、第２、第３、および第４三色ピクセル要素の前記第１ピクセル行中の前記赤エミッタおよび前記緑エミッタへつながれている、第１行ライン；
前記第２行ラインドライバへつながれた第２行ラインであって、前記第２行ラインが前記第１および前記第２三色ピクセル要素の前記第２ピクセル行中の前記青エミッタへつながれ、また前記第１、第２、第３、および第４三色ピクセル要素の前記第２ピクセル行中の前記赤エミッタおよび前記緑エミッタへつながれている、第２行ライン；

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前記三色ピクセル要素の各々へつながれた第１ないし第１０列ラインドライバ；
前記第１列ラインドライバへつながれた第１列ラインであって、前記第１列ラインが前記第１三色ピクセル要素の、前記第１ピクセル行中の前記赤エミッタおよび前記第２ピクセル行中の前記緑エミッタへつながれている、第１列ライン；
前記第２列ラインドライバへつながれた第２列ラインであって、前記第２列ラインが前記第１三色ピクセル要素の前記青エミッタへつながれ、また前記第３三色ピクセル要素の前記青エミッタへつながれた第８列ラインへつながれている、第２列ライン；
前記第３列ラインドライバへつながれた第３列ラインであって、前記第３列ラインが前記第１三色ピクセル要素の、前記第２ピクセル行中の前記赤エミッタおよび前記第１ピクセル行中の前記緑エミッタへつながれている、第３列ライン；
前記第４列ラインドライバへつながれた第４列ラインであって、前記第４列ラインが前記第２三色ピクセル要素の、前記第１ピクセル行中の前記赤エミッタおよび前記第２ピクセル行中の前記緑エミッタへつながれている、第４列ライン；
前記第５列ラインドライバへつながれた第５列ラインであって、前記第５列ラインが前記第２三色ピクセル要素の前記青エミッタへつながれ、また前記第４三色ピクセル要素の前記青エミッタへつながれた第１１列ラインへつながれている、第５列ライン；
前記第６列ラインドライバへつながれた第６列ラインであって、前記第６列ラインが前記第２三色ピクセル要素の、前記第２ピクセル行中の前記赤エミッタおよび前記第１ピクセル行中の前記緑エミッタへつながれている、第６列ライン；
前記第７列ラインドライバへつながれた第７列ラインであって、前記第７列ラインが前記第３三色ピクセル要素の、前記第１ピクセル行中の前記赤エミッタおよび前記第２ピクセル行中の前記緑エミッタへつながれている、第７列ライン；
前記第８列ラインドライバへつながれた第９列ラインであって、前記第９列ラインが前記第４三色ピクセル要素の、前記第２ピクセル行中の前記赤エミッタおよび前記第１ピクセル行中の前記緑エミッタへつながれている、第９列ライン；
前記第９列ラインドライバへつながれた第１０列ラインであって、前記第１０列ラインが前記第４三色ピクセル要素の、前記第１ピクセル行中の前記赤エミッタおよび前記第２ピクセル行中の前記緑エミッタへつながれている、第１０列ライン；および
前記第１０列ラインドライバへつながれた第１２列ラインであって、前記第１０列ラインが前記第４三色ピクセル要素の、前記第２ピクセル行中の前記赤エミッタおよび前記第１ピクセル行中の前記緑エミッタへつながれている、第１２列ライン；
を含むアレイ。

【請求項３９】
請求項３８に記載のアレイであって、前記アレイがドット・インバージョンによって駆動されるアレイ。

【請求項４０】
請求項３８に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記行ラインの各々が選択トランジスタのゲートへつながれているアレイ。

【請求項４１】
請求項３８に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記列ラインの各々が選択トランジスタのソース／ドレイン端子へつながれているアレイ。

【請求項４２】
請求項３８に記載のアレイであって、ここで前記緑エミッタが前記第１行中の前記左側単位面積多角形を占め、また前記赤エミッタが前記第１行中の前記右側単位面積多角形を占めており；またここで前記赤エミッタが前記第１行中の前記左側単位面積多角形を占め、また前記緑エミッタが前記第１行中の前記右側単位面積多角形を占めている、アレイ。

【請求項４３】
請求項３８に記載のアレイであって、ここで前記単位面積多角形が正方形であるアレイ。

【請求項４４】
請求項３８に記載のアレイであって、ここで前記単位面積多角形が長方形であるアレイ。
【請求項４５】
請求項３８に記載のアレイであって、ここで前記第１および前記第２の両行中の前記中央単位面積多角形を占める前記青エミッタが互いに配線でつながれている、アレイ。
【請求項４６】
ディスプレイ用アレイであって：
複数のアレイ行位置および複数の列位置；
複数の三色ピクセル要素であって、前記三色ピクセル要素の１つが前記行位置および前記列位置の各々に配置されており、前記三色ピクセル要素の各々が：
第１および第２ピクセル行であって、各ピクセル行が３つの単位面積多角形を含み、ここで各々の前記単位面積多角形を１つのエミッタが占めており、ここで赤エミッタが前記第１ピクセル行中の左側単位面積多角形を占め、緑エミッタが前記第１ピクセル行中の右側単位面積多角形を占めており；ここで緑エミッタが前記第２ピクセル行中の左側単位面積多角形を占め、赤エミッタが前記第２ピクセル行中の右側単位面積多角形を占めており；またここで単一の青エミッタが前記第１および前記第２ピクセル行中の両方の中央単位面積多角形を占めている、第１および第２ピクセル行；
前記アレイ中の前記行位置の各々に付随する複数の行ラインであって、前記行ラインの第１のものは前記アレイ行位置にある前記三色ピクセル要素の各々の中の前記第１ピクセル行の前記青エミッタ、前記赤エミッタ、および前記緑エミッタへつながれており、ここで前記行ラインの前記第１のものは隣接する前記三色ピクセル要素の偶数番目ごとの対の前記青エミッタへつながれており、また前記行ラインの第２のものは前記アレイ行位置にある前記三色ピクセル要素の各々の中の前記第２ピクセル行にある前記青エミッタ、前記赤エミッタ、および前記緑エミッタへつながれており、ここで前記行ラインの前記第２のものは隣接する前記三色ピクセル要素の奇数番目ごとの対の前記青エミッタへつながれている、複数の行ライン；および
前記アレイ中の前記列位置の各々に付随する複数の列ラインであって、前記列ラインの第１のものは前記三色ピクセル要素の各々の中の前記青エミッタの左側に配置された前記列位置にある前記赤エミッタおよび前記緑エミッタへつながれており、前記列ラインの第２のものは前記三色ピクセル要素の各々の中の前記列位置にある前記青エミッタへつながれており、また前記列ラインの第３のものは前記三色ピクセル要素の各々の中の前記青エミッタの右側に配置された前記列位置にある前記赤エミッタおよび前記緑エミッタへつながれており、ここで前記第２列ラインは二番目に近い隣接する前記三色ピクセル要素の前記第２列ラインへつながれている、複数の列ライン；
を含んでいる三色ピクセル要素；
を含むアレイ。
【請求項４７】
請求項４６に記載のアレイであって、前記三色ピクセル要素の各々が行方向において列方向よりも高い空間周波数を持つアレイ。
【請求項４８】
請求項４６に記載のアレイであって、前記三色ピクセル要素の各々が列方向において行方向よりも高い空間周波数を持つアレイ。
【請求項４９】
請求項４６に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記行ラインの各々が選択トランジスタのゲートへつながれているアレイ。
【請求項５０】
請求項４６に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記列ラインの各々が選択トランジスタのソース／ドレイン端子へつながれているアレイ。

Petitioner Ex 1015, p. 312
BOE et al. v. Samsung, IPR2023-00988

【請求項５１】
請求項４６に記載のアレイであって、前記アレイがドット・インバージョンによって駆動されるアレイ。
【請求項５２】
請求項４６に記載のアレイであって、ここで前記緑エミッタが前記第１ピクセル行中の前記左側単位面積多角形を占め、また前記赤エミッタが前記第１ピクセル行中の前記右側単位面積多角形を占めており；またここで前記赤エミッタが前記第２ピクセル行中の前記左側単位面積多角形を占め、また前記緑エミッタが前記第２ピクセル行中の前記右側単位面積多角形を占めている、アレイ。
【請求項５３】
請求項４６に記載のアレイであって、ここで前記単位面積多角形が正方形であるアレイ。
【請求項５４】
請求項４６に記載のアレイであって、ここで前記単位面積多角形が長方形であるアレイ。
【請求項５５】
三色ピクセル要素のアレイであって：
第１、第２、第３、および第４三色ピクセル要素を含む１つのアレイ行であって、各三色ピクセル要素が第１および第２ピクセル行を含み、各ピクセル行が３つの単位面積多角形を含んでおり、ここで前記単位面積多角形の各々を１つのエミッタが占有しており、ここで赤エミッタが前記第１ピクセル行中の左側単位面積多角形を占め、緑エミッタが前記第１ピクセル行中の右側単位面積多角形を占めており、ここで緑エミッタが前記第２ピクセル行中の左側単位面積多角形を占め、赤エミッタが前記第２ピクセル行中の右側単位面積多角形を占めており、またここで単一の青エミッタが前記第１および前記第２の両ピクセル行中の中央単位面積多角形を占めている、アレイ行；
前記三色ピクセル要素の各々へつながれた第１および第２行ラインドライバ；
前記第１行ラインドライバへつながれた第１行ラインであって、前記第１行ラインが前記第３および前記第４三色ピクセル要素の前記青エミッタへつながれ、また前記第１、第２、第３、および第４三色ピクセル要素の前記第１ピクセル行中の前記赤エミッタおよび前記緑エミッタへつながれている、第１行ライン；
前記第２行ラインドライバへつながれた第２行ラインであって、前記第２行ラインが前記第１および前記第２三色ピクセル要素の前記青エミッタへつながれ、また前記第１、第２、第３、および第４三色ピクセル要素の前記第２ピクセル行中の前記赤エミッタおよび前記緑エミッタへつながれている、第２行ライン；
前記三色ピクセル要素の各々へつながれた第１ないし第１０列ラインドライバ；
前記第１列ラインドライバへつながれた第１列ラインであって、前記第１列ラインが前記第１三色ピクセル要素の、前記第１ピクセル行中の前記赤エミッタおよび前記第２ピクセル行中の前記緑エミッタへつながれている、第１列ライン；
前記第２列ラインドライバへつながれた第２列ラインであって、前記第２列ラインが前記第１三色ピクセル要素の前記青エミッタへつながれ、また前記第３三色ピクセル要素の前記青エミッタへつながれた第８列ラインへつながれている、第２列ライン；
前記第３列ラインドライバへつながれた第３列ラインであって、前記第３列ラインが前記第１三色ピクセル要素の、前記第２ピクセル行中の前記赤エミッタおよび前記第１ピクセル行中の前記緑エミッタへつながれている、第３列ライン；
前記第４列ラインドライバへつながれた第４列ラインであって、前記第４列ラインが前記第２三色ピクセル要素の、前記第１ピクセル行中の前記赤エミッタおよび前記第２ピクセル行中の前記緑エミッタへつながれている、第４列ライン；
前記第５列ラインドライバへつながれた第５列ラインであって、前記第５列ラインが前記第２三色ピクセル要素の前記青エミッタへつながれ、また前記第４三色ピクセル要素の前記青エミッタへつながれた第１１列ラインへつながれている、第５列ライン；
前記第６列ラインドライバへつながれた第６列ラインであって、前記第６列ラインが前記第２三色ピクセル要素の、前記第２ピクセル行中の前記赤エミッタおよび前記第１ピクセ

ル行中の前記緑エミッタへつながれている、第６列ライン；
前記第７列ラインドライバへつながれた第７列ラインであって、前記第７列ラインが前記第３三色ピクセル要素の、前記第１ピクセル行中の前記赤エミッタおよび前記第２ピクセル行中の前記緑エミッタへつながれている、第７列ライン；
前記第８列ラインドライバへつながれた第９列ラインであって、前記第９列ラインが前記第４三色ピクセル要素の、前記第２ピクセル行中の前記赤エミッタおよび前記第１ピクセル行中の前記緑エミッタへつながれている、第９列ライン；
前記第９列ラインドライバへつながれた第１０列ラインであって、前記第１０列ラインが前記第４三色ピクセル要素の、前記第１ピクセル行中の前記赤エミッタおよび前記第２ピクセル行中の前記緑エミッタへつながれている、第１０列ライン；
前記第１０列ラインドライバへつながれた第１２列ラインであって、前記第１０列ラインが前記第４三色ピクセル要素の、前記第２ピクセル行中の前記赤エミッタおよび前記第１ピクセル行中の前記緑エミッタへつながれている、第１２列ライン；
を含むアレイ。
【請求項５６】
請求項５５に記載のアレイであって、前記アレイがドット・インバージョンによって駆動されるアレイ。
【請求項５７】
請求項５５に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記行ラインの各々が選択トランジスタのゲートへつながれているアレイ。
【請求項５８】
請求項５５に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記列ラインの各々が選択トランジスタのソース／ドレイン端子へつながれているアレイ。
【請求項５９】
請求項５５に記載のアレイであって、ここで前記緑エミッタが前記第１ピクセル行中の前記左側単位面積多角形を占め、また前記赤エミッタが前記第１ピクセル行中の前記右側単位面積多角形を占めており；またここで前記赤エミッタが前記第２ピクセル行中の前記左側単位面積多角形を占め、また前記緑エミッタが前記第２ピクセル行中の前記右側単位面積多角形を占めている、アレイ。
【請求項６０】
請求項５５に記載のアレイであって、ここで前記単位面積多角形が正方形であるアレイ。
【請求項６１】
請求項５５に記載のアレイであって、ここで前記単位面積多角形が長方形であるアレイ。
【請求項６２】
ディスプレイ用アレイであって：
複数のアレイ行位置および複数の列位置；
複数の三色ピクセル要素であって、前記三色ピクセル要素の１つが前記アレイ行位置および前記列位置の各々に配置されており、前記三色ピクセル要素の各々が：
第１および第２ピクセル行であって、各行が３つの単位面積多角形を含み、ここで各々の前記単位面積多角形を１つのエミッタが占めており、ここで赤エミッタが前記第１ピクセル行中の左側単位面積多角形を占め、緑エミッタが前記第１ピクセル行中の右側単位面積多角形を占めており；ここで緑エミッタが前記第１ピクセル行中の左側単位面積多角形を占め、赤エミッタが前記第１ピクセル行中の右側単位面積多角形を占めており；またここで単一の青エミッタが前記第１および前記第２の両ピクセル行中の中央単位面積多角形を占めている、第１および第２ピクセル行；
ここで、前記三色ピクセル要素の横方向の対は互いに１ピクセル行だけ縦方向にオフセットされており；
前記アレイ行位置の各々に付随する複数の行ライン；

ここで、前記行ラインの第１のものは、前記アレイ行位置の各々にある前記三色ピクセル要素の各奇数対の前記第１ピクセル行中の前記赤エミッタおよび前記緑エミッタすべてにつながれ、また前記アレイ行位置の各々にある前記三色ピクセル要素の各偶数対の前記第２ピクセル行中の前記赤エミッタおよび前記緑エミッタすべてにつながれており、ここで前記行ラインの前記第１のものは隣接する前記三色ピクセル要素の奇数番目ごとの対の前記青エミッタへつながれており；
ここで、前記行ラインの第２のものは、前記アレイ行位置の各々にある前記三色ピクセル要素の各奇数対の前記第２ピクセル行中の前記赤エミッタおよび前記緑エミッタすべてにつながれ、また前記アレイ行位置の各々にある前記三色ピクセル要素の各偶数対の前記第１ピクセル行中の前記赤エミッタおよび前記緑エミッタすべてにつながれており、ここで前記行ラインの前記第１のものは隣接する前記三色ピクセル要素の偶数番目ごとの対の前記青エミッタへつながれており；および
前記アレイ中の前記列位置の各々に付随する複数の列ライン；
ここで、前記列ラインの第１、第４、第７、および第１０のものは、各前記三色ピクセル要素中の前記青エミッタの左側に配置された前記列位置にある前記赤エミッタおよび青エミッタへつながれており；
ここで、前記列ラインの第２、第５、第８、および第１１のものは、各前記三色ピクセル要素中の前記列位置にある前記青エミッタへつながれており、ここで前記列ラインの第２のものは前記列ラインの前記第８のものへつながれており、またここで前記列ラインの第５のものは前記列ラインの前記第１１のものへつながれており；また
ここで、前記列ラインの第３、第６、第９、および第１２のものは、各前記三色ピクセル要素中の前記青エミッタの右側に配置された前記列位置にある前記赤エミッタおよび青エミッタへつながれている；
を含んでいる三色ピクセル要素；
を含むアレイ。

【請求項６３】
請求項６２に記載のアレイであって、前記三色ピクセル要素の各々が行方向において列方向よりも高い空間周波数を持つアレイ。

【請求項６４】
請求項６２に記載のアレイであって、前記三色ピクセル要素の各々が列方向において行方向よりも高い空間周波数を持つアレイ。

【請求項６５】
請求項６２に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記行ラインの各々が選択トランジスタのゲートへつながれているアレイ。

【請求項６６】
請求項６２に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記列ラインの各々が選択トランジスタのソース／ドレイン端子へつながれているアレイ。

【請求項６７】
請求６２に記載のアレイであって、前記アレイがドット・インバージョンによって駆動されるアレイ。

【請求項６８】
請求項６２に記載のアレイであって、ここで前記緑エミッタが前記第１ピクセル行中の前記左側単位面積多角形を占め、また前記赤エミッタが前記第１ピクセル行中の前記右側単位面積多角形を占めており；またここで前記赤エミッタが前記第２ピクセル行中の前記左側単位面積多角形を占め、また前記緑エミッタが前記第２ピクセル行中の前記右側単位面積多角形を占めている、アレイ。

【請求項６９】
請求項６２に記載のアレイであって、ここで前記単位面積多角形が正方形であるアレイ。

Petitioner Ex 1015, p. 315
BOE et al. v. Samsung, IPR2023-00988

【請求項７０】
請求項６２に記載のアレイであって、ここで前記単位面積多角形が長方形であるアレイ。
【請求項７１】
三色ピクセル要素のアレイであって：
三色ピクセル要素を含む複数のアレイ行および複数のアレイ列であって、前記三色ピクセル要素の各々が第１および第２ピクセル行を含んでおり、各ピクセル行が３つの単位面積多角形を含んでおり、ここで前記単位面積多角形の各々を１つのエミッタが占めており、ここで赤エミッタが前記第１ピクセル行中の左側単位面積多角形を占め、緑エミッタが前記第１ピクセル行中の左側単位面積多角形を占めており；ここで緑エミッタが前記第２ピクセル行中の左側単位面積多角形を占め、赤エミッタが前記第２ピクセル行中の右側単位面積多角形を占めており；またここで単一の青エミッタが前記第１および第２の両ピクセル行中の中央単位面積多角形を占めている、アレイ行およびアレイ列；
ここで、三色ピクセル要素の隣接する横方向の対が互いに１ピクセル行だけ縦方向にオフセットされており；
前記三色ピクセル要素の各々へつながれた第１および第２行ラインドライバ；
前記第１行ラインドライバへつながれた第１行ラインであって、ここで前記第１行ラインは前記アレイ行位置の各々にある前記三色ピクセル要素の各奇数対の前記第１ピクセル行中の前記赤エミッタおよび前記緑エミッタすべてにつながれ、また前記アレイ行位置の各々にある前記三色ピクセル要素の各偶数対の前記第２ピクセル行中の前記赤エミッタおよび前記緑エミッタすべてにつながれており、ここで前記行ラインの前記第１のものは隣接する前記三色ピクセル要素の奇数番目ごとの対の前記青エミッタへつながれている、第１行ライン；
前記第２行ラインドライバへつながれた第２行ラインであって、ここで前記第２行ラインは前記アレイ行位置の各々にある前記三色ピクセル要素の各奇数対の前記第２ピクセル行中の前記赤エミッタおよび前記緑エミッタすべてにつながれ、また前記アレイ行位置の各々にある前記三色ピクセル要素の各偶数対の前記第１ピクセル行中の前記赤エミッタおよび前記緑エミッタすべてにつながれており、ここで前記行ラインの前記第１のものは隣接する前記三色ピクセル要素の偶数番目ごとの対の前記青エミッタへつながれている、第２行ライン；および
前記三色ピクセル要素の各々へつながれた第１ないし第１０列ラインドライバ；
前記第１列ラインドライバへつながれた第１列ラインであって、前記第１列ラインが前記アレイ列の第１のものの中にあるすべての前記三色ピクセル要素の最も左側のエミッタすべてにつながれている、第１列ライン；
前記第２列ラインドライバへつながれた第２列ラインであって、前記第２列ラインが前記アレイ列の第２のものの中にあるすべての前記三色ピクセル要素の中央エミッタすべてにつながれ、また前記アレイ列の第８のものの中にあるすべての前記三色ピクセル要素の中央エミッタすべてにつながれた第８列ラインへつながれている、第２列ライン；
前記第３列ラインドライバへつながれた第３列ラインであって、前記第３列ラインが前記アレイ列の第３のものの中にあるすべての前記三色ピクセル要素の最も右側のエミッタすべてにつながれている、第３列ライン；
前記第４列ラインドライバへつながれた第４列ラインであって、前記第４列ラインが前記アレイ列の第４のものの中にあるすべての前記三色ピクセル要素の最も左側のエミッタすべてにつながれている、第４列ライン；
前記第５列ラインドライバへつながれた第５列ラインであって、前記第５列ラインが前記アレイ列の第５のものの中にあるすべての前記三色ピクセル要素の中央エミッタすべてにつながれ、また前記アレイ列の第１１のものの中にあるすべての前記三色ピクセル要素の中央エミッタすべてにつながれた第１１列ラインへつながれている、第５列ライン；
前記第６列ラインドライバへつながれた第６列ラインであって、前記第６列ラインが前記アレイ列の第６のものの中にあるすべての前記三色ピクセル要素の最も右側のエミッタすべてにつながれている、第６列ライン；

前記第７列ラインドライバへつながれた第７列ラインであって、前記第７列ラインが前記アレイ列の第７のものの中にあるすべての前記三色ピクセル要素の最も左側のエミッタすべてにつながれている、第７列ライン；
前記第８列ラインドライバへつながれた第９列ラインであって、前記第９列ラインが前記アレイ列の第９のものの中にあるすべての前記三色ピクセル要素の最も右側のエミッタすべてにつながれている、第９列ライン；
前記第９列ラインドライバへつながれた第１０列ラインであって、前記第１０列ラインが前記アレイ列の第１０のものの中にあるすべての前記三色ピクセル要素の最も左側のエミッタすべてにつながれている、第１０列ライン；
前記第１０列ラインドライバへつながれた第１２列ラインであって、前記第１２列ラインが前記アレイ列の第１２のものの中にあるすべての前記三色ピクセル要素の最も右側のエミッタすべてにつながれている、第１２列ライン；
を含むアレイ。
【請求項７２】
請求項７１に記載のアレイであって、前記アレイがドット・インバージョンによって駆動されるアレイ。
【請求項７３】
請求項７１に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記行ラインの各々が選択トランジスタのゲートへつながれているアレイ。
【請求項７４】
請求項７１に記載のアレイであって、前記赤エミッタ、前記緑エミッタ、および前記青エミッタの各々へつながれた前記列ラインの各々が選択トランジスタのソース／ドレイン端子へつながれているアレイ。
【請求項７５】
請求項７１に記載のアレイであって、ここで前記緑エミッタが前記第１ピクセル行中の前記左側単位面積多角形を占め、また前記赤エミッタが前記第１ピクセル行中の前記右側単位面積多角形を占めており；またここで前記赤エミッタが前記第２ピクセル行中の前記左側単位面積多角形を占め、また前記緑エミッタが前記第２ピクセル行中の前記右側単位面積多角形を占めている、アレイ。
【請求項７６】
請求項７１に記載のアレイであって、ここで前記単位面積多角形が正方形であるアレイ。
【請求項７７】
請求項７１に記載のアレイであって、ここで前記単位面積多角形が長方形であるアレイ。
【請求項７８】
ディスプレイの三色ピクセル要素を駆動する方法であって：
第１、第２、第３、および第４象限を有するＸ、Ｙ座標系の原点に配置された正方形の中心に配置された青エミッタ、ここで前記青エミッタは正方形をしている、前記青エミッタから距離を置いて前記第２および第４象限中に前記青エミッタ回りに対称に配置された一対の赤エミッタ、ここで前記赤エミッタは前記青エミッタによって占有されない前記第２および第４象限の部分を占めており、また前記赤エミッタは一般に前記青エミッタの側辺に平行な端部を形成するように切り詰めた、内側を向く隅を有する正方形をしている、および前記青エミッタから距離を置いて前記第１および第３象限中に前記青エミッタ回りに対称に配置された一対の緑エミッタ、ここで前記緑エミッタは前記青エミッタによって占有されない前記第１および第３象限の部分を占めており、また前記緑エミッタは一般に前記青エミッタの側辺に平行な端部を形成するように切り詰めた、内側を向く隅を有する正方形をしている、を含む三色ピクセル要素の提供；および
前記青エミッタ、前記赤エミッタ、および前記緑エミッタを駆動することであって、ここで前記三色ピクセル要素の前記青エミッタは二番目に近い隣接する三色ピクセル要素の青エミッタへつながれている、エミッタの駆動；

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を含む方法。
【請求項７９】
ディスプレイの三色ピクセル要素を駆動する方法であって：
第１、第２、第３、および第４象限を有するＸ、Ｙ座標系の原点に配置された正方形の中心に配置された青エミッタ、ここで前記青エミッタは正方形をしている、前記青エミッタから距離を置いて前記第２および第４象限中に前記青エミッタ回りに対称に配置された一対の赤エミッタ、ここで前記赤エミッタは前記青エミッタによって占有されない前記第２および第４象限の部分を占めており、また前記赤エミッタはＬ字形をしている、および前記青エミッタから距離を置いて前記第１および第３象限中に前記青エミッタ回りに対称に配置された一対の緑エミッタ、ここで前記緑エミッタは前記青エミッタによって占有されない前記第１および第３象限の部分を占めており、また前記緑エミッタはＬ字形をしている、を含む三色ピクセル要素の提供；および
前記青エミッタ、前記赤エミッタ、および前記緑エミッタを駆動することであって、ここで前記三色ピクセル要素の前記青エミッタは二番目に近い隣接する三色ピクセル要素の青エミッタへつながれている、エミッタの駆動；
を含む方法。
【請求項８０】
ディスプレイの三色ピクセル要素を駆動する方法であって：
第１および第２ピクセル行を含む三色ピクセル要素を提供することであって、各ピクセル行は３つの単位面積多角形を含んでおり、ここで前記単位面積多角形の各々を１つのエミッタが占有しており、ここで赤エミッタが前記第１ピクセル行中の左側単位面積多角形を占め、緑エミッタが前記第１ピクセル行中の右側単位面積多角形を占めており、ここで緑エミッタが前記第２ピクセル行中の左側単位面積多角形を占め、赤エミッタが前記第２ピクセル行中の右側単位面積多角形を占めており、またここで青エミッタが前記第１および前記第２の両ピクセル行中の中央単位面積多角形を占めている、三色ピクセルの提供；および
前記青エミッタ、前記赤エミッタ、および前記緑エミッタを駆動することであって、ここで前記三色ピクセル要素の前記青エミッタが二番目に近い隣接する三色ピクセル要素の青エミッタ対へつながれている、エミッタの駆動；
を含む方法。
【請求項８１】
請求項８０に記載の方法であって、ここで前記緑エミッタが前記第１ピクセル行中の前記左側単位面積多角形を占め、また前記赤エミッタが前記第１ピクセル行中の前記右側単位面積多角形を占めており；またここで前記赤エミッタが前記第２ピクセル行中の前記左側単位面積多角形を占め、また前記緑エミッタが前記第２ピクセル行中の前記右側単位面積多角形を占めている；方法。
【請求項８２】
ディスプレイの三色ピクセル要素を駆動する方法であって：
第１および第２ピクセル行を含む三色ピクセル要素を提供することであって、各ピクセル行は３つの単位面積多角形を含んでおり、ここで前記単位面積多角形の各々を１つのエミッタが占有しており、ここで赤エミッタが前記第１ピクセル行中の左側単位面積多角形を占め、緑エミッタが前記第１ピクセル行中の右側単位面積多角形を占めており；ここで緑エミッタが前記第２ピクセル行中の左側単位面積多角形を占め、赤エミッタが前記第２ピクセル行中の右側単位面積多角形を占めており；またここで青エミッタが前記第１および前記第２の両ピクセル行中の中央単位面積多角形を占めている、三色ピクセルの提供；および
前記青エミッタ、前記赤エミッタ、および前記緑エミッタを駆動することであって、ここで前記三色ピクセル要素の前記青エミッタが二番目に近い隣接する三色ピクセル要素の青エミッタへつながれている、エミッタの駆動；
を含む方法。

【請求項８３】
請求項８２に記載の方法であって、ここで前記緑エミッタが前記第１ピクセル行中の前記左側単位面積多角形を占め、また前記赤エミッタが前記第１ピクセル行中の前記右側単位面積多角形を占めており；またここで前記赤エミッタが前記第２ピクセル行中の前記左側単位面積多角形を占め、また前記緑エミッタが前記第２ピクセル行中の前記右側単位面積多角形を占めている；方法。
【請求項８４】
ディスプレイの三色ピクセル要素を駆動する方法であって：
第１および第２ピクセル行を含む三色ピクセル要素を提供することであって、各ピクセル行は３つの単位面積多角形を含んでおり、ここで前記単位面積多角形の各々を１つのエミッタが占有しており、ここで赤エミッタが前記第１ピクセル行中の左側単位面積多角形を占め、緑エミッタが前記第１ピクセル行中の右側単位面積多角形を占めており、ここで緑エミッタが前記第２ピクセル行中の左側単位面積多角形を占め、赤エミッタが前記第２ピクセル行中の右側単位面積多角形を占めており、ここで単一の青エミッタが前記第１および前記第２の両ピクセル行中の中央単位面積多角形を占めており、更にここで前記三色ピクセル要素の隣接する横方向の対が互いに１ピクセル行だけ縦方向にオフセットされている、三色ピクセルの提供；および
前記青エミッタ、前記赤エミッタ、および前記緑エミッタを駆動することであって、ここで前記三色ピクセル要素の前記青エミッタが二番目に近い隣接する三色ピクセル要素の青エミッタへつながれている、エミッタの駆動；
を含む方法。
【請求項８５】
請求項８４に記載の方法であって、ここで前記緑エミッタが前記第１ピクセル行中の前記左側単位面積多角形を占め、また前記赤エミッタが前記第１ピクセル行中の前記右側単位面積多角形を占めており；またここで前記赤エミッタが前記第２ピクセル行中の前記左側単位面積多角形を占め、また前記緑エミッタが前記第２ピクセル行中の前記右側単位面積多角形を占めている；方法。
【発明の詳細な説明】
【０００１】
（背景）
本出願はカラー・ピクセル配置に関するものであって、更に詳細には電子式画像装置およびディスプレイで使用するカラー・ピクセル配置に関する。
【０００２】
フルカラーの知覚は錐体と呼ばれる三色受容器神経細胞タイプによって目の中で行なわれる。この３つのタイプは光の異なる波長：長波長、中間、短波長に感度を持つ（それぞれ、“赤”、“緑”、“青”）。これら３つの相対的な密度は互いにかなり違っている。緑受容器に比べて赤受容器のほうが少し多い。赤や緑と比べると、青受容器は非常に少ない。色受容器のほかに、比較的波長に鈍感な桿体と呼ばれる受容器があって、モノクロの暗視野に寄与する。
【０００３】
人間の視覚系は目によって検出された情報をいくつかの異なる知覚チャンネル：明るさ、色、および運動のチャンネルで処理する。運動は画像システム設計者にとって、フリッカーの閾値に関してのみ重要である。明るさチャンネルはすべての利用可能な受容器、錐体、桿体から入力を受け取る。これは“色盲的”である。それはエッジのコントラストを強調するように情報を処理する。色チャンネルはエッジコントラストの強調を行なわない。明るさチャンネルはすべての受容器を使用し強調するので、明るさチャンネルの分解能は色チャンネルよりも数倍高い。明るさ知覚への青受容器の寄与は５％あるいは２０分の１以下である。従って、ＮＡＳＡのＡＭＥＳ研究センターにおける実験（ＳＩＤダイジェスト１９９３に掲載されたＲ．Ｍａｒｔｉｎ（マーチン）、Ｊ．Ｇｉｌｌｅ（ギル）、Ｊ．Ｌａｒｉｍｅｒ（ラリマー）による投影式ディスプレイにおける青ピクセル数減少の検出

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可能性（Ｄｅｔｅｃｔａｂｉｌｉｔｙ ｏｆ Ｒｅｄｕｃｅｄ Ｂｌｕｅ Ｐｉｘｅｌ Ｃｏｕｎｔ ｉｎ Ｐｒｏｊｅｃｔｉｏｎ Ｄｉｓｐｌａｙｓ））が示すように、青の分解能を１オクターブ下げることによって導入される誤差はほとんどの視聴者にとって検出されるとしてもわずかに気づく程度である。

【０００４】

色の知覚は、“同化”（ａｓｓｉｍｉｌａｔｉｏｎ）あるいはフォン・ベゾルド（ｖｏｎ Ｂｅｚｏｌｄ）のカラー・ブレンド効果と呼ばれる過程によって影響される。これはディスプレイのいくつかの別々に分離したカラー・ピクセル（あるいはサブピクセルまたはエミッタ）を１つの混ざった色として知覚させるものである。このブレンド効果は視野の中の与えられた角度範囲に広がって発生する。青受容器は比較的まばらなので、このブレンドは青については、赤や緑よりも広い角度にわたって発生する。この角度範囲は青については約０．２５度であり、他方、赤や緑については約０．１２度である。１２インチの観察距離において、０．２５度はディスプレイ上で５０ミル（１，２７０ミクロン）に相当する。従って、もしも青ピクセルのピッチがこのブレンド・ピッチの半分（６２５ミクロン）よりも狭ければ、画質を犠牲にせずに色のブレンドが起こる。

【０００５】

フラット・パネル式ディスプレイおよび固体カメラ・チップ用のカラー用シングル・プレーン画像マトリックス技術の現状はＲＧＢ（赤－緑－青）カラー・トライアド（ｔｒｉａｄ）である。このシステムは３つの色を分離し、各色に対して等しい空間周波数重み付けを与えることによってフォン・ベゾルド効果を活用している。２つの製造業者が二枚あるいは三枚のパネルを使用して、それらの画像を重畳させる改良形のディスプレイ・デザインを発表した。投影式ディスプレイの１業者は、赤、緑、および青の３つのパネルを使用した。青パネルは、人間の視覚要求と表示された画像との整合性に従って、落とした分解能を利用している。別の業者であるオレゴン州のビバートン・プレナー・システム（Ｐｌａｎａｒ Ｓｙｓｔｅｍｓ ｏｆ Ｂｅａｖｅｒｔｏｎ）は、開発モデルを構築するために、１つのパネルに赤および緑のピクセルを備え、もう１つのパネルに青のピクセルを備えた二重発光パネルを有する“多重行アドレッシング”技術を採用している。青パネルは縦軸のみで分解能を落としている。これにより、青い蛍光体は赤および緑のピクセルと比べて、より高速に励起されることになり、青蛍光体の輝度が低い問題を克服することができる。従来技術に関する問題点は人間の視覚と表示との間の整合した分解能バランスを同じように保つために、付加的な表示パネル／プレーンを、付加的なドライバ電子回路と一緒に用いることである。

【０００６】

シルバーブルック（Ｓｉｌｖｅｒｂｒｏｏｋ）に与えられた米国特許第６，００８，８６８号に開示されたような別の表示方法は二進数で制御されるエミッタを使用している。二進数で制御されるエミッタでは、各エミッタが不連続な明るさの値を有しており、従って面積対明るさの正確な関係をディスプレイが有することを要求する。この従来技術では、人間の視覚がより低い青色スペース間隔を有することに応じて、パネルに組み込む青の“ビット深さ”を減らしている。従来の表示方法はまた、１本の縦ストライプに１つの色を使用している。従来のストライプは横軸では変調伝達関数（ＭＴＦ）、高い空間周波数分解能を制限するので、単色のストライプは最適でない。

【０００７】

表示装置には液晶表示（ＬＣＤ）装置が含まれる。ＬＣＤ装置は、電卓、時計、カラーテレビ、およびコンピュータ・モニターを含む多彩な用途に使用されている。従来の液晶パネルは、典型的な場合、一対の透明ガラス製の基板を含み、それらが平行に配置されてそれらの間に狭いギャップを構成し、そこを液晶材料で埋めている。典型的には複数のピクセル電極が透明ガラス基板の一方の内側表面上にマトリックス状に取り付けられ、またピクセル電極に対応する複数の共通電極が２枚の透明ガラス基板のうちの他方の基板の内側表面上に配置されている。対向するピクセル電極と共通電極とによって１個の液晶セルが定義される。画像は、電極対へ供給される電圧に従って、セルの光透過を制御することに

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よって表示される。

【０００８】

従来のアクティブ・マトリックスＬＣＤ装置では、１つの基板上に、複数の列ラインに直交するように複数の行ラインが形成される。行および列のラインによって定義される、対応する複数のピクセル領域上に複数のピクセル電極が取り付けられる。ピクセル領域のそれぞれの上に、対応する薄膜トランジスタ（ＴＦＴ）が形成され、その上に形成されるピクセル電極を駆動する。

【０００９】

同じ極性を持つ電圧で液晶セルを繰り返して駆動すると、液晶材料中をイオン性不純物が移動することによる電気化学変化をピクセル電極と共通電極との間に引き起こすことがある。この変化は表示感度および輝度を大幅に低下させ得る。従って、この現象を防止するために、一般に液晶に供給される電圧の極性を繰り返し反転させることが望ましい。液晶セルを駆動するこの方法は“インバージョン”として知られている。当業者にはいくつかのインバージョン方式が知られており、その中には“フレーム・インバージョン”、“コラム・インバージョン”、“ライン（あるいは行）・インバージョン”、あるいは“ドット・インバージョン”が含まれる。

【００１０】

従来のドット・インバージョン駆動法は、例えば、ピクセル要素を負電圧および正電圧で交互に駆動することによるなど、その極性を隣接するサブピクセル電極と異なるように列ライン電圧を供給することを含む。典型的には、与えられた１つのピクセル電極に供給される駆動電圧の極性は、電圧を供給するたびに反転させられる。供給電圧は各行で交番しながら行ごとにサブピクセルに記憶される。この結果、サブピクセルの二次元マトリックス上には極性が“チェッカー・ボード”のパターンに配置される。

【００１１】

上述の従来のドット・インバージョン駆動法は、液晶材料中のイオン・マイグレーションを防止し、また表示中に“フリッカー”が知覚されることを少なくするのに有用であるが。この“フリッカー”を回避するために、三色ピクセル要素の新規な配置およびそれに付随する駆動構造に対して“ドット・インバージョン”を適用するときには特別な注意が必要である。

【００１２】

（概要）

従来技術の欠点および不利な点は、簡易アドレッシング方式によるフルカラー画像装置用カラー・ピクセルの配置によって解決される。

【００１３】

ディスプレイ用のアレイおよび行および列ライン構造が開示される。アレイは複数の行および列位置と複数の三色ピクセル要素を含む。三色ピクセル要素の各々は１個の青エミッタ、一対の赤エミッタ、および一対の緑エミッタを含む。三色ピクセル要素にはいくつかのデザインが可能である。駆動マトリックスは個々のエミッタを駆動するための複数個の行および列ドライバを含む。行ドライバは各行の赤、緑、および青エミッタを駆動する。各列の赤および緑エミッタは単一の列ドライバによって駆動される。しかし、単一の列ドライバによって２つの列ライン青エミッタ、すなわち、１つおきに隣接する三色ピクセル要素の第１列ラインおよび第２列ラインを駆動できる。こうすることで、従来技術で使用されていた列ラインおよび付随するドライバ電子回路の数を本発明では減らすことができる。

【００１４】

三色ピクセル要素のアレイ用の駆動マトリックスについても開示される。アレイは本発明の三色ピクセル要素のそれぞれ複数行および複数列を含むが、駆動マトリックスは個々のエミッタを駆動するための複数の行および列ドライバを含む。行ドライバは各行の赤、緑、および青エミッタを駆動する。各列の赤および緑エミッタは単一の列ドライバによって駆動される。しかし、単一の列ドライバによって２つの列ライン青エミッタ、すなわち、

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１つおきに隣接する三色ピクセル要素の第１列ラインおよび第２列ラインを駆動できる。このようにここでも、列ラインおよび付随するドライバ電子回路の数を減らすことができる。

【００１５】

ディスプレイ中の三色ピクセル要素を駆動する方法が開示される。本方法は、いくつかの可能なデザインのうち任意のデザインを有する三色ピクセル要素１個を提供することを含む。青エミッタ、赤エミッタ、および緑エミッタが駆動され、三色ピクセル要素の１つの青エミッタは、二番目に近い隣接する三色ピクセル要素の青エミッタへつながれる。

【００１６】

（詳細な説明）

当業者は理解されるであろうが、本発明の以下の説明はほんの一例にしか過ぎず、決して限定的なものではない。本発明のその他の実施の形態がそのような当業者には容易に示唆されよう。

【００１７】

三色ピクセル要素の配置はピクセルのカラー・ブレンドに影響する。各々の三色ピクセル要素は少なくとも、１個の青エミッタ、１個の赤エミッタ、および１個の緑エミッタを含み、いくつかの異なるデザインに従ってそれらをグループ化できる。複数の行ドライバおよび列（あるいは列ライン）ドライバは個々のエミッタを駆動するように動作する。行ドライバは各行の赤、緑、および青エミッタを駆動する。各列の赤および緑エミッタは単一の列ドライバによって駆動される。しかし、１つおきに隣接する三色ピクセル要素の青エミッタの第１列ラインおよび第２列ラインの２本の列ラインを単一の列ドライバを用いて駆動することによって、列ドライバの数を減らすことができる。この配置はドット・インバージョン法によってディスプレイ装置、特に液晶ディスプレイ装置を駆動する場合に有利である。

【００１８】

図１は三色ピクセル要素１０の配置の例示的な実施の形態を示す。三色ピクセル要素は１つの青エミッタ１２、２つの赤エミッタ１４、および２つの緑エミッタ１６を含む。三色ピクセル要素１０は正方形をしており、Ｘ、Ｙ座標系の原点に中心を持つ。青エミッタ１２はこの正方形の原点に中心を持ち、Ｘ、Ｙ座標系の第１、第２、第３、および第４象限に広がっている。一対の赤エミッタ１４は対向する象限（例えば、第２および第４象限）に配置され、また一対の緑エミッタ１６も対向する象限（例えば、第１および第３象限）に配置されて、青エミッタ１２によって占有されない象限部分を占めている。図１に示すように、青エミッタ１２は正方形であり、それの隅を座標系のＸおよびＹ軸と揃えているが、赤１４および緑１６のエミッタの対向する対は一般に正方形であるが、青エミッタ１２の側辺に平行な端部を形成するように切り詰めた、内側を向く隅を有する。

【００１９】

三色ピクセル要素２０の別の例示的な実施の形態が図２に示されている。この実施の形態でも、三色ピクセル要素２０は正方形をしており、Ｘ、Ｙ座標系の原点に中心を持ち、Ｘ、Ｙ座標系の第１、第２、第３、および第４象限へ広がっている。青エミッタ２２はこの正方形の原点に中心を持ち、正方形をしており、側辺が座標系のＸおよびＹ軸と平行に揃っている。一対の赤エミッタ２４は対向する象限（例えば、第２および第４象限）に配置され、また一対の緑エミッタ２６は対向する象限（例えば、第１および第３象限）に配置されて、青エミッタ２２によって占有されない象限部分を占めている。この実施の形態で、赤エミッタ２４および緑エミッタ２６の対向する対はＬ字形をしている。このＬ字形エミッタは青エミッタを取り囲んでおり、Ｌ字形エミッタの内側の隅は青エミッタの隅と揃っている。

【００２０】

好適な実施の形態に従えば、三色ピクセル要素は等しい赤、緑、および青エミッタ面積を有する。これは、個々の赤および緑エミッタの面積よりも大きい面積を有する青エミッタを三色ピクセル要素の中心に配置することによって実現されよう。当業者は理解されるで

あろうが、その他の実施の形態では、青エミッタの面積はその他の赤または緑エミッタと比べてより小型にされよう。青エミッタは、赤または緑エミッタのいずれかよりも輝度を高くできるか、あるいは赤および緑エミッタが可能なのと同程度の輝度を有することができる。例えば、青エミッタの駆動対明るさの利得は赤または緑エミッタのそれよりも大きいであろう。

【００２１】

上述の説明は好適な実施の形態の例示であり、当業者はその他の代替例を容易に思いつくであろう。例えば、エミッタは異なる形状、例えば円形であったり多角形であったりできる。それらはまた、明瞭な端部を有するのではなく、曖昧であってもよい。三色ピクセル要素は各軸において等しい空間周波数で配置される必要はない。本質的に存在しないようにエミッタ間の開口比を最小化するかあるいは特に強調するようにしてもよいし、また空間は黒または白を含む別の色にしてもよい。エミッタは既知の任意の技術あるいは未来の発明によってもよく、それらには液晶（ＬＣＤ）、プラズマ、薄膜電気発光、ディスクリートな発光ダイオード（ＬＥＤ）、ポリマー発光ダイオード、エレクトロ・クロミック、エレクトロ・メカニカル、白熱発光、あるいは電界放出励起蛍光体（ＦＥＤ）を利用したディスプレイが含まれる。

【００２２】

図３は図１の三色ピクセル要素のアレイ３０である。アレイ３０はパネルまたはチップ上で繰り返されて、所望のマトリックス分解能を持つ装置を完成する。三色ピクセル要素１０の繰り返しによって赤３２および緑３４のエミッタが交番する“チェッカー・ボード”が形成され、青エミッタ３６は装置に亘って赤３２および緑３４のエミッタの分解能の半分で均等に分散している。

【００２３】

三色ピクセル要素アレイの１つの特長はカラー・ディスプレイの分解能改善である。これは明るさチャンネルの高分解能知覚に大きく貢献するのは赤と緑のエミッタのみであることから生ずる。従って、青エミッタの数を減らし、いくつかを赤および緑エミッタで置換することによって、より人間の視覚に整合させることで分解能を改善する。

【００２４】

縦軸で赤および緑エミッタを半分に分割することで空間アドレッシング性を高めるのは、従来技術による伝統的な縦方向単一カラー・ストライプよりも進んだ方法である。赤および緑エミッタが交番する“チェッカー・ボード”は変調伝達関数（ＭＴＦ）、高空間周波数分解能を可能とし、横および縦の両軸で分解能を増大させる。

【００２５】

三色ピクセル要素アレイはまた、最新の商用ビデオカメラや電子式静止カメラに見られる固体式の画像キャプチャ装置にも使用されよう。画像キャプチャおよびディスプレイの両方で青エミッタ分解能を下げることの利点は、記憶された画像が、記録または処理で各色に対して同じ分解能を提供する必要はないということである。このことは、高品位テレビ（ＨＤＴＶ）録画、再生、放送、および表示を含むテレビ、ビデオゲーム、コンピュータなどの電子式画像およびディスプレイ・システムにおけるソフトウエアおよびハードウエアを含む電子式記憶画像の符号化、圧縮、および展開における節約につながる。

【００２６】

図４は横方向に揃えられた２個の三色ピクセル要素の配置４０を示す。三色ピクセル要素は正方形をしており、各々がＸ、Ｙ座標系の各原点に中心を持つ。青エミッタ４２ａは第１三色ピクセル要素の正方形の原点に中心を持ち、そのＸ、Ｙ座標系の第１、第２、第３、および第４象限へ広がっている。青エミッタ４２ｂは第２三色ピクセル要素の正方形の原点に中心を持ち、そのＸ、Ｙ座標系の第１、第２、第３、および第４象限へ広がっている。赤エミッタ４４ａおよび４４ｂはそれぞれ、第１および第２のピクセル要素の第２象限に配置されている。緑エミッタ４６ａおよび４６ｂはそれぞれ、第１ピクセルおよび第２ピクセル要素の第３象限に配置されている。緑エミッタ４８ａおよび４８ｂはそれぞれ、第１ピクセルおよび第２ピクセル要素の第１象限に配置されている。赤エミッタ５０ａ

および５０ｂはそれぞれ、第１ピクセルおよび第２のピクセル要素の第４象限に配置されている。図４に示すように、各青エミッタ（例えば４２ａ）は正方形をしており、その隅は各座標系のＸおよびＹ軸と揃っている。赤エミッタの対向する対（例えば、４４ａおよび５０ａ）および緑エミッタの対向する対（例えば、４８ａおよび４６ａ）は一般に正方形であって、青エミッタ（例えば、４２ａ）の側辺に平行な端部を形成するように、切り詰めた、内側に向いた隅を有する。各三色ピクセル要素で、赤および緑エミッタは青エミッタによって占有されない象限部分を占める。

【００２７】

図５は三色ピクセル要素配置４０用の例示的な駆動マトリックス６０の図である。便宜上、液晶ディスプレイ・エミッタはキャパシタとして模式的に表されている。各液晶ディスプレイ・エミッタは、赤エミッタ４４ａに関して図５に示すように、選択トランジスタを介して行および列ラインへつながれる。液晶ディスプレイ・エミッタは選択トランジスタのゲートを介して行ラインへつながれる。列ラインは選択トランジスタの第１ソース／ドレイン端子および選択トランジスタの第２ソース／ドレイン端子へつながれ、それは液晶ディスプレイ・エミッタへつながれる。一定の電位が液晶ディスプレイ・エミッタへつながれる。本発明の液晶ディスプレイ・エミッタは、カメラ用チップやその他の適当な装置に見られるような電荷結合デバイス（ＣＣＤ）、あるいはアクティブ・マトリックス液晶ディスプレイ（ＡＭＬＣＤ）に見られる薄膜トランジスタ（ＴＦＴ）のようなアクティブな電子デバイスでよい。

【００２８】

図５に示す例示的な駆動マトリックス６０は２×５の駆動マトリックスを含み、ここでは４つの列ドライバが赤および緑エミッタを駆動し、単一の列ドライバが青エミッタを駆動するようになっている。第１列ドライバ６２は赤エミッタ４４ａおよび緑エミッタ４６ａを駆動する。青エミッタ４２ａおよび４２ｂは一緒につながれて、第２列ドライバ６４によって駆動される。第３列ドライバ６６は緑エミッタ４８ａおよび赤エミッタ５０ａを駆動し、他方、第４列ドライバ６８は赤エミッタ４４ｂおよび緑エミッタ４６ｂを駆動する。緑エミッタ４８ｂおよび赤エミッタ５０ｂは第５の列ドライバ７０によって駆動される。２つの行ドライバおよび１０個の列ドライバを備え、少なくとも４個の三色ピクセル要素を使用する別の実施の形態についてもここに更に提示する。

【００２９】

行ドライバは各行の赤、緑、および青エミッタを駆動する。行ドライバ７２は青エミッタ４２ｂのほかに、赤エミッタ４４ａおよび４４ｂ、緑エミッタ４８ａおよび４８ｂを駆動する。行ドライバ７４は緑エミッタ４６ａおよび４６ｂ、赤エミッタ５０ａおよび５０ｂ、および青エミッタ４２ａを駆動する。各エミッタは、従来技術のエミッタが１つのピクセル要素中のランダムな場所で不連続な明るさの値で駆動されるのと異なり、１つのピクセル要素中の特定の場所で連続的な明るさの値で駆動できる。

【００３０】

この駆動マトリックスは、与えられた画像を提供するために、トライアド配置用の従来技術の２×６駆動マトリックスよりも約１６％少ない列ドライバを使用する。青エミッタ１２が組み合わされるため、列ラインを少なくできる。この全体配置は９０度回転することができ、そうすれば組み合わされた青エミッタ１２が同じ行ドライバによって駆動されることになる。そのような従来技術で既知の幾何学的に同一の変形すべてが可能な実施の形態となる。更に、ドライバのタイプ、電圧、およびタイミングは各々のデバイス技術に関して従来既知のものと同じようにすることができる。

【００３１】

配置および駆動マトリックスの別の実施の形態が図６および７に示されている。図６は横に揃えられた４個の三色ピクセル要素の配置７６である。各三色ピクセル要素は正方形をしており、各々がＸ、Ｙ座標系の各原点に中心を持つ。この場合、青エミッタ８０ａ、８０ｂ、８０ｃ、および８０ｄは各三色ピクセル要素の正方形の原点に中心を持つ。青エミッタ８０ａ、８０ｂ、８０ｃ、および８０ｄは各Ｘ、Ｙ座標系の第１、第２、第３、およ

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び第４象限へ広がっている。赤エミッタ５２ａ、５２ｂ、５２ｃ、および５２ｄはそれぞれ、第１、第２、第３、および第４三色ピクセル要素の第２象限に配置される。緑エミッタ５４ａ、５４ｂ、５４ｃ、および５４ｄはそれぞれ、第１、第２、第３、および第４三色ピクセル要素の第３象限に配置される。緑エミッタ５６ａ、５６ｂ、５６ｃ、および５６ｄはそれぞれ、第１、第２、第３、および第４三色ピクセル要素の第１象限に配置される。赤エミッタ５８ａ、５８ｂ、５８ｃ、および５８ｄはそれぞれ、第１、第２、第３、および第４三色ピクセル要素の第４象限に配置される。図６に示すように、各青エミッタ（例えば、８０ａ）は正方形をしており、各座標系のＸおよびＹ軸と揃った隅を有する。赤エミッタの対向する対（例えば、５２ａおよび５８ａ）および緑エミッタの対向する対（例えば、５４ａおよび５６ａ）は一般に正方形をしており、青エミッタ（例えば、８０ａ）の側辺に平行な端部を形成するように切り詰めた、内側を向く隅を有する。各三色ピクセル要素で、赤および緑エミッタは青エミッタによって占有されない象限部分を占める。

【００３２】

図７は配置７６用の例示的な駆動マトリックス７８の図である。図７に示された例示的駆動マトリックス７８は２×１０の駆動マトリックスを含み、ここでは８つの列ドライバが８個の赤エミッタおよび８個の緑エミッタを駆動し、また２つの列ドライバが４個の青エミッタを駆動する。第１列ドライバ９４は赤エミッタ５２ａおよび緑エミッタ５４ａを駆動する。青エミッタ８０ａおよび８０ｃは一緒につながれて、第２列ドライバ９６によって駆動される。第３列ドライバ９８は緑エミッタ５６ａおよび赤エミッタ５８ａを駆動し、第４列ドライバ１００は赤エミッタ５２ｂおよび緑エミッタ５４ｂを駆動する。第５列ドライバ１０２は、８０ｄと結合された青エミッタ８０ｂを駆動する。緑エミッタ５６ｂおよび赤エミッタ５８ｂは第６列ドライバ１０４によって駆動され、他方、第７列ドライバ１０６は赤エミッタ５２ｃおよび緑エミッタ５４ｃを駆動する。第８列ドライバ１０８は緑エミッタ５６ｃおよび赤エミッタ５８ｃを駆動し、他方、第９列ドライバ１１０は赤エミッタ５２ｄおよび緑エミッタ５４ｄを駆動する。最後に、第１０列ドライバ１１２は緑エミッタ５６ｄおよび赤エミッタ５８ｄを駆動する。

【００３３】

行ドライバは各ピクセル行中の赤、緑、および青エミッタを駆動する。行ドライバ９０は青エミッタ８０ｃおよび８０ｄのほか、赤エミッタ５２ａ、５２ｂ、５２ｃ、および５２ｄと、緑エミッタ５６ａ、５６ｂ、５６ｃ、および５６ｄを駆動する。行ドライバ９２は緑エミッタ５４ａ、５４ｂ、５４ｃ、および５４ｄ、赤エミッタ５８ａ、５８ｂ、５８ｃ、および５８ｄ、そして青エミッタ８０ａおよび８０ｂを駆動する。各エミッタは、従来技術のエミッタが１つのピクセル要素中のランダムな場所で不連続な明るさの値で駆動されるのと異なり、１つのピクセル要素中の特定の場所で連続的な明るさの値で駆動できる。

【００３４】

この駆動マトリックスは、与えられた画像を提供するために、トライアド配置用の従来技術の２×１２駆動マトリックスよりも約１６．６％少ない列ドライバを使用する。青エミッタが組み合わされる（８０ａおよび８０ｃ；８０ｂおよび８０ｄ）ため、列ラインを少なくできる。ドライバのタイプ、電圧、およびタイミングは各々のデバイス技術に関して従来既知のものと同じようにすることができる。

【００３５】

三色ピクセル要素配置および駆動マトリックスの別の実施の形態が図８および９に示されている。図８は１つのアレイ行として横方向に揃えられた４個の三色ピクセル要素の配置１１４である。各三色ピクセル要素は、正方形あるいは長方形でよく、各行に単位面積の多角形３個を含む２つの行を含み、各単位面積多角形を１個のエミッタが占有する。第１、第２、第３、および第４三色ピクセル要素の第１ピクセル行の中央にはそれぞれ、青エミッタ１３０ａ、１３０ｂ、１３０ｃ、および１３０ｄが配置される。第１、第２、第３、および第４三色ピクセル要素の第２ピクセル行の中央にはそれぞれ、青エミッタ１３２

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ａ、１３２ｂ、１３２ｃ、および１３２ｄが配置される。赤エミッタ１２０ａ、１２０ｂ、１２０ｃ、および１２０ｄはそれぞれ、第１、第２、第３、および第４三色ピクセル要素の青エミッタ１３０ａ、１３０ｂ、１３０ｃ、および１３０ｄの左側の、第１ピクセル行に配置される。緑エミッタ１２２ａ、１２２ｂ、１２２ｃ、および１２２ｄはそれぞれ、第１、第２、第３、および第４三色ピクセル要素の青エミッタ１３２ａ、１３２ｂ、１３２ｃ、および１３２ｄの左側の、第２ピクセル行に配置される。緑エミッタ１２４ａ、１２４ｂ、１２４ｃ、および１２４ｄはそれぞれ、第１、第２、第３、および第４三色ピクセル要素の青エミッタ１３０ａ、１３０ｂ、１３０ｃ、および１３０ｄの右側の、第１ピクセル行に配置される。赤エミッタ１２６ａ、１２６ｂ、１２６ｃ、および１２６ｄはそれぞれ、第１、第２、第３、および第４三色ピクセル要素の青エミッタ１３２ａ、１３２ｂ、１３２ｃ、および１３２ｄの右側の、第２ピクセル行に配置される。

【００３６】

図９は三色ピクセル要素配置１１４用の例示的駆動マトリックス１１６の図である。図９に示された例示的駆動マトリックス１１６は２×１０の駆動マトリックスを含み、ここでは８つの列ドライバが８個の赤エミッタおよび８個の緑エミッタを駆動し、２つの列ドライバが４個の青エミッタを駆動する。第１列ドライバ１４０は赤エミッタ１２０ａおよび緑エミッタ１２２ａを駆動する。青エミッタ１３０ａ、１３２ａ、１３０ｃ、および１３２ｃは一緒につながれて、第２列ドライバ１４２によって駆動される。第３列ドライバ１４４は緑エミッタ１２４ａおよび赤エミッタ１２６ａを駆動し、他方、第４列ドライバ１４６は赤エミッタ１２０ｂおよび緑エミッタ１２２ｂを駆動する。第５列ドライバ１４８は１３０ｄおよび１３２ｄと、それらにつながれた青エミッタ１３０ｂおよび１３２ｂを駆動する。緑エミッタ１２４ｂおよび赤エミッタ１２６ｂは第６列ドライバ１５０によって駆動され、他方、第７列ドライバ１５２は赤エミッタ１２０ｃおよび緑エミッタ１２２ｃを駆動する。第８列ドライバ１５４は緑エミッタ１２４ｃおよび赤エミッタ１２６ｃを駆動し、他方、第９列ドライバ１５６は赤エミッタ１２０ｄおよび緑エミッタ１２２ｄを駆動する。最後に、第１０列ドライバ１５８は緑エミッタ１２４ｄおよび赤エミッタ１２６ｄを駆動する。

【００３７】

行ドライバは各ピクセル行の赤、緑、および青エミッタを駆動する。行ドライバ１６０は青エミッタ１３０ｃ、１３２ｃ、１３０ｄ、および１３２ｄのほかに、赤エミッタ１２０ａ、１２０ｂ、１２０ｃ、および１２０ｄと、緑エミッタ１２４ａ、１２４ｂ、１２４ｃ、および１２４ｄを駆動する。行ドライバ１６２は緑エミッタ１２２ａ、１２２ｂ、１２２ｃ、および１２２ｄ、赤エミッタ１２６ａ、１２６ｂ、１２６ｃ、および１２６ｄ、そして青エミッタ１３０ａ、１３２ａ、１３０ｂ、および１３２ｂを駆動する。各エミッタは、従来技術のエミッタが１つのピクセル要素中のランダムな場所で不連続な明るさの値で駆動されるのと異なり、１つのピクセル要素中の特定の場所で連続的な明るさの値で駆動できる。

【００３８】

この駆動マトリックスは、与えられた画像を提供するために、トライアド配置用の従来技術の２×１２駆動マトリックスよりも約１６．６％少ない列ドライバを使用する。青エミッタが組み合わされる（１３０ａ、１３２ａ、および１３０ｃ、１３２ｃ；１３０ｂ、１３２ｂ、および１３０ｄ、１３２ｄ）ため、列ラインを少なくできる。ドライバのタイプ、電圧、およびタイミングは各々のデバイス技術に関して従来既知のものと同じようにすることができる。

【００３９】

三色ピクセル要素配置および駆動マトリックスの別の実施の形態が図１０および１１に示されている。図１０は１つのアレイ行として横方向に揃えられた４個の三色ピクセル要素の配置１６４である。各三色ピクセル要素は、正方形あるいは長方形でよく、各行に３個の単位面積の多角形を含む２つの行を含み、各単位面積多角形を１個のエミッタが占有する。少なくとも１つの単位面積多角形は、他の単位面積多角形の少なくとも２倍であって

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、青エミッタ１６８ａ、１６８ｂ、１６８ｃ、および１６８ｄによって占有される。青エミッタ１６８ａ、１６８ｂ、１６８ｃ、および１６８ｄは単一のエミッタとして形成できるか、あるいは互いに配線でつながれた２つの別々の青エミッタとして形成できる。

【００４０】

図１０に示すように、青エミッタ１６８ａ、１６８ｂ、１６８ｃ、および１６８ｄはそれぞれ、第１、第２、第３、および第４三色ピクセル要素の赤エミッタと緑エミッタとの間に配置される。赤エミッタおよび緑エミッタは２つのピクセル行に配置される。赤エミッタ１７０ａ、１７０ｂ、１７０ｃ、および１７０ｄはそれぞれ、第１、第２、第３、および第４三色ピクセル要素の、青エミッタ１６８ａ、１６８ｂ、１６８ｃ、および１６８ｄの左側の、第１ピクセル行に配置される。緑エミッタ１７２ａ、１７２ｂ、１７２ｃ、および１７２ｄはそれぞれ、第１、第２、第３、および第４三色ピクセル要素の、青エミッタ１６８ａ、１６８ｂ、１６８ｃ、および１６８ｄの左側の、第２ピクセル行に配置される。緑エミッタ１７４ａ、１７４ｂ、１７４ｃ、および１７４ｄはそれぞれ、第１、第２、第３、および第４三色ピクセル要素の、青エミッタ１６８ａ、１６８ｂ、１６８ｃ、および１６８ｄの右側の、第１ピクセル行に配置される。赤エミッタ１７６ａ、１７６ｂ、１７６ｃ、および１７６ｄはそれぞれ、第１、第２、第３、および第４三色ピクセル要素の、青エミッタ１６８ａ、１６８ｂ、１６８ｃ、および１６８ｄの右側の、第２ピクセル行に配置される。

【００４１】

図１１は三色ピクセル要素配置１６４用の例示的駆動マトリックス１６６の図である。図１１に示された例示的駆動マトリックス７８は２×１０の駆動マトリックスを含み、ここでは８つの列ドライバが８個の赤エミッタおよび８個の緑エミッタを駆動し、２つの列ドライバが４個の青エミッタを駆動している。第１列ドライバ１７８は赤エミッタ１７０ａおよび緑エミッタ１７２ａを駆動する。青エミッタ１６８ａおよび１６８ｃは一緒につながれて、第２列ドライバ１８０によって駆動される。第３列ドライバ１８２は緑エミッタ１７４ａおよび赤エミッタ１７６ａを駆動し、他方、第４列ドライバ１８４は赤エミッタ１７０ｂおよび緑エミッタ１７２ｂを駆動する。第５列ドライバ１８６は１６８ｄと、それにつながれた青エミッタ１６８ｂを駆動する。緑エミッタ１７４ｂおよび赤エミッタ１７６ｂは第６列ドライバ１８８によって駆動され、他方、第７列ドライバ１９０は赤エミッタ１７０ｃおよび緑エミッタ１７２ｃを駆動する。第８列ドライバ１９２は緑エミッタ１７４ｃおよび赤エミッタ１７６ｃを駆動し、他方、第９列ドライバ１９４は赤エミッタ１７０ｄおよび緑エミッタ１７２ｄを駆動する。最後に、第１０列ドライバ１９６は緑エミッタ１７４ｄおよび赤エミッタ１７６ｄを駆動する。

【００４２】

行ドライバは各ピクセル行の赤、緑、および青エミッタを駆動する。行ドライバ１９８は青エミッタ１６８ｃ、１６８ｄのほかに、赤エミッタ１７０ａ、１７０ｂ、１７０ｃ、および１７０ｄと、緑エミッタ１７４ａ、１７４ｂ、１７４ｃ、および１７４ｄを駆動する。行ドライバ２００は緑エミッタ１７２ａ、１７２ｂ、１７２ｃ、および１７２ｄ、赤エミッタ１７６ａ、１７６ｂ、１７６ｃ、および１７６ｄ、そして青エミッタ１６８ａおよび１６８ｂを駆動する。各エミッタは、従来技術のエミッタが１つのピクセル要素中のランダムな場所で不連続な明るさの値で駆動されるのと異なり、１つのピクセル要素中の特定の場所で連続的な明るさの値で駆動できる。

【００４３】

この駆動マトリックスは、与えられた画像を提供するために、トライアド配置用の従来技術の２×１２の駆動マトリックスよりも約１６．６％少ない列ドライバを使用する。青エミッタが組み合わされる（１６８ａおよび１６８ｃ；１６８ｂおよび１６８ｄ）ため、列ラインを少なくできる。ドライバのタイプ、電圧、およびタイミングは各々のデバイス技術に関して従来既知のものと同じようにすることができる。

【００４４】

三色ピクセル要素配置および駆動マトリックスの別の実施の形態が図１２および１３に示

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されている。図１２は各アレイ行に４個ずつ横に並べた８個の三色ピクセル要素を含む配置２０１である。各三色ピクセル要素は、正方形あるいは長方形でよく、各行に３個の単位面積の多角形を含む２つの行を含み、各単位面積多角形を１個のエミッタが占有する。少なくとも１つの単位面積多角形は他の単位面積多角形の面積の少なくとも２倍であって、青エミッタ２１０ａ、２１０ｂ、２１０ｃ、２１０ｄ、２２０ａ、および２２０ｃによって占有される。青エミッタ２１０ａ、２１０ｂ、２１０ｃ、２１０ｄ、２２０ａ、および２２０ｃは単一のエミッタとして形成できるか、あるいは互いに配線でつながれた２つの別々の青エミッタとして形成できる。この配置２０１において、青エミッタ２１０ｂと２１０ｄはジグザグ配置になっており、図１２に示すように、より小型（赤および緑エミッタの寸法）の青エミッタが、より大型の青エミッタと縦方向で揃うようにアレイの端部に位置している。例えば、青エミッタ２２２ａ、２２４ａはジグザグ配置の青エミッタ２１０ｃの両側で縦にずらして配置されており、また青エミッタ２２２ｂ、２２４ｂはジグザグ配置の青エミッタ２１０ｄの両側で縦にずらして配置されている。

【００４５】

図１２に示すように、青エミッタ２１０ａ、２１０ｂ、２１０ｃ、２１０ｄ、２２０ａ、２２０ｃ、２２２ａ、２２２ｂ、２２４ａ、および２２４ｂは赤エミッタと緑エミッタとの間に配置されている。赤エミッタ２０２ａ、２０２ｂ、２０２ｃ、および２０２ｄは第１アレイ行の第１ピクセル行に、また緑エミッタ２０４ａ、２０４ｂ、２０４ｃ、および２０４ｄは第１アレイ行の第２ピクセル行に、それぞれ、第１、第２、第３、および第４三色ピクセル要素の青エミッタ２１０ａ、２１０ｂ、２１０ｃ＆２２２ａ、および２１０ｄ＆２２２ｂの左側の配置されている。緑エミッタ２０６ａ、２０６ｂ、２０６ｃ、および２０６ｄは第１アレイ行の第１ピクセル行に、また赤エミッタ２０８ａ、２０８ｂ、２０８ｃ、および２０８ｄは第１アレイ行の第２ピクセル行に、それぞれ、第１、第２、第３、および第４三色ピクセル要素の青エミッタ２１０ａ、２１０ｂ、２１０ｃ＆２２２ａ、および２１０ｄ＆２２２ｂの右側の配置されている。赤エミッタ２１２ａ、２１２ｂ、２１２ｃ、および２１２ｄは第２アレイ行の第１ピクセル行に、また緑エミッタ２１４ａ、２１４ｂ、２１４ｃ、および２１４ｄは第２アレイ行の第２ピクセル行に、それぞれ、第１、第２、第３、および第４三色ピクセル要素の青エミッタ２２０ａ、２２０ｂ、２２０ｃ＆２２４ａ、および２１０ｄ＆２２４ｂの左側の配置されている。緑エミッタ２１６ａ、２１６ｂ、２１６ｃ、および２１６ｄは第２アレイ行の第１ピクセル行に、また赤エミッタ２１８ａ、２１８ｂ、２１８ｃ、および２１８ｄは第２アレイ行の第２ピクセル行に、それぞれ、第１、第２、第３、および第４三色ピクセル要素の青エミッタ２２０ａ、２２０ｂ、２２０ｃ＆２２４ａ、および２１０ｄ＆２２４ｂの右側の配置されている。当業者は理解されるように、このアレイにおいて大型の青エミッタはジグザグ配置になっており、大型の青エミッタと縦方向で揃うように端部に小型の青エミッタを有することが必要になる。

【００４６】

図１３は図１２に示す三色ピクセル要素配置２０１用の例示的駆動マトリックス２５４の図である。図１３に示された例示的駆動マトリックス２５４は２×１０の駆動マトリックスを含み、ここでは８つの列ドライバが３２個の赤エミッタと８個の緑エミッタを駆動し、２つの列ドライバが１０個の青エミッタを駆動している。第１列ドライバ２３４は赤エミッタ２０２ａ、２１２ａおよび緑エミッタ２０４ａ、２１４ａを駆動する。青エミッタ２１０ａ、２２０ａは青エミッタ２２２ａ、２１０ｃ、２２４ａと一緒につながれて、第２列ドライバ２３６によって駆動される。第３列ドライバ２３８は緑エミッタ２０６ａ、２１６ａおよび赤エミッタ２０８ａ、２１８ａを駆動し、他方、第４列ドライバ２４０は赤エミッタ２０２ｂ、２１２ｂおよび緑エミッタ２０４ｂ、２１４ｂを駆動する。第５列ドライバ２４２は、２２２ｂ、２１０ｄ、２２４ｂと、それらと一緒につながれた青エミッタ２１０ｂ、２２０ｂとを駆動する。緑エミッタ２０６ｂ、２１６ｂおよび赤エミッタ２０８ｂ、２１８ｂは第６列ドライバ２４４によって駆動され、また第７列ドライバ２４６は赤エミッタ２０２ｃ、２１２ｃおよび緑エミッタ２０４ｃ、２１４ｃを駆動する。第

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８列ドライバ２４８は緑エミッタ２０６ｃ、２１６ｃおよび赤エミッタ２０８ｃ、２１８ｃを駆動し、他方、第９列ドライバ２５０は赤エミッタ２０２ｄ、２１２ｄおよび緑エミッタ２０４ｄ、２１４ｄを駆動する。最後に、第１０列ドライバ２５２は緑エミッタ２０６ｄ、２１６ｄおよび赤エミッタ２０８ｄ、２１８ｄを駆動する。

【００４７】

行ドライバは各ピクセル行の赤、緑、および青エミッタを駆動する。行ドライバ２２６は青エミッタ２１０ａ、２１０ｂ、２２２ａ、２２２ｂのほかに、赤エミッタ２０２ａ、２０２ｂ、２０２ｃ、および２０２ｄと、緑エミッタ２０６ａ、２０６ｂ、２０６ｃ、および２０６ｄを駆動する。行ドライバ２２８は緑エミッタ２０４ａ、２０４ｂ、２０４ｃ、および２０４ｄ、赤エミッタ２０８ａ、２０８ｂ、２０８ｃ、および２０８ｄ、そして青エミッタ２１０ｃ、２１０ｄを駆動する。行ドライバ２３０は青エミッタ２２０ａ、２２０ｂのほかに、赤エミッタ２１２ａ、２１２ｂ、２１２ｃ、および２１２ｄと、緑エミッタ２１６ａ、２１６ｂ、２１６ｃ、および２１６ｄを駆動する。行ドライバ２３２は緑エミッタ２１４ａ、２１４ｂ、２１４ｃ、および２１４ｄ、赤エミッタ２１８ａ、２１８ｂ、２１８ｃ、および２１８ｄ、そして青エミッタ２２４ａ、２２４ｂを駆動する。各エミッタは、従来技術のエミッタが１つのピクセル要素中のランダムな場所で不連続な明るさの値で駆動されるのと異なり、１つのピクセル要素中の特定の場所で連続的な明るさの値で駆動できる。

【００４８】

この駆動マトリックスは、与えられた画像を提供するために、トライアド配置用の従来技術の２×１２の駆動マトリックスよりも約１６．６％少ない列ドライバを使用する。青エミッタが組み合わされる（２１０ａ、２２０ａ、および２１０ｃ、２２２ａ、２２４ａ；２１０ｂ、２２０ｂ、および２１０ｄ、２２２ｂ、２２４ｂ）ため、列ラインを少なくできる。ドライバのタイプ、電圧、およびタイミングは各々のデバイス技術に関して従来既知のものと同じようにすることができる。

【００４９】

ドット・インバージョンは、上に述べたように、列および行の形に配置したパネルを駆動するための選択肢として好適な方法である。青、赤、および緑の各エミッタは交番的な極性で駆動される。例えば、第１の駆動事象では、赤エミッタが正の電圧で駆動され、次の事象では同じ赤エミッタが負の電圧で駆動される。図６、８、１０、および１２に示された配置を使用する場合、それは第１三色ピクセル要素の青エミッタの列ラインを、二番目に近い隣接する三色ピクセル要素（例えば、第３三色ピクセル要素の青エミッタ）と接続する。同様に、第２三色ピクセル要素の青エミッタは、二番目に近い隣接する三色ピクセル要素（例えば、第４三色ピクセル要素の青エミッタ）と接続される。“二番目に近い隣接する”三色ピクセル要素は、互いに組み合わされた一対の三色ピクセル要素のうち、１つおきの青エミッタとして構成することができる。例えば、第１三色ピクセル要素が第３三色ピクセル要素と接続され、第２三色ピクセル要素が第４三色ピクセル要素と接続され、第５三色ピクセル要素が第７三色ピクセル要素と接続され、第６三色ピクセル要素が第８三色ピクセル要素と接続される、等々である。この場合、“フリッカー”の発生は低減または解消される。

【００５０】

この配置を使用する場合、もしもクロストークが発生してもそれが各列について同じであることを保証するために、すべての列ラインはそれに隣接するラインと逆極性の信号で駆動されなければならない。もしもアレイがこのように駆動されなければ、非対称なクロストークがスクリーン上に目に見えるアーティファクトとなって現れよう。更に、“フリッカー”が発生しないことを確かなものとするために、別々のピクセル要素に属する隣接する赤および緑エミッタも互いに逆極性の信号で駆動されなければならない。例えば、図１４は、図６と同じ配置に対する赤、緑、および青エミッタの極性を示している。ここで、緑エミッタ５６ａ（負の値を有する）は赤エミッタ５２ｂ（正の値を有する）とは反対の極性を持たなければならない。この配置は、列ラインが１つの青エミッタを、二番目に近

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い隣接する三色ピクセル要素の青エミッタへ接続するため、“フリッカー”を解消する。青エミッタ上に示された極性は列ラインのそれであり、青エミッタに記憶されている極性ではない。青エミッタの極性はその青エミッタをアドレッシングしている活性行によって決められ、それは二番目に近い隣接する三色ピクセル要素の青エミッタとつながっている。

【００５１】

赤、緑、および青エミッタの極性による別のドット・インバージョンを示す別の例が図１５および１６に示されている。図１５および１６は両方とも、図８に示された配置１１４をベースとしており、付加的な横配置（図１５の１１５；図１６の３１４）を含んでいる。図１５で、赤エミッタ１２０ａ（正の値を有する）は緑エミッタ１２２ａ（負の値を有する）の極性とは反対の極性の信号によって駆動されなければならない。青エミッタ１３０ａ（負の値を有する）は青エミッタ１３２ａ（正の値を有する）の極性とは反対の極性の信号によって駆動されなければならない。赤エミッタ１２４ａ（正の値を有する）は緑エミッタ１２６ａ（負の値を有する）の極性とは反対の極性の信号によって駆動されなければならない。同じ極性が付加的な横配置１１５で複製される。この配置もまた、列ラインが１つの青エミッタを二番目に近い隣接する三色ピクセル要素の青エミッタと接続するため、“フリッカー”を解消する。

【００５２】

図１６には、横配置３１４を備えた別のドット・インバージョン方式が示されている。ここで、赤エミッタ１２０ａおよび１２６ａと、緑エミッタ１２２ａおよび１２４ａ（正の値を有する）は、赤エミッタ３０２ａおよび３０８ａと、緑エミッタ３０４ａおよび３０６ａ（負の値を有する）を駆動する信号の極性とは反対の極性の信号によって駆動されなければならない。同じことが青エミッタ１３０ａおよび１３２ａ（正の値を有する）と、青エミッタ３１０ａおよび３１２ａ（負の値を有する）とにも当てはまる。この配置もまた、列ラインが１つの青エミッタを二番目に近い隣接する三色ピクセル要素の青エミッタと接続するため、“フリッカー”を解消する。

【００５３】

赤、緑、および青エミッタの極性によるドット・インバージョンを示す別の例が図１７に示されており、これは図１０に示した配置１６４をベースにしており、別の横配置３６４を含んでいる。ここで、赤エミッタ１７０ａおよび緑エミッタ１７４ａ（正の値を有する）と、緑エミッタ１７２ａおよび赤エミッタ１７６ａ（負の値を有する）は、それぞれ赤エミッタ３７０ａおよび緑エミッタ３７４ａ（正の値を有する）と、緑エミッタ３７２ａおよび赤エミッタ３７６ａ（負の値を有する）と同じ極性の信号によって駆動されなければならない。青エミッタ１６８ａ（正の値を有する）は青エミッタ３６８ａ（負の値を有する）とは反対の極性の信号によって駆動されなければならない。この配置もまた、列ラインが１つの青エミッタを二番目に近い隣接する三色ピクセル要素の青エミッタと接続するため、“フリッカー”を解消する。

【００５４】

図１８には、横配置１６４、２６４を備える別のドット・インバージョン方式が示されている。ここで、赤エミッタ１７０ａおよび１７６ａと、緑エミッタ１７２ａおよび１７４ａ（正の値を有する）は、赤エミッタ３７０ａおよび３７６ａと、緑エミッタ３７２ａおよび３７４ａ（負の値を有する）を駆動する信号の極性とは反対の極性の信号によって駆動されなければならない。同じことが青エミッタ１６８ａ（負の値を有する）と、青エミッタ３６８ａ（正の値を有する）にも当てはまる。この配置もまた、列ラインが１つの青エミッタを二番目に近い隣接する三色ピクセル要素の青エミッタと接続するため、“フリッカー”を解消する。

【００５５】

赤、緑、および青エミッタの極性によるドット・インバージョンの別の例が図１９に示されており、これは図１２に示した配置２０１をベースにしている。ここで、赤エミッタ２０２ａおよび緑エミッタ２０６ａ（正の値を有する）と、緑エミッタ２０４ａおよび赤エ

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ミッタ２０８ａ（負の値を有する）とは、それぞれ赤エミッタ２１２ａおよび緑エミッタ２１６ａ（正の値を有する）と、緑エミッタ２１４ａおよび赤エミッタ２１８６ａ（負の値を有する）と同じ極性の信号によって駆動されなければならない。青エミッタ２１０ａ（正の値を有し、負の値を記憶する）は青エミッタ２２０ａ（負の値を有し、正の値を記憶する）とは反対の極性の信号によって駆動されなければならない。青エミッタ２１０ｃ（正の値を有し、負の値を記憶する）は青エミッタ２２０ｃ（負の値を有し、正の値を記憶する）とは反対の極性の信号によって駆動されなければならない。他方、青エミッタ２２２ａおよび２２４ｂは青エミッタ２２２ｂおよび２２４ａとは反対の極性の信号によって駆動されなければならない。当業者はここに説明した極性について理解されよう。この配置もまた、列ラインが１つの青エミッタを二番目に近い隣接する三色ピクセル要素の青エミッタと接続するため、“フリッカー”を解消する。

【００５６】

図２０には、横配置２０１を備える別のドット・インバージョン方式が示されている。ここで、赤エミッタ２０２ａ、２０８ａおよび緑エミッタ２０４ａ、２０６ａ（正の値を有する）は、赤エミッタ２１２ａ、２１８ａおよび緑エミッタ２１４ａ、２１６ａ（負の値を有する）とは反対の極性の信号によって駆動されなければならない。同じことが青エミッタ２１０ａ（負の値を有し、正の値を記憶する）および青エミッタ２２０ａ（正の値を有し、負の値を記憶する）にも当てはまる。青エミッタ２１０ｃ（負の値を有し、正の値を記憶する）は青エミッタ２２０ｃ（正の値を有し、負の値を記憶する）とは反対の極性の信号によって駆動されなければならない。他方、青エミッタ２２２ａおよび２２４ｂは青エミッタ２２２ｂおよび２２４ａとは反対の極性の信号によって駆動されなければならない。当業者はここに説明した極性について理解されよう。この配置もまた、列ラインが１つの青エミッタを二番目に近い隣接する三色ピクセル要素の青エミッタと接続するため、“フリッカー”を解消する。

【００５７】

上述の配置の任意のものに従う三色ピクセル要素は、個々のエミッタを適切に駆動することにより動作させることができる。各々の行および列ドライバを介して、個々の行ラインおよび列ラインへ電圧が供給される。この時点で、各エミッタが適正な電圧に従って点灯し、ディスプレイ上に画像を生成する。

【００５８】

１つの青エミッタの列ラインを二番目に近い隣接する三色ピクセル要素からの青エミッタの列ラインへつなぐことによって、“フリッカー”を実質的に解消することができ、同時に列ドライバの数を減らすことができる。

【００５９】

本発明は例示的な実施の形態について説明してきたが、本発明のスコープから外れることなく、これの要素に対して多様な変更を行い、また置換を行いうることを当業者は理解すべきである。更に、その本質的なスコープから外れることなく、教えるところに対して特別な状況や材料を適用するために多くの修正を施すことができる。従って、本発明は、本発明を実施するために考え得る最良のものとして開示された特別な実施の形態に限定されることなく、却って本発明は添付される特許請求の範囲のスコープに含まれるすべての実施の形態を包含するであろう。

【図面の簡単な説明】

ここで図面を参照するが、同様な要素には同じ番号をつけてある。

【図１】

三色ピクセル要素の配置。

【図２】

三色ピクセル要素の別の配置。

【図３】

三色ピクセル要素のアレイ。

【図４】

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横に整列させた２個の三色ピクセル要素の配置。
【図５】
図４のピクセル配置に対する例示的駆動マトリックスを示す図。
【図６】
横に整列させた４個の三色ピクセル要素の配置。
【図７】
図６のピクセル配置に対する例示的駆動マトリックスを示す図。
【図８】
横に整列させた４個の三色ピクセル要素の別の配置。
【図９】
図８のピクセル配置に対する例示的駆動マトリックスを示す図。
【図１０】
横に整列させた４個の三色ピクセル要素の別の配置。
【図１１】
図１０のピクセル配置に対する例示的駆動マトリックスを示す図。
【図１２】
横に整列させた４個の三色ピクセル要素の別の配置。
【図１３】
図１２のピクセル配置に対する例示的駆動マトリックスを示す図。
【図１４】
図６のピクセル配置に対するドット・インバージョン方式を示す図。
【図１５】
図８のピクセル配置に対するドット・インバージョン方式を示す別の図。
【図１６】
図１５に対する別の図であって、図８のピクセル配置に対するドット・インバージョン方式を示す図。
【図１７】
図１０のピクセル配置に対するドット・インバージョン方式を示す別の図。
【図１８】
図１７に対する別の図であって、図１０のピクセル配置に対するドット・インバージョン方式を示す図。
【図１９】
図１２のピクセル配置に対するドット・インバージョン方式を示す別の図。および
【図２０】
図１９に対する別の図であって、図１０のピクセル配置に対するドット・インバージョン方式を示す図。

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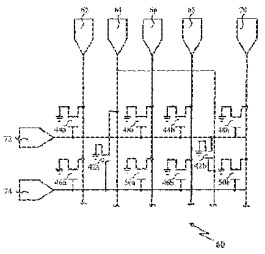
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(54) Title: ARRANGEMENT OF COLOR PIXELS FOR FULL COLOR IMAGING DEVICES WITH SIMPLIFIED ADDRESSING



(57) Abstract: An array and row and column line architecture for a display is disclosed. The array consists of a plurality of row and column positions and a plurality of three-color pixel elements. A three-color pixel element can comprise a blue emitter, a pair of red emitters, and a pair of green emitters. Several designs for the three-colour pixel element are contemplated. The drive matrix consists of a plurality of row and column drivers to drive the individual emitters. The row drivers drive the red, green and blue emitters in each row. The red and green emitters in each column are driven by a single column driver. However, a single column driver can drive two column lines of blue emitters, a first column line and a second column line of the next nearest neighboring three-color pixel element. Methods of driving a three-color pixel element are also disclosed.

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SPECIFICATION

# ARRANGEMENT OF COLOR PIXELS FOR FULL COLOR IMAGING DEVICES WITH SIMPLIFIED ADDRESSING

## BACKGROUND

The present application relates to color pixel arrangements, and specifically to color pixel arrangements used in electronic imaging devices and displays.

Full color perception is produced in the eye by three-color receptor nerve cell types called cones. The three types are sensitive to different wavelengths of light: long, medium, and short (" red", " green", and " blue", respectively). The relative density of the three differs significantly from one another. There are slightly more red receptors than green receptors. There are very few blue receptors compared to red or green receptors. In addition to the color receptors, there are relative wavelength insensitive receptors called rods that contribute to monochrome night vision.

The human vision system processes the information detected by the eye in several perceptual channels: luminance, chromanance, and motion. Motion is only important for flicker threshold to the imaging system designer. The luminance channel takes the input from all of the available receptors, cones and rods. It is " color blind". It processes the information in such a manner that the contrast of edges is enhanced. The chromanance channel does not have edge contrast enhancement. Since the luminance channel uses and enhances every receptor, the resolution of the luminance channel is several times higher than the chromanance channel. The blue receptor contribution to luminance perception is less than 5%, or one part in twenty. Thus, the error introduced by lowering the blue resolution by one octave will be barely noticeable by the most perceptive viewer, if at all, as experiments at NASA, Ames Research Center (R. Martin, J. Gille, J. Larimer, Detectability of Reduced Blue Pixel Count in Projection Displays, SID Digest 1993) have demonstrated.

Color perception is influenced by a process called " assimilation", or the Von Bezold color blending effect. This is what allows separate color pixels (or sub-pixels or emitters) of a display to be perceived as the mixed color. This blending effect happens over a given angular distance in the field of view. Because of the relatively scarce blue receptors, this blending happens over a greater angle for blue than for red or green. This distance is approximately 0.25° for blue, while for red or green it is approximately 0.12°. At a viewing

distance of twelve inches, 0.25° subtends 50 mils (1,270 μ) on a display. Thus, if the blue pixel pitch is less than half (625μ) of this blending pitch, the colors will blend without loss of picture quality.

The present state of the art of color single plane imaging matrix, for flat panel displays and solid state camera chips is the (red-green-blue) RGB color triad. The system takes advantage of the Von Bezold effect by separating the three colors and placing equal spatial frequency weight on each color. Two manufacturers have shown improvements in display design by using dual or triple panels whose images are superimposed. One manufacturer of projection displays used three panels, red, green, and blue. The blue panel utilizes reduced resolution in accordance with the match between human vision requirements and the displayed image. Another manufacturer, Planar Systems of Beaverton, Oregon employs a " Multi-row Addressing" technique having a dual electroluminescent panel, one panel with red and green pixels, the other with blue pixels to build a developmental model. The blue pixels have reduced resolution in the vertical axis only. This allows the blue phosphors to be excited at a higher rate than the red and green pixels, thus overcoming a problem with lower blue phosphor brightness. The problem with the prior art is that in providing the same matched resolution balance between human vision and display, additional display panels/planes are used, along with additional driver electronics.

Other display methods such as disclosed in U.S. Patent No. 6,008,868 to Silverbrook use binary controlled emitters. In using binary controlled emitters, each emitter has a discrete luminance value, therefore, requiring the display to have an exact area to luminance relationship. This prior art used reduced blue " bit depth" built into the panel in accordance with human vision's lower blue color space increments. Conventional display methods also use a single color in a vertical stripe. Since conventional stripes have limited the Modulation Transfer Function (MTF), high spatial frequency resolution, in the horizontal axis, stripes of a single color are non-optimal.

Display devices can include liquid crystal display (LCD) devices. LCD devices have been used in a variety of applications, including calculators, watches, color televisions, and computer monitors. A conventional liquid crystal panel typically includes a pair of transparent glass substrates that are arranged in parallel to define a narrow gap therebetween that is filled with a liquid crystal material. A plurality of pixel electrodes typically are disposed in a matrix on an inner surface of one of the transparent glass substrates, and a plurality of common electrodes corresponding to the pixel electrodes are arranged on the



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inner surface of the other substrate of the two transparent glass substrates. A liquid crystal cell is defined by opposing pixel electrodes and common electrodes. Images are displayed by controlling light transmission through the cell according to a voltage applied to the electrode pair.

In a conventional active matrix LCD device, a plurality of row lines are formed on one substrate, transverse to a plurality of column lines. A plurality of pixel electrodes are disposed on a corresponding plurality of pixels regions defined by the row and column lines. A respective thin-film transistor (TFT) is formed on a respective one of the pixel regions, and drives the pixel electrode formed thereon.

Repeatedly driving a liquid crystal cell with voltages having the same polarity can cause an electrochemical change in the pixel electrode and the common electrode due to migration of ionic impurities within the liquid crystal material. This change can significantly reduce display sensitivity and brightness. Accordingly, it is generally desirable to repeatedly invert the polarity of the voltage applied to the liquid crystal cell in order to prevent this phenomenon. This method of driving a liquid crystal cell is known as " inversion". There are several inversion schemes that are known in the art, including "frame inversion", "column inversion", "line (or row) inversion", or "dot inversion".

A conventional dot inversion driving technique involves applying column line voltages that have different polarities to adjacent sub-pixel electrodes, for example, by driving alternating pixel elements with negative and positive voltages. Typically, the polarity of the driving voltage applied to a given pixel electrode is inverted each time the voltage is applied. The applied voltage is stored on the sub-pixel, row by row, alternating with each row. The result is a "checker board" pattern of polarities on the two dimensional matrix of sub-pixels.

Although the above-mentioned conventional dot-inversion driving technique is useful to prevent ion migration in the liquid crystal material and lowering perceived "flicker" in the display. Special care must be taken when applying "dot inversion" to the novel arrangement of the three-color pixel elements, and its associated drive structure to avoid this "flicker".

## SUMMARY

The drawbacks and disadvantages of the prior art are overcome by the arrangement of color pixels for full color imaging devices with simplified addressing.



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An array and row and column line architecture for a display is disclosed. The array consists of a plurality of row and column positions and a plurality of three-color pixel elements. Each three-color pixel element can comprise a blue emitter, a pair of red emitters, and a pair of green emitters. Several designs for the three-color pixel element are contemplated. The drive matrix consists of a plurality of row and column drivers to drive the individual emitters. The row drivers drive the red, green and blue emitters in each row. The red and green emitters in each column are driven by a single column driver. However, a single column driver can drive two column lines of blue emitters, a first column line and a second column line of the next nearest neighboring three-color pixel element. Thus, the number of column lines and associated driver electronics, as used in the prior art, are reduced in the present invention.

A drive matrix for an array of three-color pixel elements is also disclosed. While the array consists of a plurality of rows and columns of each three-color pixel element of the present invention, the drive matrix consists of a plurality of row and column drivers to drive the individual emitters. The row drivers drive the red, green and blue emitters in each row. The red and green emitters in each column are driven by a single column driver. However, a single column driver can drive two column lines of blue emitters, a first column line and a second column line of the next nearest neighboring three-color pixel element. Thus, also reducing the number of column lines and associated driver electronics.

Methods of driving a three-color pixel element in a display are disclosed. The method comprises providing a three-color pixel element having any of several contemplated designs. The blue emitter, the red emitters, and the green emitters are driven, such that the blue emitter of the three-color pixel element is coupled to a blue emitter of a next nearest neighboring three-color pixel element.

## BRIEF DESCRIPTION OF THE DRAWINGS

Referring now to the figures, wherein like elements are numbered alike:

FIG. 1 is an arrangement of a three-color pixel element;

FIG. 2 is another arrangement of a three-color pixel element;

FIG. 3 is an array of three-color pixel elements;

FIG. 4 is an arrangement of two three-color pixel elements, aligned horizontally;

FIG. 5 is a diagram showing an illustrative drive matrix for the pixel arrangement of FIG. 4;



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FIG. 6 is an arrangement of four three-color pixel elements, aligned horizontally;

FIG. 7 is a diagram showing an illustrative drive matrix for the pixel arrangement of FIG. 6;

FIG. 8 is another arrangement of four three-color pixel elements, aligned horizontally;

FIG. 9 is a diagram showing an illustrative drive matrix for the pixel arrangement of FIG. 8;

FIG. 10 is another arrangement of four three-color pixel elements, aligned horizontally;

FIG. 11 is a diagram showing an illustrative drive matrix for the pixel arrangement of FIG. 10;

FIG. 12 is another arrangement of four three-color pixel elements, aligned horizontally;

FIG. 13 is a diagram showing an illustrative drive matrix for the pixel arrangement of FIG. 12;

FIG. 14 is a diagram illustrating a dot inversion scheme for the pixel arrangement of FIG. 6;

FIG. 15 is another diagram illustrating a dot inversion scheme for the pixel arrangement of FIG. 8;

FIG. 16 is an alternate diagram for FIG. 15 also illustrating a dot inversion scheme for the pixel arrangement of FIG. 8;

FIG. 17 is another diagram illustrating a dot inversion scheme for the pixel arrangement of FIG. 10;

FIG. 18 is an alternate diagram for FIG. 17 also illustrating a dot inversion scheme for the pixel arrangement of FIG. 10;

FIG. 19 is another diagram illustrating a dot inversion scheme for the pixel arrangement of FIG. 12; and

FIG. 20 is an alternate diagram for FIG. 19 also illustrating a dot inversion scheme for the pixel arrangement of FIG. 10.

## DETAILED DESCRIPTION

Those of ordinary skill in the art will realize that the following description of the present invention is illustrative only and not in any way limiting. Other embodiments of the invention will readily suggest themselves to such skilled persons.



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The arrangement of three-color pixel elements influences the effect of the blending of the colors of the pixels. Each three-color pixel element comprises at least a blue emitter, a red emitter, and a green emitter and can be group in several different designs. A plurality of row drivers and column (or column line) drivers are operated to drive the individual emitters. The row drivers drive the red, green and blue emitters in each row. The red and green emitters in each column are driven by a single column driver. However, reduction of the number of column drivers can be achieved by using a single column driver to drive two column lines of blue emitters, a first column line and a second column line of the next nearest neighboring three-color pixel element. This arrangement aids in the driving of the display device, especially liquid crystal display devices, by dot inversion methods.

FIG. 1 shows an illustrative embodiment of an arrangement of a three-color pixel element 10. The three-color pixel element consists of a blue emitter 12, two red emitters 14, and two green emitters 16. The three-color pixel element 10 is square shaped and is centered at the origin of an X, Y coordinate system. The blue emitter 12 is centered at the origin of the square and extends into the first, second, third, and fourth quadrants of the X, Y coordinate system. A pair of red emitters 14 are disposed in opposing quadrants (i.e., the second and the fourth quadrants), and a pair of green emitters 16 are disposed in opposing quadrants (i.e., the first and the third quadrants), occupying the portions of the quadrants not occupied by the blue emitter 12. As shown in FIG. 1, the blue emitter 12 is square shaped, having corners aligned at the X and Y axes of the coordinate system, and the opposing pairs of red 14 and green 16 emitters are generally square shaped, having truncated inwardly-facing corners forming edges parallel to the sides of the blue emitter 12.

Another illustrative embodiment of a three-color pixel element 20 is shown in FIG. 2. In this embodiment, the three-color pixel element 20 is also square shaped and is centered at the origin of an X, Y coordinate system, extending into the first, second, third, and fourth quadrants of the X, Y coordinate system. The blue emitter 22 is centered at the origin of the square and is square shaped having sides aligned parallel to the X and Y axes of the coordinate system. A pair of red emitters 24 are disposed in opposing quadrants (i.e., the second and the fourth quadrants), and a pair of green emitters 26 are disposed in opposing quadrants (i.e., the first and the third quadrants), occupying the portions of the quadrants not occupied by the blue emitter 22. In this embodiment, the opposing pairs of red emitters 24 and green emitters 26 are L-shaped. The L-shaped emitters envelop the blue emitter having the inside corners of the L-shaped emitters aligned with the corners of the blue emitter.



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According to a preferred embodiment, the three-color pixel element has equal red, green and blue emitter areas. This may be achieved by placing in the center of the three-color pixel element a blue emitter having an area larger than the areas of the individual red and green emitters. Those of ordinary skill in the art will recognize that, in other embodiments, the area of the blue emitter may be smaller in relation to either the red or green emitters. The blue emitter can be brighter than either the red or green emitters can, or it can be the same brightness as the red and green emitters can. For example, the drive-to-luminance gain of the blue emitter may be greater than that of the red or green emitters.

Although the above description is illustrative of a preferred embodiment, those of ordinary skill in the art will readily recognize other alternatives. For example, the emitters may have different shapes, such as rounded or polygonal. They may also be diffuse rather than having sharp edges. The three-color pixel elements need not be arranged with equal spatial frequency in each axis. The aperture ratio between the emitters may be minimized to substantially non-existent or it may be very pronounced, and the space may also be different colors, including black or white. The emitters may be any technology known or invented in the future, such as displays using Liquid Crystal (LCD), Plasma, Thin Film Electroluminescent, Discrete Light Emitting Diode (LED), Polymer Light Emitting Diode, Electro-Chromic, Electro-Mechanical, Incandescent Bulb, or Field Emission excited phosphor (FED).

FIG. 3 is an array 30 of the three-color pixel elements 10 of FIG. 1. The array 30 is repeated across a panel or chip to complete a device with a desired matrix resolution. The repeating three-color pixel elements 10 form a "checker board" of alternating red 32 and green 34 emitters with blue emitters 36 distributed evenly across the device, but at half the resolution of the red 32 and green 34 emitters.

One advantage of the three-color pixel element array is improved resolution of color displays. This occurs since only the red and green emitters contribute significantly to the perception of high resolution in the luminance channel. Thus, reducing the number of blue emitters and replacing some with red and green emitters improves resolution by more closely matching human vision.

Dividing the red and green emitters in half in the vertical axis to increase spatial addressability is an improvement over the conventional vertical single color stripe of the prior art. An alternating "checkerboard" of red and green emitters allows the Modulation Transfer



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Function (MTF), high spatial frequency resolution, to increase in both the horizontal and the vertical axes.

The three-color pixel element array may also be used in solid state image capture devices found in modern consumer video cameras and electronic still cameras. An advantage of using the reduced blue emitter resolution in both image capture and display is that stored images do not need to supply the same resolution for each color in storage or processing. This presents potential savings during coding, compression, and decompression of electronically stored images, including software and hardware in electronic imaging and display systems such as computers, video games, and television, including High Definition Television (HDTV) recording, playback, broadcasting, and display.

FIG. 4 is an arrangement 40 of two three-color pixel elements aligned horizontally. The three-color pixel elements are square-shaped and each is centered at each origin of an X, Y coordinate system. The blue emitter 42a is centered at the origin of the square of the first three-color pixel element and extends into the first, second, third, and fourth quadrants of its X, Y coordinate system. Blue emitter 42b is centered at the origin of the square of the second three-color pixel element and extends into the first, second, third, and fourth quadrants of its X, Y coordinate system. Red emitters 44a and 44b are disposed in the second quadrants of the first and second pixel elements, respectively. Green emitters 46a and 46b are disposed in the third quadrants of the first pixel and second pixel elements, respectively. Green emitters 48a and 48b are disposed in the first quadrant of the first pixel and second pixel elements. Red emitters 50a and 50b are disposed in the fourth quadrants of the first pixel and second pixel elements, respectively. As shown in FIG. 4, each blue emitter (e.g., 42a) is square-shaped having corners aligned at the X and Y axes of each coordinate system. The opposing pairs of red emitters (e.g., 44a and 50a) and green emitters (e.g., 48a and 46a) are generally square shaped, having truncated inwardly-facing corners forming edges parallel to the sides of the blue emitter (e.g., 42a). In each three-color pixel element, the red and green emitters occupy the portion of the quadrant not occupied by the blue emitter.

FIG. 5 is a diagram of an illustrative drive matrix 60 for the three-color pixel element arrangement 40. The liquid crystal display emitters are schematically represented as capacitors for convenience. Each liquid crystal display emitter is coupled to the row and column lines through a select transistor, as in FIG. 5 with red emitter 44a. The liquid crystal display emitters are coupled through the gate of the select transistor to the row line. The column line is coupled to the first source/drain terminal of the select transistor and the second



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source/drain terminal of the select transistor, which is coupled to the liquid crystal display emitter. A fixed potential is coupled to the liquid crystal display emitter. The liquid crystal display emitters of the invention may be active electronic devices such as Thin Film Transistors (TFT) found in Active Matrix Liquid Crystal Display (AMLCD), or Charge Coupled Devices (CCD) as found in camera chips, or other suitable devices.

The illustrative drive matrix 60 shown in FIG. 5 consists of a 2 X 5 drive matrix, where four column drivers drive the red and green emitters and a single column driver drives the blue emitters. A first column driver 62 drives the red emitter 44a and the green emitter 46a. The blue emitters 42a and 42b are tied together and driven by a second column driver 64. A third column driver 66 drives the green emitter 48a and the red emitter 50a, while a fourth column driver 68 drives the red emitter 44b and the green emitter 46b. The green emitter 48b and the red emitter 50b are driven by a fifth column driver 70. Alternative embodiments, using at least four three-color pixel elements with two row drivers and ten column drivers, are presented further herein.

The row drivers drive the red, green and blue emitters in each row. Row driver 72 drives red emitters 44a and 44b, green emitters 48a and 48b, as well as blue emitter 42b. Row driver 74 drives green emitters 46a and 46b, red emitters 50a and 50b and blue emitter 42a. Each emitter can be driven at continuous luminance values at specific locations in a pixel element, unlike emitters in the prior art, which are driven at discrete luminance values at random locations in a pixel element.

The drive matrix uses approximately 16% fewer column drivers to present a given image than does a prior art 2 X 6-drive matrix for the triad arrangement. The column lines are reduced since the blue emitters 12 are combined. This entire arrangement can be turned 90 degrees such that the combined blue emitters 12 are driven by the same row driver. All such topologically identical variants known in the art are possible embodiments. In addition, the driver type, voltage, and timing can be the same as already known in the art for each device technology.

An alternative embodiment of an arrangement and drive matrix is illustrated in FIGS. 6 and 7. FIG. 6 is an arrangement 76 of four three-color pixel elements aligned horizontally. Each three-color pixel element is square-shaped and each is centered at each origin of an X, Y coordinate system. In this case, the blue emitters 80a, 80b, 80c, and 80d are centered at the origin of the square of each of the three-color pixel elements. The blue emitters 80a, 80b, 80c, and 80d extend into the first, second, third, and fourth quadrants of each X, Y coordinate



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system. Red emitters 52a, 52b, 52c, and 52d are disposed in the second quadrants of the first, second, third, and fourth three-color pixel elements, respectively. Green emitters 54a, 54b, 54c, and 54d are disposed in the third quadrants of the first, second, third, and fourth three-color pixel elements, respectively. Green emitters 56a, 56b, 56c, and 56d are disposed in the first quadrants of the first, second, third, and fourth three-color pixel elements, respectively. Red emitters 58a, 58b, 58c, and 58d are disposed in the fourth quadrants of the first, second, third, and fourth three-color pixel elements, respectively. As shown in FIG. 6, each blue emitter (e.g., 80a) is square-shaped, having corners aligned at the X and Y axes of each coordinate system. The opposing pairs of red emitters (e.g., 52a and 58a) and green emitters (e.g., 54a and 56a) are generally square shaped, having truncated inwardly-facing corners forming edges parallel to the sides of the blue emitter (e.g., 80a). In each three-color pixel element, the red and green emitters occupy the portion of the quadrant not occupied by the blue emitter.

FIG. 7 is a diagram of an illustrative drive matrix 78 for the arrangement 76. The illustrative drive matrix 78 shown in FIG. 7 consists of a 2 X 10 drive matrix, where eight column drivers drive the eight red and eight green emitters and two column drivers drive the four blue emitters. A first column driver 94 drives the red emitter 52a and the green emitter 54a. The blue emitters 80a and 80c are tied together and driven by a second column driver 96. A third column driver 98 drives the green emitter 56a and the red emitter 58a, while a fourth column driver 100 drives the red emitter 52b and the green emitter 54b. A fifth column driver 102 drives the blue emitter 80b, which is tied together with 80d. The green emitter 56b and the red emitter 58b are driven by a sixth column driver 104, while a seventh column driver 106 drives red emitter 52c and green emitter 54c. An eighth column driver 108 drives green emitter 56c and red emitter 58c, while a ninth column driver 110 drives red emitter 52d and green emitter 54d. Finally, a tenth column driver 112 drives green emitter 56d and red emitter 58d.

The row drivers drive the red, green and blue emitters in each pixel row. Row driver 90 drives red emitters 52a, 52b, 52c, and 52d, green emitters 56a, 56b, 56c, and 56d, as well as blue emitters 80c and 80d. Row driver 92 drives green emitters 54a, 54b, 54c, and 54d, red emitters 58a, 58b, 58c, and 58d, and blue emitters 80a and 80b. Each emitter can be driven at continuous luminance values at specific locations in a pixel element, unlike emitters in the prior art, which are driven at discrete luminance values at random locations in a pixel element.



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The drive matrix uses approximately 16.6% fewer column drivers to present a given image than does a prior art 2 X 12-drive matrix for the triad arrangement. The column lines are reduced since the blue emitters (80a and 80c; 80b and 80d) are combined. The driver type, voltage, and timing can be the same as already known in the art for each device technology.

Another embodiment of a three-color pixel element arrangement and drive matrix is illustrated in FIGS. 8 and 9. FIG. 8 is an arrangement 114 of four three-color pixel elements aligned horizontally in an array row. Each three-color pixel element can be square-shaped or rectangular-shaped and has two rows including three unit-area polygons, such that an emitter occupies each unit-area polygon. Disposed in the center of the first pixel row of the first, second, third, and fourth three-color pixel elements are blue emitters 130a, 130b, 130c, and 130d, respectively. Disposed in the center of the second pixel row of the first, second, third, and fourth three-color pixel elements are blue emitters 132a, 132b, 132c, and 132d, respectively. Red emitters 120a, 120b, 120c, and 120d are disposed in the first pixel row, to the left of blue emitters 130a, 130b, 130c, and 130d, of the first, second, third, and fourth three-color pixel elements, respectively. Green emitters 122a, 122b, 122c, and 122d are disposed in the second pixel row, to the left of blue emitters 132a, 132b, 132c, and 132d, of the first, second, third, and fourth three-color pixel elements, respectively. Green emitters 124a, 124b, 124c, and 124d are disposed in the first pixel row, to the right of blue emitters 130a, 130b, 130c, and 130d, of the first, second, third, and fourth three-color pixel elements, respectively. Red emitters 126a, 126b, 126c, and 126d are disposed in the second pixel row, to the right of blue emitters 132a, 132b, 132c, and 132d, of the first, second, third, and fourth three-color pixel elements, respectively.

FIG. 9 is a diagram of an illustrative drive matrix 116 for the three-color pixel element arrangement 114. The illustrative drive matrix 116 shown in FIG. 9 consists of a 2 X 10 drive matrix, where eight column drivers drive the eight red and eight green emitters and two column drivers drive the four blue emitters. A first column driver 140 drives the red emitter 120a and the green emitter 122a. The blue emitters 130a, 132a, 130c, and 132c are tied together and driven by a second column driver 142. A third column driver 144 drives the green emitter 124a and the red emitter 126a, while a fourth column driver 146 drives the red emitter 120b and the green emitter 122b. A fifth column driver 148 drives blue emitters 130b and 132b, which are tied together with 130d and 132d. The green emitter 124b and the red emitter 126b are driven by a sixth column driver 150, while a seventh column driver 152



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drives red emitter 120c and green emitter 122c. An eighth column driver 154 drives green emitter 124c and red emitter 126c, while a ninth column driver 156 drives red emitter 120d and green emitter 122d. Finally, a tenth column driver 158 drives green emitter 124d and red emitter 126d.

The row drivers drive the red, green and blue emitters in each pixel row. Row driver 160 drives red emitters 120a, 120b, 120c, and 120d, green emitters 124a, 124b, 124c, and 124d, as well as blue emitters 130c, 132c, 130d, and 132d. Row driver 162 drives green emitters 122a, 122b, 122c, and 122d, red emitters 126a, 126b, 126c, and 126d, and blue emitters 130a, 132a, 130b, and 132b. Each emitter can be driven at continuous luminance values at specific locations in a pixel element, unlike emitters in the prior art, which are driven at discrete luminance values at random locations in a three-color pixel element.

The drive matrix uses approximately 16.6% fewer column drivers to present a given image than does a prior art 2 X 12-drive matrix for the triad arrangement. The column lines are reduced since the blue emitters (130a, 132a and 130c, 132c; 130b, 132b and 130d, 132d) are combined. The driver type, voltage, and timing can be the same as already known in the art for each device technology.

Another embodiment of a three-color pixel element arrangement and drive matrix is illustrated in FIGS. 10 and 11. FIG. 10 is an arrangement 164 of four three-color pixel elements aligned horizontally in an array row. Each three-color pixel element can be square-shaped or rectangular-shaped and has two rows with each row including three unit-area polygons, such that an emitter occupies each unit-area polygon.. At least one unit-area polygon is at least two times the area of the other unit-area polygons and is occupied by blue emitters 168a, 168b, 168c, and 168d. The blue emitters 168a, 168b, 168c, and 168d can be formed as a single emitter or can be two separate blue emitters wired together.

As illustrated in FIG. 10, blue emitters 168a, 168b, 168c, and 168d are disposed between the red emitters and green emitters of the first, second, third, and fourth three-color pixel elements, respectively. The red emitters and green emitters are disposed in two pixel rows. Red emitters 170a, 170b, 170c, and 170d are disposed in the first pixel row, to the left of blue emitters 168a, 168b, 168c, and 168d,of the first, second, third, and fourth three-color pixel elements, respectively. Green emitters 172a, 172b, 172c, and 172d are disposed in the second pixel row, to the left of blue emitters 168a, 168b, 168c, and 168d, of the first, second, third, and fourth three-color pixel elements, respectively. Green emitters 174a, 174b, 174c, and 174d are disposed in the first pixel row, to the right of blue emitters 168a, 168b, 168c,



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and 168d, of the first, second, third, and fourth three-color pixel elements, respectively. Red emitters 176a, 176b, 176c, and 176d are disposed in the second pixel row, to the right of blue emitters 168a, 168b, 168c, and 168d, of the first, second, third, and fourth three-color pixel elements, respectively.

FIG. 11 is a diagram of an illustrative drive matrix 166 for the three-color pixel element arrangement 164. The illustrative drive matrix 78 shown in FIG. 11 consists of a 2 X 10 drive matrix, where eight column drivers drive the eight red and eight green emitters and two column drivers drive the four blue emitters. A first column driver 178 drives the red emitter 170a and the green emitter 172a. The blue emitters 168a and 168c are tied together and driven by a second column driver 180. A third column driver 182 drives the green emitter 174a and the red emitter 176a, while a fourth column driver 184 drives the red emitter 170b and the green emitter 172b. A fifth column driver 186 drives the blue emitter 168b, which is tied together with 168d. The green emitter 174b and the red emitter 176b are driven by a sixth column driver 188, while a seventh column driver 190 drives red emitter 170c and green emitter 172c. An eighth column driver 192 drives green emitter 174c and red emitter 176c, while a ninth column driver 194 drives red emitter 170d and green emitter 172d. Finally, a tenth column driver 196 drives green emitter 174d and red emitter 176d.

The row drivers drive the red, green and blue emitters in each pixel row. Row driver 198 drives red emitters 170a, 170b, 170c, and 170d, green emitters 174a, 174b, 174c, and 174d, as well as blue emitters 168c and 168d. Row driver 200 drives green emitters 172a, 172b, 172c, and 172d, red emitters 176a, 176b, 176c, and 176d, and blue emitters 168a and 168b. Each emitter can be driven at continuous luminance values at specific locations in a pixel element, unlike emitters in the prior art, which are driven at discrete luminance values at random locations in a pixel element.

The drive matrix uses approximately 16.6% fewer column drivers to present a given image than does a prior art 2 X 12 drive matrix for the triad arrangement. The column lines are reduced since the blue emitters (168a and 168c; 168b and 168d) are combined. The driver type, voltage, and timing can be the same as already known in the art for each device technology.

Another embodiment of a three-color pixel element arrangement and drive matrix is illustrated in FIGS. 12 and 13. FIG. 12 is an arrangement 201 of eight three-color pixel elements aligned horizontally, four in each array row. Each three-color pixel element can be square-shaped or rectangular-shaped and has two rows with each row including three unit-



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area polygons, such that an emitter occupies each unit-area polygon. At least one unit-area polygon is at least two times the area of the other unit-area polygons and is occupied by blue emitters 210a, 210b, 210c, 210d, 220a, and 220c. The blue emitters 210a, 210b, 210c, 210d, 220a, and 220c can be formed as a single emitter or can be two separate blue emitters wired together. In this arrangement 201, the blue emitters 210b and 210d are staggered such that a smaller blue emitter (the size of the red and green emitters) will be positioned at the edges of the array vertically aligned with the large blue emitter, as illustrated in FIG. 12. For example, blue emitters 222a, 224a are vertically disposed on either side of the staggered blue emitter 210c and blue emitters 222b, 224b are vertically disposed on either side of the staggered blue emitter 210d.

As illustrated in FIG. 12, blue emitters 210a, 210b, 210c, 210d, 220a, 220c, 222a, 222b, 224a, and 224b are disposed between the red emitters and green emitters. Red emitters 202a, 202b, 202c, 202d are disposed in the first pixel row of the first array row and green emitters 204a, 204b, 204c, and 204d are disposed in the second pixel row of the first array row to the left of blue emitters 210a, 210b, 210c & 222a, and 210d & 222b of the first, second, third, and fourth three-color pixel elements, respectively. Green emitters 206a, 206b, 206c, and 206d are disposed in the first pixel row of the first array row and red emitters 208a, 208b, 208c, and 208d are disposed in the second pixel row of the first array row to the right of blue emitters 210a, 210b, 210c & 222a, and 210d & 222b of the first, second, third, and fourth three-color pixel elements, respectively. Red emitters 212a, 212b, 212c, and 212d are disposed in the first pixel row of the second array row and green emitters 214a, 214b, 214c, and 214d are disposed in the second pixel row of the second array row to the left of blue emitters 220a, 220b, 220c & 224a, and 210d & 224b of the first, second, third, and fourth three-color pixel elements, respectively. Green emitters 216a, 216b, 216c, and 216d are disposed in the first pixel row of the second array row and red emitters 218a, 218b, 218c, and 218d are disposed in the second pixel row of the second array row to the right of blue emitters 220a, 220b, 220c & 224a, and 210d & 224b of the first, second, third, and fourth three-color pixel elements, respectively. An individual skilled in the art will appreciate that the large blue emitters are staggered throughout the array, which requires having smaller blue emitters at the edges vertically aligned with the larger blue emitters.

FIG. 13 is a diagram of an illustrative drive matrix 254 for the three-color pixel element arrangement 201 illustrated in FIG. 12. The illustrative drive matrix 254 shown in FIG. 13 consists of a 2 X 10 drive matrix, where eight column drivers drive the thirty-two red



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and eight green emitters and two column drivers drive the ten blue emitters. A first column driver 234 drives the red emitters 202a, 212a and the green emitters 204a, 214a. The blue emitters 210a, 220a are tied together with blue emitters 222a, 210c, 224a and are driven by a second column driver 236. A third column driver 238 drives the green emitters 206a, 216a and the red emitters 208a, 218a, while a fourth column driver 240 drives the red emitters 202b, 212b and the green emitters 204b, 214b. A fifth column driver 242 drives the blue emitters 210b, 220b, which is tied together with 222b, 210d, 224b. The green emitters 206b, 216b and the red emitters 208b, 218b are driven by a sixth column driver 244, while a seventh column driver 246 drives red emitters 202c, 212c and green emitters 204c, 214c. An eighth column driver 248 drives green emitters 206c, 216c and red emitters 208c, 218c, while a ninth column driver 250 drives red emitters 202d, 212d and green emitters 204d, 214d. Finally, a tenth column driver 252 drives green emitters 206d, 216d and red emitters 208d, 218d.

The row drivers drive the red, green and blue emitters in each pixel row. Row driver 226 drives red emitters 202a, 202b, 202c, and 202d, green emitters 206a, 206b, 206c, and 206d, as well as blue emitters 210a, 210b, 222a, 222b. Row driver 228 drives green emitters 204a, 204b, 204c, and 204d, red emitters 208a, 208b, 208c, and 208d, and blue emitters 210c, 210d. Row driver 230 drives red emitters 212a, 212b, 212c, and 212d, green emitters 216a, 216b, 216c, and 216d, as well as blue emitters 220a, 220b. Row driver 232 drives green emitters 214a, 214b, 214c, and 214d, red emitters 218a, 218b, 218c, and 218d, and blue emitters 224a, 224b. Each emitter can be driven at continuous luminance values at specific locations in a three-color pixel element, unlike emitters in the prior art, which are driven at discrete luminance values at random locations in a pixel element.

The drive matrix uses approximately 16.6% fewer column drivers to present a given image than does a prior art 2 X 12-drive matrix for the triad arrangement. The column lines are reduced since the blue emitters (210a, 220a and 210c, 222a, 224a; 210b, 220b and 210d, 222b, 224b) are combined. The driver type, voltage, and timing can be the same as already known in the art for each device technology.

Dot inversion is the preferred method of choice for driving panels having the arrangement of columns and rows as discussed above. Each blue, red and green emitter is driven with alternating polarities. For example, in a first drive event, a red emitter is driven with a positive voltage and at the next drive event, the same red emitter is driven with a negative voltage. In using the arrangements illustrated in FIGS. 6, 8, 10, and 12 that connect



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the column line of the blue emitter of the first three-color pixel element with its next nearest neighboring three-color pixel element (e.g., the blue emitter of the third three-color pixel element). Likewise, the blue emitter of the second three-color pixel element is coupled with its next nearest neighboring three-color pixel element (e.g., the blue emitter of the fourth three-color pixel element). The "next nearest neighboring" three-color pixel element can be construed as being every other blue emitter of a pair of three-color pixel elements coupled together. For example, the first three-color pixel element is connected with the third three-color pixel element, the second three-color pixel element is connected with the fourth three-color pixel element, the fifth three-color pixel element is connected with the seventh three-color pixel element, the sixth three-color pixel element is connected with the eight three-color pixel element, etc. In this case, any incidence of " flicker" is reduced or eliminated.

In using these arrangements, every column line must be driven with a signal of polarity opposite of its neighbors to guarantee, that should any crosstalk occur, it would be the same for each column. If the array is not driven in this way, asymmetrical crosstalk will result in visible artifacts across the screen. Also, nearby red and green emitters of separate pixel elements must be driven by signals of the opposite polarity to ensure that " flicker" will not occur. For example, FIG. 14 illustrates the polarities of the red, green, and blue emitters on the same arrangement in FIG. 6. Here, green emitter 56a (having a negative value) must have an opposite polarity than red emitter 52b (having a positive value). This arrangement eliminates " flicker" since the column line connects one blue emitter with the blue emitter of its next nearest neighboring three-color pixel element. The polarities shown on the blue emitters are those of the column lines, not the polarities stored on the blue emitter. The polarity of the blue emitter is determined by the row that is actively addressing the blue emitter, which is connected to the blue emitter of its next nearest neighboring three-color pixel element.

Additional examples illustrating separate dot inversion schemes by the polarities of the red, green, and blue emitters are found in FIGS. 15 and 16. Both FIGS. 15 and 16 are based on the arrangement 114 illustrated in FIG. 8, including another horizontal arrangement (FIG. 15, 115; FIG. 16, 314). In FIG. 15, red emitter 120a (having a positive value) must be driven by signals of an opposite polarity than the polarity of the green emitter 122a (having a negative value). Blue emitter 130a (having a negative value) must be driven by signals of an opposite polarity than the polarity of the blue emitter 132a (having a positive value). Red emitter 124a (having a positive value) must be driven by signals of an opposite polarity than



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the polarity of the green emitter 126a (having a negative value). The same polarities are duplicated in the additional horizontal arrangement 115. This arrangement also eliminates " flicker" since the column lines connect one blue emitter with the blue emitter of its next nearest neighboring three-color pixel element.

In FIG. 16, an alternate dot inversion scheme is illustrated with horizontal arrangement 314. Here, red emitters 120a and 126a and green emitters 122a and 124a (having positive values) must be driven by signals of an opposite polarity than the polarity of the signals driving the red emitters 302a and 308a and green emitters 304a and 306a (having negative values). The same applies for blue emitters 130a and 132a (having positive values) and blue emitters 310a and 312a (having negative values). This arrangement also eliminates "flicker" since the column lines connect one blue emitter with the blue emitter of its next nearest neighboring three-color pixel element.

Another example that illustrates dot inversion by the polarities of the red, green, and blue emitters is found in FIG. 17, which is based on the arrangement 164 illustrated in FIG. 10, including another horizontal arrangement 364. Here, red emitter 170a and green emitter 174a (having positive values) and green emitter 172a and red emitter 176a (having negative values) must be driven by signals of the same polarity as red emitter 370a and green emitter 374a (having positive values) and green emitter 372a and red emitter 376a (having negative values), respectively. Blue emitter 168a (having a positive value) must be driven by signals of an opposite polarity than blue emitter 368a (having a negative value). This arrangement also eliminates " flicker" since the column lines connect a blue emitter with the blue emitter of its next nearest neighboring three-color pixel element.

In FIG. 18, an alternate dot inversion scheme is illustrated with horizontal arrangements 164, 264. Here, red emitters 170a, 176a and green emitters 172a, 174a (having positive values) must be driven by signals of an opposite polarity than the polarity of red emitters 370a, 376a and green emitters 372a, 374a (having negative values). The same applies for blue emitter 168a (having a negative value) and blue emitter 368a (having a positive value). This arrangement also eliminates " flicker" since the column lines connect a blue emitter with the blue emitter of its next nearest neighboring three-color pixel element.

Another example that illustrates dot inversion by the polarities of the red, green, and blue emitters is found in FIG. 19, which is based on the arrangement 201 illustrated in FIG. 12. Here, red emitter 202a and green emitter 206a (having positive values) and green emitter 204a and red emitter 208a (having negative values) must be driven be driven by signals of the



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same polarities as red emitter 212a and green emitter 216a (having positive values) and green emitter 214a and red emitter 2186a (having negative values), respectively. Blue emitter 210a (having a positive value with a stored negative value) must be driven by signals of an opposite polarity than blue emitter 220a (having a negative value with a stored positive value). Blue emitter 210c (having a positive value with a stored negative value) must be driven by signals of an opposite polarity than blue emitter 220c (having a negative value with a stored positive value). While blue emitters 222a and 224b must be driven by signals of an opposite polarity than blue emitters 222b and 224a. An individual skilled in the art will appreciate the polarities as described herein. This arrangement also eliminates " flicker" since the column lines connect a blue emitter with the blue emitter of its next nearest neighboring three-color pixel element.

In FIG. 20, an alternate dot inversion scheme is illustrated with horizontal arrangement 201. Here, red emitters 202a, 208a and green emitters 204a, 206a (having positive values) must be driven by signals of an opposite polarity than red emitters 212a, 218a and green emitters 214a, 216a (having negative values). The same applies for blue emitter 210a (having a negative value with a stored positive value) and blue emitter 220a (having a positive value with a stored negative value). Blue emitter 210c (having a negative value with a stored positive value) must be driven by signals of an opposite polarity than blue emitter 220c (having a positive value with a stored negative value). While blue emitters 222a and 224b must be driven by signals of an opposite polarity than blue emitters 222b and 224a. An individual skilled in the art will appreciate the polarities as described herein. This arrangement also eliminates " flicker" since the column lines connect a blue emitter with the blue emitter of its next nearest neighboring three-color pixel element.

The three-color pixel element, according to any of the above arrangements, can be operated by appropriately driving the individual emitters. A voltage is applied through each row and column driver to each individual row line and column line. At this point, each emitter is illuminated, according to the proper voltage, to create an image on the display.

By connecting the column lines of one blue emitter with the column line of the blue emitter from the next nearest neighboring three-color pixel element, "flicker" is virtually eliminated while at the same time enabling a reduction in column drivers.

While the invention has been described with reference to an exemplary embodiment, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the



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invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the appended claims.

What is claimed is:



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CLAIMS

1. An array for a display, comprising:

a plurality of row positions and a plurality of column positions;

a plurality of three-color pixel elements, one of said three-color pixel elements disposed in each of said row positions and said column positions, each of said three-color pixel elements comprising:

a blue emitter disposed at a center of a square disposed at an origin of an X, Y coordinate system having a first, a second, a third, and a fourth quadrant, wherein said blue emitter is square-shaped;

a pair of red emitters spaced apart from said blue emitter and symmetrically disposed about said blue emitter in said second and said fourth quadrants, wherein said red emitters occupy a portion of said second and said fourth quadrants not occupied by said blue emitter, wherein said red emitters are generally square-shaped having truncated inwardly-facing corners forming edges parallel to sides of said blue emitter;

a pair of green emitters spaced apart from said blue emitter and symmetrically disposed about said blue emitter in said first and said third quadrants, wherein said green emitters occupy a portion of said first and said third quadrants not occupied by said blue emitter, wherein said green emitters are generally square-shaped having truncated inwardly-facing corners forming edges parallel to said sides of said blue emitter;

a pair of row lines associated with each said row position in said array, a first of said row lines coupled to said red emitters and to said green emitters in said row position disposed above said origin of said coordinate system in each of said three-color pixel elements and coupled to said blue emitters of every even pair of adjacent said three-color pixel elements in said row position, and a second of said row lines coupled to said red emitters and to said green emitters in said row position disposed below said origin of said coordinate system in each of said three-color pixel elements, and coupled to said blue emitters of every odd pair of adjacent said three-color pixel elements in said row position; and

three column lines associated with each said column position in said array, a first of said column lines coupled to said red emitters and to said green emitters in said column position disposed left of said origin of said rectangular coordinate system in each of said three-color pixel elements, a second of said column lines coupled to said blue emitter in said column position disposed at said origin of said rectangular coordinate system in each of



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said three-color pixel elements, and a third of said column lines coupled to said red emitters and to said green emitters in said column position disposed right of said origin of said rectangular coordinate system in each of said three-color pixel elements, wherein said second column line is coupled to said second column line of a next nearest neighboring said three-color pixel element.

2. The array of Claim 1, wherein each said three-color pixel element in a row direction has a spatial frequency greater than a column direction.

3. The array of Claim 1, wherein each said three-color pixel element in a column direction has a spatial frequency greater than in a row direction.

4. The array of Claim 1, wherein each said row line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a gate of a select transistor.

5. The array of Claim 1, wherein each said column line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a source/drain terminal of a select transistor.

6. The array of Claim 1, wherein said array is driven by dot inversion.

7. An array for a display, comprising:

a plurality of row positions and a plurality of column positions;

a plurality of three-color pixel elements, one of said elements disposed in each of said row positions and said column positions, each of said three-color pixel elements comprising:

a blue emitter disposed at a center of a square disposed at an origin of an X, Y coordinate system having a first, a second, a third, and a fourth quadrant, wherein said blue emitter is square-shaped;

a pair of red emitters spaced apart from said blue emitter and symmetrically disposed about said blue emitter in said second and said fourth quadrants, wherein said red emitters occupy a portion of said second and said fourth quadrants not occupied by said blue emitter, wherein said red emitters are L-shaped;



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a pair of green emitters spaced apart from said blue emitter and symmetrically disposed about said blue emitter in said first and said third quadrants, wherein said green emitters occupy a portion of said first and said third quadrants not occupied by said blue emitter, wherein said green emitters are L-shaped;

a pair of row lines associated with each said row position in said array, a first of said row lines coupled to said red emitters and to said green emitters in said row position disposed above said origin of said coordinate system in each of said three-color pixel elements and coupled to said blue emitters of every even pair of adjacent said three-color pixel elements in said row position, and a second of said row lines coupled to said red emitters and to said green emitters in said row position disposed below said origin of said coordinate system in each of said three-color pixel elements and coupled to said blue emitters of every odd pair of adjacent said three-color pixel elements in said row position; and

three column lines associated with each said column position in said array, a first of said column lines coupled to said red emitters and to said green emitters in said column position disposed left of said center of said square in each of said three-color pixel elements, a second of said column lines coupled to said blue emitter in said column position disposed at said center of said square in each of said three-color pixel elements, and a third of said column lines coupled to said red emitters and to said green emitters in said column position disposed right of said center of said square in each of said three-color pixel elements, wherein said second column line is coupled to said second column line of a next nearest neighboring said three-color pixel element.

8. The array of Claim 7, wherein each said three-color pixel element in a row direction has a spatial frequency greater than in a column direction.

9. The array of Claim 7, wherein each said three-color pixel element in a column direction has a spatial frequency greater than in a row direction.

10. The array of Claim 7, wherein each said row line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a gate of a select transistor.

11. The array of Claim 7, wherein each said column line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a source/drain terminal of a select transistor.



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12. The array of Claim 7, wherein said array is driven by dot inversion.

13. An array of three-color pixel elements, comprising:

a row comprising first, second, third, and fourth three-color pixel elements, each three-color pixel element comprising a blue emitter disposed at a center of a square disposed at an origin of an X, Y coordinate system having a first, a second, a third, and a fourth quadrant, wherein said blue emitter is square-shaped, a pair of red emitters spaced apart from said blue emitter and symmetrically disposed about said blue emitter in said second and said fourth quadrants, wherein said red emitters occupy a portion of said second and said fourth quadrants not occupied by said blue emitter, wherein said red emitters are generally square-shaped having truncated inwardly-facing corners forming edges parallel to sides of said blue emitter, and a pair of green emitters spaced apart from said blue emitter and symmetrically disposed about said blue emitter in said first and said third quadrants, wherein said green emitters occupy a portion of said first and said third quadrants not occupied by said blue emitter, wherein said green emitters are generally square-shaped having truncated inwardly-facing corners forming edges parallel to said sides of said blue emitter;

first and second row line drivers coupled to each said three-color pixel elements;

a first row line coupled to said first row line driver, said first row line coupled to said blue emitter of said third and said fourth three-color pixel elements and to a first red emitter and a first green emitter of said first, second, third, and fourth three-color pixel elements;

a second row line coupled to said second row line driver, said second row line coupled to said blue emitter of said first and said second three-color pixel elements and to a second red emitter and said a green emitter of said first, second, third, and fourth three-color pixel elements;

first through tenth column line drivers coupled to each of said three-color pixel elements,

a first column line coupled to said first column line driver, said first column line coupled to said first red emitter and said second green emitter of said first three-color pixel element;



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a second column line coupled to said second column line driver, said second column line coupled to said blue emitter of said first three-color pixel element and to an eighth column line coupled to said blue emitter of said third three-color pixel element;

a third column line coupled to said third column line driver, said third column line coupled to said second red emitter and said first green emitter of said first three-color pixel element;

a fourth column line coupled to said fourth column line driver, said fourth column line coupled to said first red emitter and said second green emitter of said second three-color pixel element;

a fifth column line coupled to said fifth column line driver, said fifth column line coupled to said blue emitter of said second three-color pixel element and to an eleventh column line coupled to said blue emitter of said fourth three-color pixel element;

a sixth column line coupled to said sixth column line driver, said sixth column line coupled to said second red emitter and said first green emitter of said second three-color pixel element;

a seventh column line coupled to said seventh column line driver, said seventh column line coupled to said first red emitter and said second green emitter of said third three-color pixel element;

a ninth column line coupled to said eighth column line driver, said ninth column line coupled to said second red emitter and said first green emitter of said fourth three-color pixel element;

a tenth column line coupled to said ninth column line driver, said tenth column line coupled to said first red emitter and said second green emitter of said fourth three-color pixel element; and

a twelfth column line coupled to said tenth column line driver, said tenth column line coupled to said second red emitter and said first green emitter of said fourth three-color pixel element.

14. The array of Claim 13, wherein said array is driven by dot inversion.

15. The array of Claim 13, wherein each said row line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a gate of a select transistor.



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16. The array of Claim 13, wherein each said column line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a source/drain terminal of a select transistor.

17. The array of Claim 13, further comprising another blue emitter in each said three-color pixel element.

18. An array of three-color pixel elements, comprising:

a row comprising first, second, third, and fourth three-color pixel elements, each three-color pixel element comprising a blue emitter disposed at a center of a square disposed at an origin of an X, Y coordinate system having a first, a second, a third, and a fourth quadrant, wherein said blue emitter is square-shaped, a pair of red emitters spaced apart from said blue emitter and symmetrically disposed about said blue emitter in said second and said fourth quadrants, wherein said red emitters occupy a portion of said second and said fourth quadrants not occupied by said blue emitter, wherein said red emitters are L-shaped, and a pair of green emitters spaced apart from said blue emitter and symmetrically disposed about said blue emitter in said first and said third quadrants, wherein said green emitters occupy a portion of said first and said third quadrants not occupied by said blue emitter, wherein said green emitters are L-shaped

first and second row line drivers coupled to each of said three-color pixel elements;

a first row line coupled to said first row line driver, said first row line coupled to said blue emitter of said third and said fourth three-color pixel element and to a first red emitter and a first green emitter of said first, second, third, and fourth three-color pixel elements;

a second row line coupled to said second row line driver, said second row line coupled to said blue emitter of said first and said second three-color pixel element and to a second red emitter and a second green emitter of said first, second, third, and fourth three-color pixel elements;

first through tenth column line drivers coupled to each of said three-color pixel elements;



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a first column line coupled to said first column line driver, said first column line coupled to said first red emitter and said second green emitter of said first three-color pixel element;

a second column line coupled to said second column line driver, said second column line coupled to said blue emitter of said first three-color pixel element and to an eighth column line coupled to said blue emitter of said third three-color pixel element;

a third column line coupled to said third column line driver, said third column line coupled to said second red emitter and said first green emitter of said first three-color pixel element;

a fourth column line coupled to said fourth column line driver, said fourth column line coupled to said first red emitter and said second green emitter of said second three-color pixel element;

a fifth column line coupled to said fifth column line driver, said fifth column line coupled to said blue emitter of said second three-color pixel element and to an eleventh column line coupled to said blue emitter of said fourth three-color pixel element;

a sixth column line coupled to said sixth column line driver, said sixth column line coupled to said second red emitter and said first green emitter of said second three-color pixel element;

a seventh column line coupled to said seventh column line driver, said seventh column line coupled to said first red emitter and said second green emitter of said third three-color pixel element;

a ninth column line coupled to said eighth column line driver, said ninth column line coupled to said second red emitter and said first green emitter of said third three-color pixel element;

a tenth column line coupled to said ninth column line driver, said tenth column line coupled to said first red emitter and said second green emitter of said fourth three color pixel element; and

a twelfth column line coupled to said tenth column line driver, said tenth column line coupled to said second red emitter and said first green emitter of said fourth three-color pixel element.

19. The array of Claim 18, wherein said array is driven by dot inversion.



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20. The array of Claim 18, wherein each said row line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a gate of a select transistor.

21. The array of Claim 18, wherein each said column line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a source/drain terminal of a select transistor.

22. The array of Claim 18, further comprising another blue emitter in each said three-color pixel element.

23. A three-color pixel element for a display, comprising:

first and second pixel rows, each pixel row including three unit-area polygons, wherein an emitter occupies each said unit-area polygon;

wherein a red emitter occupies a left unit-area polygon in said first pixel row and a green emitter occupies a right unit-area polygon in said first pixel row;

wherein a green emitter occupies a left unit-area polygon in said second pixel row and a red emitter occupies a right unit-area polygon in said second pixel row; and

wherein a blue emitter occupies a center unit-area polygon in both said first and said second pixel rows.

24. The three-color pixel element of Claim 23, wherein said green emitter occupies said left unit-area polygon in said first pixel row and said red emitter occupies said right unit-area polygon in said first pixel row; and wherein said red emitter occupies said left unit-area polygon in said second pixel row and said green emitter occupies said right unit-area polygon in said second pixel row.

25. The three-color pixel element of Claim 23, wherein said unit-area polygon is a square.

26. The three-color pixel element of Claim 23, wherein said unit-area polygon is a rectangle.



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27. The three-color pixel element of Claim 23, wherein said blue emitters occupying said center unit-area polygon in both said first and said second pixel rows are wired together.

28. An array for a display, comprising:

a plurality of array row positions and a plurality of column positions;

a plurality of three-color pixel elements, one of said three-color pixel elements disposed in each of said row positions and said column positions, each of said three-color pixel elements comprising:

first and second pixel rows, each pixel row including three unit-area polygons, wherein an emitter occupies each said unit-area polygon, wherein a red emitter occupies a left unit-area polygon in said first pixel row and a green emitter occupies a right unit-area polygon in said first pixel row, wherein a green emitter occupies a left unit-area polygon in said second pixel row and a red emitter occupies a right unit-area polygon in said second pixel row, and wherein a blue emitter occupies a center unit-area polygon in both said first and said second pixel rows;

a plurality of row lines associated with each said row position in said array, a first of said row lines coupled to said blue emitter in said first pixel row, to said red emitters in said first pixel row and to said green emitters in said first pixel row in each of said three-color pixel elements in said array row position, wherein said first of said row lines is coupled to said blue emitters in said first pixel row of every even pair of adjacent said three-color pixel elements, and a second of said row lines coupled to said blue emitter in said second pixel row, to said red emitters in said second pixel row, and to said green emitters in said second pixel row in each of said three-color pixel elements in said array row position, wherein said second of said row lines is coupled to said blue emitters in said second row of every odd pair of adjacent said three-color pixel elements; and

a plurality of column lines associated with each said column position, a first of said column lines coupled to said red emitters and to said green emitters in said column position disposed left of said blue emitters in each of said three-color pixel elements, a second of said column lines coupled to said blue emitters in said column position disposed at said center of square in each of said three-color pixel elements, and a third of said column lines coupled to said red emitters and to said green emitters in said column position disposed right of said blue emitters in each of said three-color pixel elements, wherein said second



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column line is coupled to said second column line of a next nearest neighboring said three-color pixel element.

29. The array of Claim 28, wherein each said three-color pixel element in a row direction has a spatial frequency greater than in a column direction.

30. The array of Claim 28, wherein each said three-color pixel element in a column direction has a spatial frequency greater than in a row direction.

31. The array of Claim 28, wherein each said row line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a gate of a select transistor.

32. The array of Claim 28, wherein each said column line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a source/drain terminal of a select transistor.

33. The array of Claim 28, wherein said array is driven by dot inversion.

34. The array of Claim 28, wherein said green emitter occupies said left unit-area polygon in said first pixel row and said red emitter occupies said right unit-area polygon in said first pixel row; and wherein said red emitter occupies said left unit-area polygon in said second pixel row and said green emitter occupies said right unit-area polygon in said second pixel row.

35. The array of Claim 28, wherein said unit-area polygon is a square.

36. The array of Claim 28, wherein said unit-area polygon is a rectangle.

37. The array of Claim 28, wherein said blue emitters occupying said center unit-area polygon in both said first and said second pixel rows are wired together.

38. An array of three-color pixel elements, comprising:



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an array row comprising first, second, third, and fourth three-color pixel elements, each said three-color pixel element comprising first and second pixel rows, each pixel row including three unit-area polygons, wherein an emitter occupies each said unit-area polygon, wherein a red emitter occupies a left unit-area polygon in said first pixel row and a green emitter occupies a right unit-area polygon in said first pixel row, wherein a green emitter occupies a left unit-area polygon in said second pixel row and a red emitter occupies a right unit-area polygon in said second pixel row, and wherein a blue emitter occupies a center unit-area polygon in both said first and said second pixel rows;

first and second row line drivers coupled to each said three-color pixel elements;

a first row line coupled to said first row line driver, said first row line coupled to said blue emitters in said first pixel row of said third and said fourth three-color pixel element and to said red emitter and said green emitter in said first pixel row of said first, second, third, and fourth three-color pixel elements;

a second row line coupled to said second row line driver, said second row line coupled to said blue emitters in said second pixel row of said first and said second three-color pixel element and to said red emitter and said green emitter in said second pixel row of said first, second, third, and fourth three-color pixel elements;

first through tenth column line drivers coupled to each said three-color pixel elements,

a first column line coupled to said first column line driver, said first column line coupled to said red emitter in said first pixel row and said green emitter in said second pixel row of said first three-color pixel element;

a second column line coupled to said second column line driver, said second column line coupled to said blue emitters of said first three-color pixel element and to an eighth column line coupled to said blue emitters of said third three-color pixel element;

a third column line coupled to said third column line driver, said third column line coupled to said red emitter in said second pixel row and said green emitter in said first pixel row of said first three-color pixel element;

a fourth column line coupled to said fourth column line driver, said fourth column line coupled to said red emitter in said first pixel row and said green emitter in said second pixel row of said second three-color pixel element;



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a fifth column line coupled to said fifth column line driver, said fifth column line coupled to said blue emitters of said second three-color pixel element and to an eleventh column line coupled to said blue emitters of said fourth three-color pixel element;

a sixth column line coupled to said sixth column line driver, said sixth column line coupled to said red emitter in said second pixel row and said green emitter in said first pixel row of said second three-color pixel element;

a seventh column line coupled to said seventh column line driver, said seventh column line coupled to said red emitter in said first pixel row and said green emitter in said second pixel row of said third three-color pixel element;

a ninth column line coupled to said eighth column line driver, said ninth column line coupled to said red emitter in said second pixel row and said green emitter in said first pixel row of said fourth three-color pixel element;

a tenth column line coupled to said ninth column line driver, said tenth column line coupled to said red emitter in said first pixel row and said green emitter in said second pixel row of said fourth three-color pixel element; and

a twelfth column line coupled to said tenth column line driver, said tenth column line coupled to said red emitter in said second pixel row and said green emitter in said first pixel row of said fourth three-color pixel element.

39. The array of Claim 38, wherein said array is driven by dot inversion.

40. The array of Claim 38, wherein each said row line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a gate of a select transistor.

41. The array of Claim 38, wherein each said column line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a source/drain terminal of a select transistor.

42. The array of Claim 38, wherein said green emitter occupies said left unit-area polygon in said first row and said red emitter occupies said right unit-area polygon in said first row; and wherein said red emitter occupies said left unit-area polygon in said first row and said green emitter occupies said right unit-area polygon in said first row.



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43. The array of Claim 38, wherein said unit-area polygon is a square.

44. The array of Claim 38, wherein said unit-area polygon is a rectangle.

45. The array of Claim 38, wherein said blue emitters occupying said center unit-area polygon in both said first and said second rows are wired together.

46. An array for a display, comprising:

a plurality of array row positions and a plurality of column positions;

a plurality of three-color pixel elements, one of said three-color pixel elements disposed in each of said row positions and said column positions, each of said three-color pixel elements comprising:

first and second pixel rows, each pixel row including three unit-area polygons, wherein an emitter occupies each said unit-area polygon, wherein a red emitter occupies a left unit-area polygon in said first pixel row and a green emitter occupies a right unit-area polygon in said first pixel row; wherein a green emitter occupies a left unit-area polygon in said second pixel row and a red emitter occupies a right unit-area polygon in said second pixel row; and wherein a single blue emitter occupies both center unit-area polygons in said first and said second pixel rows;

a plurality of row lines associated with each said row position in said array, a first of said row lines coupled to said blue emitter, to said red emitters, and to said green emitters in said first pixel row in each of said three-color pixel elements in said array row position, wherein said first of said row lines is coupled to said blue emitters of every even pair of adjacent said three-color pixel elements, and a second of said row lines coupled to said blue emitter, to said red emitters, and to said green emitters in said second pixel row in each of said three-color pixel elements in said array row position, wherein said second of said row lines is coupled to said blue emitters of every odd pair of adjacent said three-color pixel elements; and

a plurality of column lines associated with each said column position in said array, a first of said column lines coupled to said red emitters and to said green emitters in said column position disposed left of said blue emitter in each of said three-color pixel elements, a second of said column lines coupled to said blue emitter in said column position in each of said three-color pixel elements, and a third of said column lines coupled to said red



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emitters and to said green emitters in said column position disposed right of said blue emitter in each of said three-color pixel elements, wherein said second column line is coupled to said second column line of a next nearest neighboring said three-color pixel element.

47. The array of Claim 46, wherein each said three-color pixel element in a row direction has a spatial frequency greater than in a column direction.

48. The array of Claim 46, wherein each said three-color pixel element in a column direction has a spatial frequency greater than in a row direction.

49. The array of Claim 46, wherein each said row line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a gate of a select transistor.

50. The array of Claim 46, wherein each said column line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a source/drain terminal of a select transistor.

51. The array of Claim 46, wherein said array is driven by dot inversion.

52. The array of Claim 46, wherein said green emitter occupies said left unit-area polygon in said first pixel row and said red emitter occupies said right unit-area polygon in said first pixel row; and wherein said red emitter occupies said left unit-area polygon in said second pixel row and said green emitter occupies said right unit-area polygon in said second pixel row.

53. The array of Claim 46, wherein said unit-area polygon is a square.

54. The array of Claim 46, wherein said unit-area polygon is a rectangle.

55. An array of three-color pixel elements, comprising:

an array row comprising first, second, third, and fourth three-color pixel elements, each three-color pixel element comprising first and second pixel rows, each pixel row including three unit-area polygons, wherein an emitter occupies each said unit-area



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polygon, wherein a red emitter occupies a left unit-area polygon in said first pixel row and a green emitter occupies a right unit-area polygon in said first pixel row; wherein a green emitter occupies a left unit-area polygon in said second pixel row and a red emitter occupies a right unit-area polygon in said second pixel row; and wherein a single blue emitter occupies both center unit-area polygons in said first and said second pixel rows;

first and second row line drivers coupled to each of said three-color pixel elements;

a first row line coupled to said first row line driver, said first row line coupled to said blue emitters of said third and said fourth three-color pixel element and to said red emitter and said green emitter in said first pixel row of said first, second, third, and fourth three-color pixel elements;

a second row line coupled to said second row line driver, said second row line coupled to said blue emitters of said first and said second three-color pixel element and to said red emitter and said green emitter in said second pixel row of said first, second, third, and fourth three-color pixel elements;

first through tenth column line drivers coupled to each of said three-color pixel elements;

a first column line coupled to said first column line driver, said first column line coupled to said red emitter in said first pixel row and said green emitter in said second pixel row of said first three-color pixel element;

a second column line coupled to said second column line driver, said second column line coupled to said blue emitter of said first three-color pixel element and to an eighth column line coupled to said blue emitter of said third three-color pixel element;

a third column line coupled to said third column line driver, said third column line coupled to said red emitter in said second pixel row and said green emitter in said first pixel row of said first three-color pixel element;

a fourth column line coupled to said fourth column line driver, said fourth column line coupled to said red emitter in said first pixel row and said green emitter in said second pixel row of said second three-color pixel element;

a fifth column line coupled to said fifth column line driver, said fifth column line coupled to said blue emitter of said second three-color pixel element and to an eleventh column line coupled to said blue emitter of said fourth three-color pixel element;



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a sixth column line coupled to said sixth column line driver, said sixth column line coupled to said red emitter in said second pixel row and said green emitter in said first pixel row of said second three-color pixel element;

a seventh column line coupled to said seventh column line driver, said seventh column line coupled to said red emitter in said first pixel row and said green emitter in said second pixel row of said third three-color pixel element;

a ninth column line coupled to said eighth column line driver, said ninth column line coupled to said red emitter in said second pixel row and said green emitter in said first pixel row of said fourth three-color pixel element;

a tenth column line coupled to said ninth column line driver, said tenth column line coupled to said red emitter in said first pixel row and said green emitter in said second pixel row of said fourth three-color pixel element; and

a twelfth column line coupled to said tenth column line driver, said tenth column line coupled to said red emitter in said second pixel row and said green emitter in said first pixel row of said fourth three-color pixel element.

56. The array of Claim 55, wherein said array is driven by dot inversion.

57. The array of Claim 55, wherein each said row line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a gate of a select transistor.

58. The array of Claim 55, wherein each said column line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a source/drain terminal of a select transistor.

59. The array of Claim 55, wherein said green emitter occupies said left unit-area polygon in said first pixel row and said red emitter occupies said right unit-area polygon in said first pixel row; and wherein said red emitter occupies said left unit-area polygon in said second pixel row and said green emitter occupies said right unit-area polygon in said second pixel row.

60. The array of Claim 55, wherein said unit-area polygon is a square.



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61. The array of Claim 55, wherein said unit-area polygon is a rectangle.

62. An array for a display, comprising:

a plurality of array row positions and a plurality of column positions;

a plurality of three-color pixel elements, one of said three-color pixel elements disposed in each of said array row positions and said column positions, wherein each of said three-color pixel elements comprises:

first and second pixel rows, each row including three unit-area polygons, wherein an emitter occupies each said unit-area polygon, wherein a red emitter occupies a left unit-area polygon in said first pixel row and a green emitter occupies a right unit-area polygon in said first pixel row; wherein a green emitter occupies a left unit-area polygon in said first pixel row and a red emitter occupies a right unit-area polygon in said first pixel row; and wherein a single blue emitter occupies both center unit-area polygons in said first and said second pixel rows;

wherein adjacent horizontal pairs of said three-color pixel elements are vertically offset from one another by one pixel row;

a plurality of row lines associated with each said array row position,

wherein a first of said row lines is coupled to all said red and said green emitters in said first pixel row of each odd pair of said three-color pixel elements in each said array row position and to all said red and said green emitters in said second pixel row of each even pair of said three-color pixel elements in each said array row position, wherein said first of said row lines is coupled to said blue emitters of every odd pair of adjacent said three-color pixel elements;

wherein a second of said row lines is coupled to all said red and said green emitters in said second pixel row of each odd pair of said three-color pixel elements in each said array row position and to all said red and said green emitters in said first pixel row of each even pair of said three-color pixel elements in each said array row position, wherein said first of said row lines is coupled to said blue emitters of every even pair of adjacent said three-color pixel elements; and

a plurality of column lines associated with each said column position in said array;



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wherein a first, a fourth, a seventh, and a tenth of said column lines is coupled to said red emitters and to said green emitters in said column position disposed left of said blue emitter in each of said three-color pixel elements;

wherein a second, a fifth, an eight, and an eleventh of said column lines is coupled to said blue emitter in said column position in each of said three-color pixel elements, wherein said second of said column lines is coupled to said eighth of said column lines and wherein said fifth of said column lines is coupled to said eleventh of said column lines; and

wherein a third, a sixth, a ninth, and a twelfth of said column lines is coupled to said red emitters and to said green emitters in said column position disposed right of said blue emitter in each of said three-color pixel elements.

63. The array of Claim 62, wherein each said three-color pixel element in a row direction has a spatial frequency greater than in a column direction.

64. The array of Claim 62, wherein each said three-color pixel element in a column direction has a spatial frequency greater than in a row direction.

65. The array of Claim 62, wherein each said row line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a gate of a select transistor.

66. The array of Claim 62, wherein each said column line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a source/drain terminal of a select transistor.

67. The array of Claim 62, wherein said array is driven by dot inversion.

68. The array of Claim 62, wherein said green emitter occupies said left unit-area polygon in said first pixel row and said red emitter occupies said right unit-area polygon in said first pixel row; and wherein said red emitter occupies said left unit-area polygon in said second pixel row and said green emitter occupies said right unit-area polygon in said second pixel row.



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69. The array of Claim 62, wherein said unit-area polygon is a square.

70. The array of Claim 62, wherein said unit-area polygon is a rectangle.

71. An array of three-color pixel elements, comprising:

a plurality of array rows and a plurality of array columns containing three-color pixel elements, each said three-color pixel element comprising first and second pixel rows, each pixel row including three unit-area polygons, wherein an emitter occupies each said unit-area polygon, wherein a red emitter occupies a left unit-area polygon in said first pixel row and a green emitter occupies a right unit-area polygon in said first pixel row; wherein a green emitter occupies a left unit-area polygon in said second pixel row and a red emitter occupies a right unit-area polygon in said second pixel row; and wherein a single blue emitter occupies both center unit-area polygons in said first and said second pixel rows;

wherein adjacent horizontal pairs of said three-color pixel elements are vertically offset from one another by one pixel row;

first and second row line drivers coupled to each of said three-color pixel elements;

a first row line coupled to said first row line driver, wherein said first row line is coupled to all said red and said green emitters in said first pixel row of each odd pair of said three-color pixel elements in each said array row position and to all said red and said green emitters in said second pixel row of each even pair of said three-color pixel elements in each said array row position, wherein said first of said row lines is coupled to said blue emitters of every odd pair of adjacent said three-color pixel elements;

a second row line coupled to said second row line driver, wherein said second row line is coupled to all said red and said green emitters in said second pixel row of each odd pair of said three-color pixel elements in each said array row position and to all said red and said green emitters in said first pixel row of each even pair of said three-color pixel elements in each said array row position, wherein said first of said row lines is coupled to said blue emitters of every even pair of adjacent said three-color pixel elements; and

first through tenth column line drivers coupled to each of said three-color pixel elements;



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a first column line coupled to said first column line driver, said first column line coupled to all left-most emitters of every said three-color pixel element in a first of said array columns;

a second column line coupled to said second column line driver, said second column line coupled to all center emitters of every said three-color pixel element in a second of said array columns and to an eighth column line coupled to all center emitters of every said three-color pixel element in an eighth of said array columns;

a third column line coupled to said third column line driver, said third column line coupled to all right-most emitters of every said three-color pixel element in a third of said array columns;

a fourth column line coupled to said fourth column line driver, said fourth column line coupled to all left-most emitters of every said three-color pixel element in a fourth of said array columns;

a fifth column line coupled to said fifth column line driver, said fifth column line coupled to all center emitters of every said three-color pixel element in a fifth of said array columns and to an eleventh column line coupled to all center emitters of every said three-color pixel element in an eleventh of said array columns;

a sixth column line coupled to said sixth column line driver, said sixth column line coupled to all right-most emitters of every said three-color pixel element in a sixth of said array columns;

a seventh column line coupled to said seventh column line driver, said seventh column line coupled to all left-most emitters of every said three-color pixel element in a seventh of said array columns;

a ninth column line coupled to said eighth column line driver, said ninth column line coupled to all right-most emitters of every said three-color pixel element in a ninth of said array columns;

a tenth column line coupled to said ninth column line driver, said tenth column line coupled to all left-most emitters of every said three-color pixel element in a tenth of said array columns; and

a twelfth column line coupled to said tenth column line driver, said twelfth column line coupled to all right-most emitters of every said three-color pixel element in a twelfth of said array columns.



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72. The array of Claim 71, wherein said array is driven by dot inversion.

73. The array of Claim 71, wherein each said row line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a gate of a select transistor.

74. The array of Claim 71, wherein each said column line coupled to each said red emitter, said green emitter, and said blue emitter is coupled to a source/drain terminal of a select transistor.

75. The array of Claim 71, wherein said green emitter occupies said left unit-area polygon in said first pixel row and said red emitter occupies said right unit-area polygon in said first pixel row; and wherein said red emitter occupies said left unit-area polygon in said second pixel row and said green emitter occupies said right unit-area polygon in said second pixel row.

76. The array of Claim 71, wherein said unit-area polygon is a square.

77. The array of Claim 71, wherein said unit-area polygon is a rectangle.

78. A method of driving a three-color pixel element in a display, comprising:

providing a three-color pixel element comprising a blue emitter disposed at a center of a square disposed at an origin of an X, Y coordinate system having a first, a second, a third, and a fourth quadrant, wherein said blue emitter is square-shaped, a pair of red emitters spaced apart from said blue emitter and symmetrically disposed about said blue emitter in said second and said fourth quadrants, wherein said red emitters occupy a portion of said second and said fourth quadrants not occupied by said blue emitter, wherein said red emitters are generally square-shaped having truncated inwardly-facing corners forming edges parallel to sides of said blue emitter, and a pair of green emitters spaced apart from said blue emitter and symmetrically disposed about said blue emitter in said first and said third quadrants, wherein said green emitters occupy a portion of said first and said third quadrants not occupied by said blue emitter, wherein said green emitters are generally square-shaped having truncated inwardly-facing corners forming edges parallel to said sides of said blue emitter; and



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driving said blue emitter, said red emitters, and said green emitters, wherein said blue emitter of said three-color pixel element is coupled to a blue emitter of a next nearest neighboring three-color pixel element.

79. A method of driving a three-color pixel element in a display, comprising:

providing a three-color pixel element comprising a blue emitter disposed at a center of a square disposed at an origin of an X, Y coordinate system having a first, a second, a third, and a fourth quadrant, wherein said blue emitter is square-shaped, a pair of red emitters spaced apart from said blue emitter and symmetrically disposed about said blue emitter in said second and said fourth quadrants, wherein said red emitters occupy a portion of said second and said fourth quadrants not occupied by said blue emitter, wherein said red emitters are L-shaped, and a pair of green emitters spaced apart from said blue emitter and symmetrically disposed about said blue emitter in said first and said third quadrants, wherein said green emitters occupy a portion of said first and said third quadrants not occupied by said blue emitter, wherein said green emitters are L-shaped; and

driving said blue emitter, said red emitters, and said green emitters, wherein said blue emitter of said three-color pixel element is coupled to a blue emitter of a next nearest neighboring three-color pixel element.

80. A method of driving a three-color pixel element in a display, comprising:

providing a three-color pixel element comprising first and second pixel rows, each pixel row including three unit-area polygons, wherein an emitter occupies each said unit-area polygon, wherein a red emitter occupies a left unit-area polygon in said first pixel row and a green emitter occupies a right unit-area polygon in said first pixel row, wherein a green emitter occupies a left unit-area polygon in said second pixel row and a red emitter occupies a right unit-area polygon in said second pixel row, and wherein a blue emitter occupies a center unit-area polygon in both said first and said second pixel rows; and

driving said blue emitters, said red emitters, and said green emitters, wherein said blue emitters of said three-color pixel element is coupled to a pair of blue emitters of a next nearest neighboring three-color pixel element.

81. The method of Claim 80, wherein said green emitter occupies said left unit-area polygon in said first pixel row and said red emitter occupies said right unit-area polygon



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in said first pixel row; and wherein said red emitter occupies said left unit-area polygon in said second pixel row and said green emitter occupies said right unit-area polygon in said second pixel row.

82. A method of driving a three-color pixel element in a display, comprising:

providing a three-color pixel element comprising first and second pixel rows, each pixel row including three unit-area polygons, wherein an emitter occupies each said unit-area polygon, wherein a red emitter occupies a left unit-area polygon in said first pixel row and a green emitter occupies a right unit-area polygon in said first pixel row; wherein a green emitter occupies a left unit-area polygon in said second pixel row and a red emitter occupies a right unit-area polygon in said second pixel row; and wherein a single blue emitter occupies both center unit-area polygons in said first and said second pixel rows; and

driving said blue emitter, said red emitters, and said green emitters, wherein said blue emitter of said three-color pixel element is coupled to a blue emitter of a next nearest neighboring three-color pixel element.

83. The method of Claim 82, wherein said green emitter occupies said left unit-area polygon in said first pixel row and said red emitter occupies said right unit-area polygon in said first pixel row; and wherein said red emitter occupies said left unit-area polygon in said second pixel row and said green emitter occupies said right unit-area polygon in said second pixel row.

84. A method of driving a three-color pixel element in a display, comprising:

providing a three-color pixel element comprising first and second pixel rows, each pixel row including three unit-area polygons, wherein an emitter occupies each said unit-area polygon, wherein a red emitter occupies a left unit-area polygon in said first pixel row and a green emitter occupies a right unit-area polygon in said first pixel row, wherein a green emitter occupies a left unit-area polygon in said second pixel row and a red emitter occupies a right unit-area polygon in said second pixel row, wherein a single blue emitter occupies both center unit-area polygons in said first and said second pixel rows, and wherein adjacent horizontal pairs of said three-color pixel elements are vertically offset from one another by one pixel row; and



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driving said blue emitter, said red emitters, and said green emitters, wherein said blue emitter of said three-color pixel element is coupled to a blue emitter of a next nearest neighboring three-color pixel element.

85. The method of Claim 84, wherein said green emitter occupies said left unit-area polygon in said first pixel row and said red emitter occupies said right unit-area polygon in said first pixel row; and wherein said red emitter occupies said left unit-area polygon in said second pixel row and said green emitter occupies said right unit-area polygon in said second pixel row.



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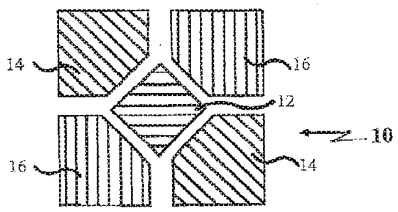



FIG. 1

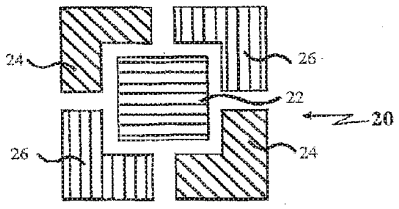



FIG. 2

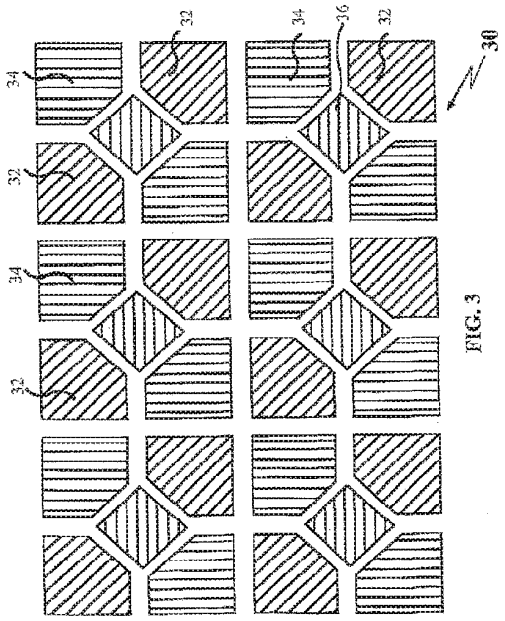



FIG. 3

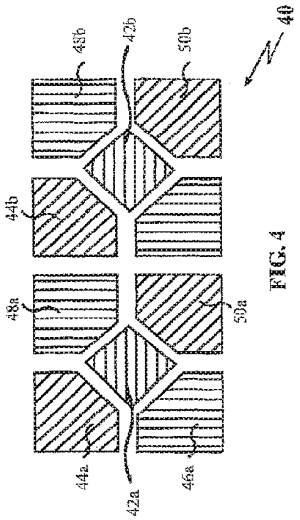



FIG. 4

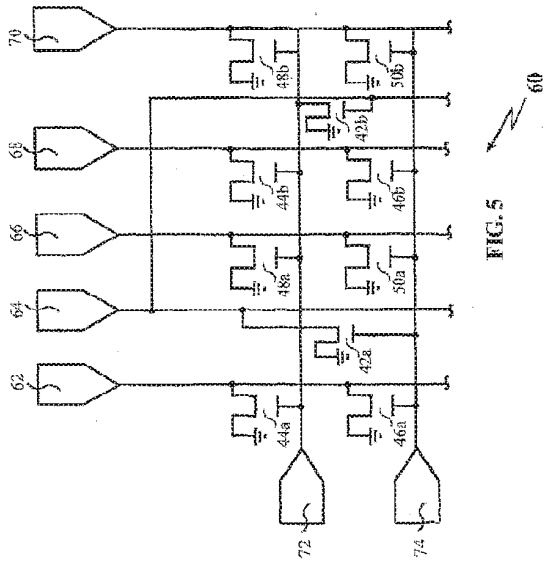



FIG. 5

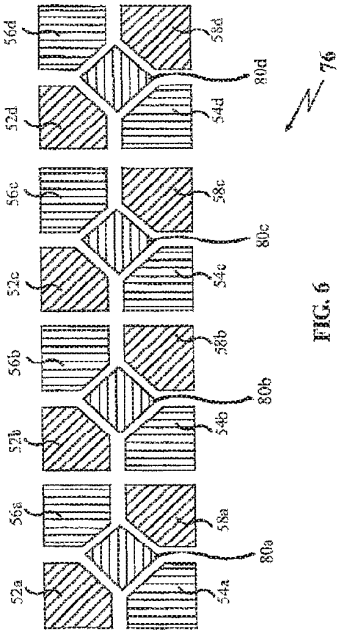

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FIG. 6

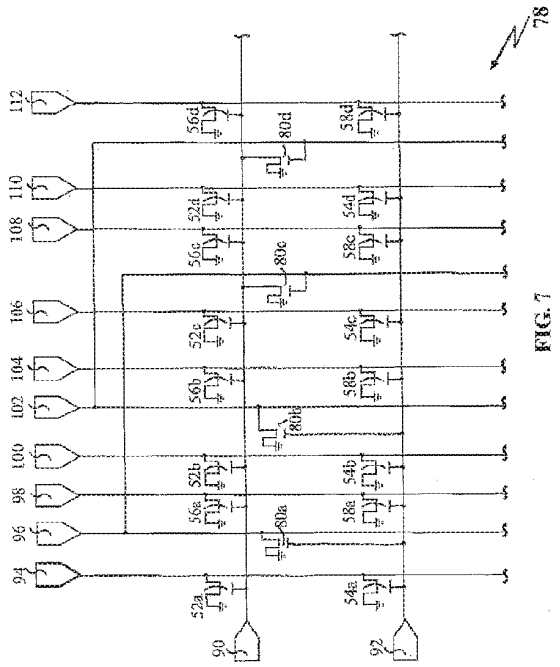

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FIG. 7

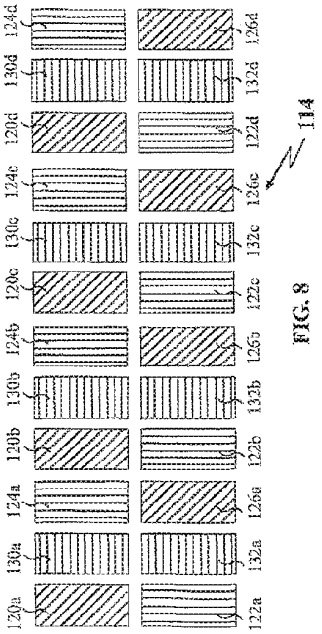

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114

FIG. 8

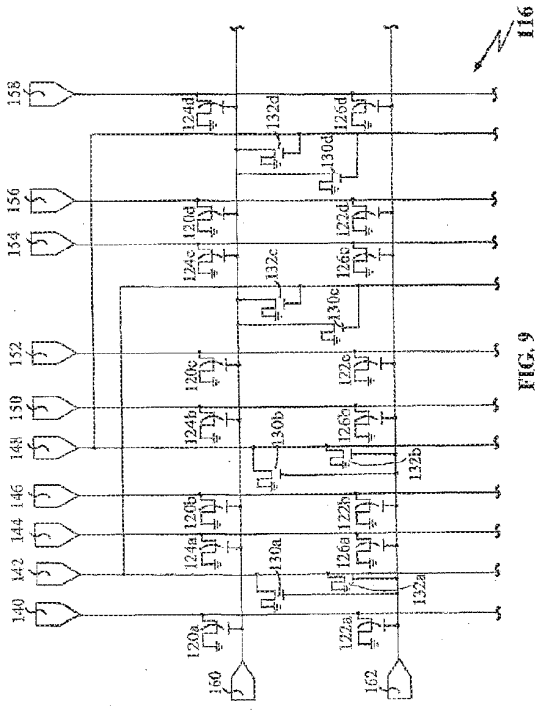

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FIG. 9

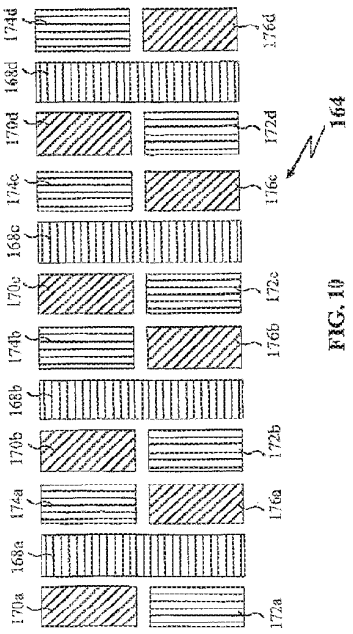

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FIG. 19

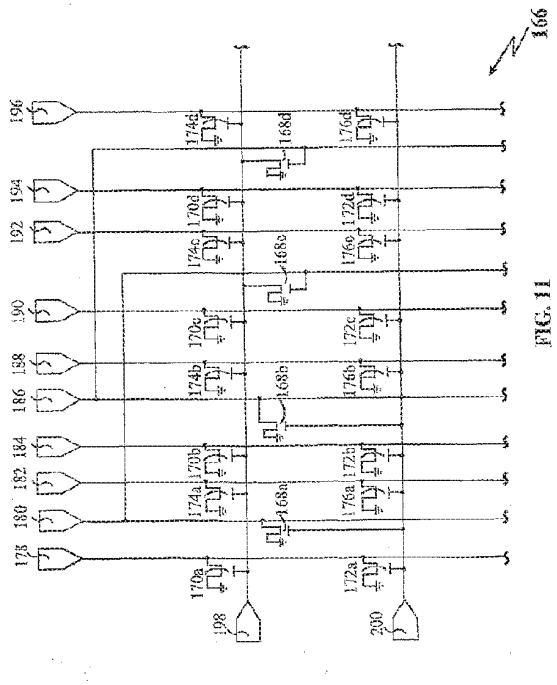

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FIG. 11

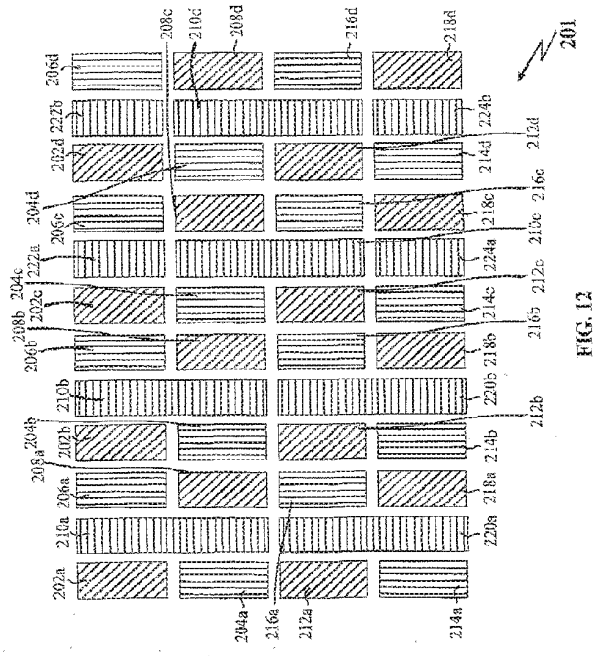

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FIG. 12

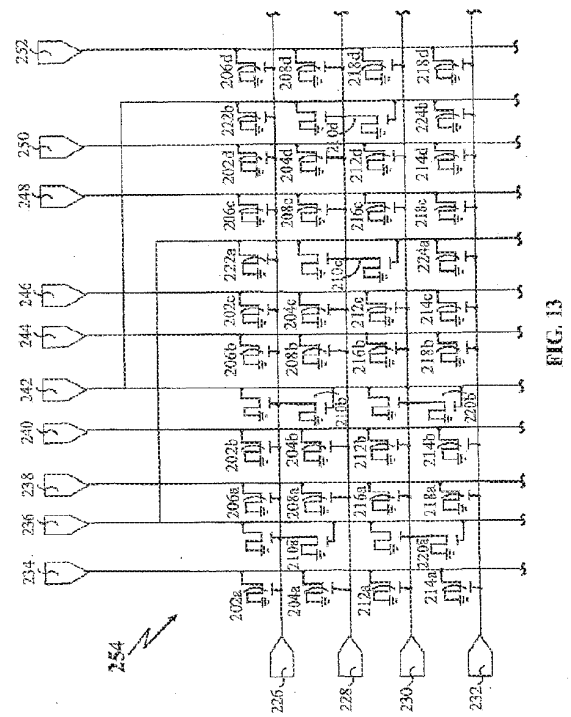



FIG. 13

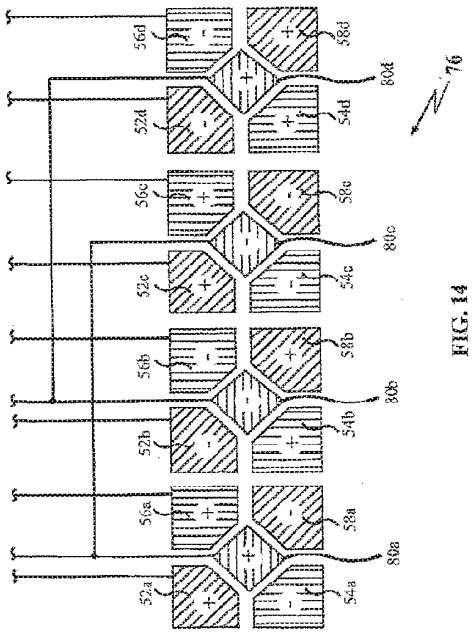

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FIG. 14

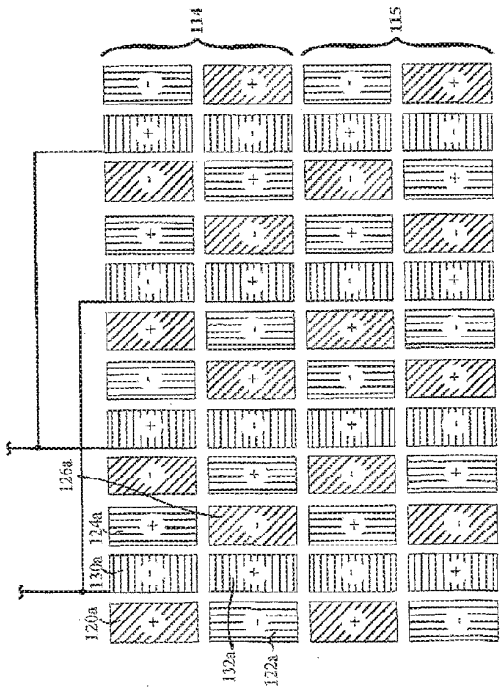



FIG. 15

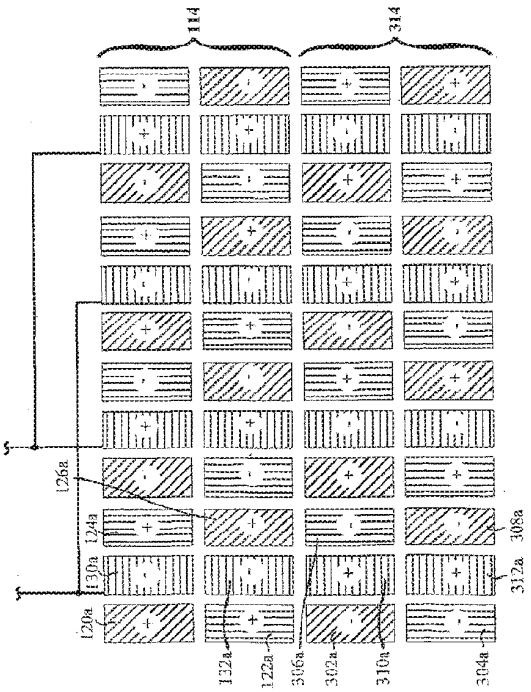

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FIG. 16

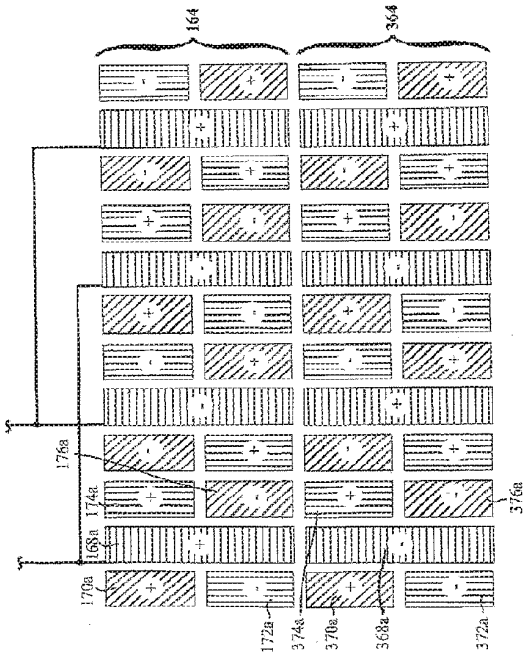



FIG. 17

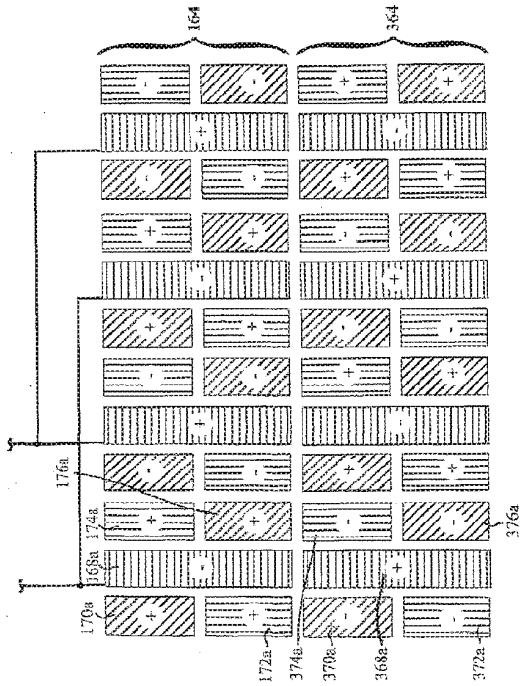



FIG. 18

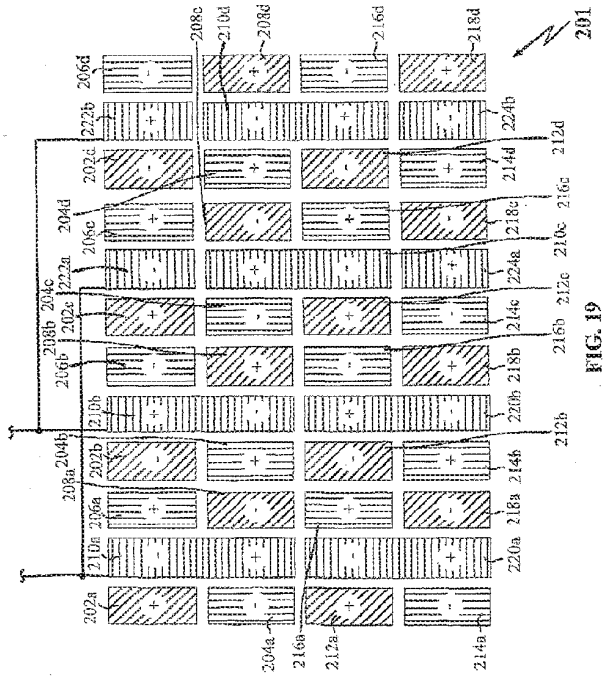

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FIG. 19

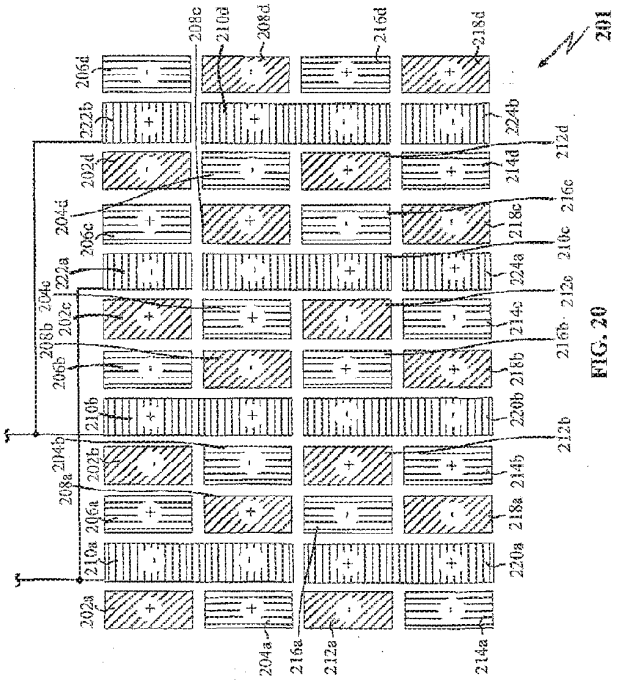

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FIG. 20

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PCT

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(72) Inventor: BROWN-ELLIOTT, Candice, Helen; 531 York Street, Vallejo, CA 94590 (US).

(74) Agents: GARRETT, Arthur S. et al.; Finnegan, Henderson, Farabow, Garrett & Dunner L. L. P., 1300 I Street, N.W., Washington, D.C. 20005-3315 (US).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

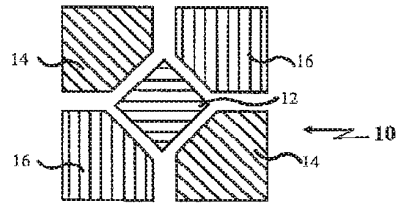
(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
*with international search report*

(88) Date of publication of the international search report:
13 March 2003

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: ARRANGEMENT OF COLOR PIXELS FOR FULL COLOR IMAGING DEVICES WITH SIMPLIFIED ADDRESSING




(57) Abstract: An array and row and column line architecture for a display is disclosed. The array consists of a plurality of row and column positions and a plurality of three-color pixel elements. A three color pixel element can comprise a blue emitter, a pair of red emitters, and a pair of green emitters. Several designs for the three colour pixel element are contemplated. The drive matrix consists of a plurality of row and column drivers to drive the individual emitters. The row drivers drive the red, green and blue emitters in each row. The red and green emitters in each column are driven by a single column driver. However, a single column driver can drive two column lines of blue emitters, a first column line and a second column line of the next nearest neighboring three-color pixel element. Methods of driving a three-color pixel element are also disclosed.

WO 02/011112 A3

【国際調査報告】

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 01/23892

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G09G3/36 G09G3/20 G02F1/1335

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G09G G02F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | EP 0 878 969 A (MATSUSHITA ELECTRIC IND CO LTD) 18 November 1998 (1998-11-18) page 5, line 33 -page 5, line 36; figure 2A | 1-85 |
| A | EP 0 671 650 A (CANON INFORMATION SYST RES) 13 September 1995 (1995-09-13) abstract; figure 8 | 1 |
| A,P | DE 199 23 527 A (LEUROCOM VISUELLE INFORMATIONS) 23 November 2000 (2000-11-23) abstract; figure 2 | 1-85 |

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☒ Patent family members are listed in annex.

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| 21 March 2002 | 04/04/2002 |

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Information on patent family members

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PCT/US 01/23892

| Patent document cited in search report | | Publication date | Patent family member(s) | | Publication date |
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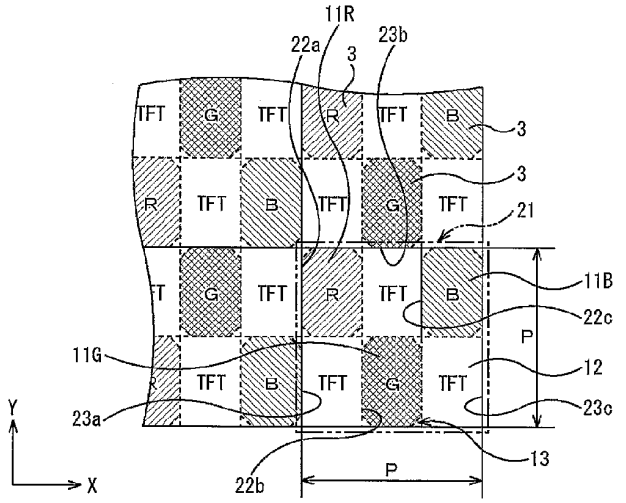
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(54) **Title:** DISPLAY APPARATUS AND MANUFACTURING METHOD THEREOF

(54) 発明の名称: 表示装置及びその製造方法




(57) **Abstract:** Each pixel (21) contains a plurality of light emitting areas having an organic EL layer (3) and includes light emitting areas (11R, 11G, 11B) corresponding to R, G, B and a plurality of TFT elements (12) arranged for the respective light emitting areas for controlling light emission of each light emitting area. The light emitting areas are arranged in a checkerboard so as to be not in contact with the adjacent light emitting areas. Each pixel (21) is divided into six divisions (22a to 22c, 23a to 23c) and the light emitting areas are arranged in three divisions of the checkerboard (22a to 22c). With this configuration, in a bottom emission type active matrix organic EL display, it is possible to effectively assure a sufficient numerical aperture and realize a pixel arrangement hardly sacrificing the numerical aperture even when increasing fineness. This contributes to suppression of power consumption required for obtaining necessary luminance and reduction in size of the drive circuit and the entire apparatus.

(57) 要約: 各画素（２１）は、有機ＥＬ層（３）を有する複数の発光領域であり、Ｒ，Ｇ，Ｂに対応する発光領域（１１Ｒ，１１Ｇ，１１Ｂ）と、発光領域毎に対応して設けられ、各発光領域の発光を制御する複数のＴＦＴ素子（１２）とを含み、各

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発光領域は、千鳥状に配置されており、隣接する発光領域と互いに非接触状態とされている。各画素（２１）は、６つの区画（２２ａ～２２ｃ，２３ａ～２３ｃ）に分割されており、千鳥状の３つの区画（２２ａ～２２ｃ）に各発光領域が配置される。この構成により、ボトムエミッション型のアクティブマトリクス有機ＥＬディスプレイにおいて、十分な開口率を効率良く確保し、高精細化を図る場合にも開口率を殆ど犠牲にすることのない画素配置を実現し、これにより必要な輝度を得るための消費電力を抑え、駆動回路及び装置全体の小型化に寄与する。

# 明 細 書

## 表示装置及びその製造方法

### 技術分野

本発明は、有機ＥＬ（Electro-Luminescence）を利用した表示装置に関し、特にボトムエミッション型のアクティブマトリクス有機ＥＬパネルに適用するものである。

### 背景技術

近年、自発光型のディスプレイとして、有機固体に電極からキャリアを注入し、面状発光を取り出す有機ＥＬを用いた有機ＥＬディスプレイの開発が盛んに行われている。この有機ＥＬディスプレイは、例えば駆動方法の相違によりパッシブマトリクス型とアクティブマトリクス型に分類される。前者はマトリクス状に配置された画素を線順次駆動により発光させる形態を採り、後者はマトリクス状の画素毎にスイッチング素子が配置され、スイッチング素子の駆動制御により個々の画素毎に発光させる形態を採る。

アクティブマトリクス型の有機ＥＬディスプレイは、各スイッチング回路により個々の画素毎に発光制御する駆動方法を採るため、特に動画の表示に最適なディスプレイとして注目されており、ガラス基板側へ発光を取り出すボトムエミッション型と、ガラス基板の反対側へ発光を取り出すトップエミッション型のものがある。

ボトムエミッション型のアクティブマトリクス有機ＥＬパネルは、画素毎にスイッチング回路を設け、しかもガラス基板側へ発光することから、画素の半分を占めるスイッチング回路の部分が必然的に非発光領域となる。加えて、フルカラー表示するために必要なＲ（赤），Ｇ（緑），Ｂ（青）の３つの発光領域は各色に対応して有機ＥＬ発光層を独立に塗り分けて形成されるため、隣接する発光領域間には色毎に塗り分けるための位置合わせマージン（ｄｍ）が必要であり、この



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ｄｍ部位も非発光領域となる。

従来、Ｒ，Ｇ，Ｂの３つの発光領域の発光領域とスイッチング回路部の配置は各色で連続している（図４（横（Ｘ方向）並び配置）参照）。画素成膜装置の位置合わせ精度とパターニング用マスクの加工精度とに依存するため、位置合わせマージン（ｄｍ）の抑制には限界があり、現状では一般的にｄｍ＝２０μｍ（±１０μｍ相当）が最小値である。ここで、高精細化を図るほど各発光領域幅は細くなるが、ｄｍの最小値は一定であるため、高精細化においては画素に占めるｄｍの割合が増加し、発光領域の占める割合（開口率）が縮小してしまう。開口率が小さくなると発光輝度が下がるため、発光に寄与する電流量を増大して必要輝度を確保する必要があり、これにより消費電力の増加を招来するという問題があった。

本発明は、上記の課題に鑑みてなされたものであり、十分な開口率を効率良く確保し、高精細化を図る場合にも開口率を殆ど犠牲にすることのない画素配置を実現し、これにより必要な輝度を得るための消費電力を抑えることができ、駆動回路及び装置全体の小型化に寄与することを可能とするボトムエミッション型のアクティブマトリクス有機ＥＬパネルを備えた表示装置、及び当該表示装置の構成を容易且つ確実に実現する製造方法を提供することを目的とする。

発明の開示

本発明の表示装置は、基板上に設けられた第１の電極及び第２の電極と、前記第１の電極と前記第２の電極との間に設けられた有機ＥＬ発光層とを有するアクティブマトリクス有機ＥＬパネルを備えた表示装置であって、前記有機ＥＬ発光層は発光領域を含み、複数の前記各発光領域が千鳥状に配置され、隣接する前記発光領域と互いに非接触状態とされている。

本発明の表示装置の製造方法は、基板上に設けられた第１の電極及び第２の電極と、前記第１の電極と前記第２の電極との間に設けられた有機ＥＬ発光層とを



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有するアクティブマトリクス有機ＥＬパネルを備えた表示装置の製造方法であって、前記有機ＥＬ発光層は発光領域を含んでなり、前記各発光領域を複数含むように形成するに際して、マスク蒸着法により、前記各発光領域に対応する前記有機ＥＬ発光層を千鳥状且つ隣接する前記発光領域と互いに非接触状態となるように形成する。

図面の簡単な説明

図１は、本実施形態による有機ＥＬディスプレイの有機ＥＬ層を示す概略断面図である。

図２は、本実施形態による有機ＥＬディスプレイの主要構成をなす有機ＥＬ発光層の表面を拡大して示す概略平面図である。

図３は、図２の画素ユニットを拡大して示す概略平面図である。

図４は、従来のボトムエミッション型のアクティブマトリクス有機ＥＬディスプレイにおける画素配置の一例を示す概略平面図である。

図５は、画素の高精細化と開口率との関係について、従来例（前記比較例）との比較に基づいて調べた結果を示す特性図である。

図６Ａ～図６Ｇは、本実施形態の有機ＥＬディスプレイを製造する際の主要工程を順に示す概略断面図である。

図７は、変形例１による有機ＥＬディスプレイの主要構成をなす有機ＥＬ発光層の表面を拡大して示す概略平面図である。

図８は、変形例２による有機ＥＬディスプレイの主要構成をなす有機ＥＬ発光層の表面を拡大して示す概略平面図である。



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発明を実施するための最良の形態

以下、本発明を適用した具体的な実施形態について図面を参照しながら詳細に説明する。

以下、本発明を適用した好適な実施形態について図面を参照しながら詳細に説明する。この実施形態では、主としてボトムエミッション型のアクティブマトリクス有機ＥＬパネルを備えた表示装置（ボトムエミッション型のアクティブマトリクス有機ＥＬディスプレイ）を対象とする。

－有機ＥＬディスプレイの具体的構成－

図１は、本実施形態による有機ＥＬディスプレイのパネル構成を示す概略断面図であり、図２は、本実施形態による有機ＥＬディスプレイの主要構成をなす有機ＥＬ発光層の表面を拡大して示す概略平面図、図３は、図２の画素を拡大して示す概略平面図である。ここで、図１は図３のＩ－Ｉ’に沿った断面に対応している。

この有機ＥＬディスプレイは、図１に示すように、透明基板として例えばガラス基板１上に、発光を制御するスイッチング回路としてＴＦＴ（Thin Film Transistor）素子１２を構成し、平坦化膜１０によりＴＦＴ素子１２及び配線の絶縁保護をするとともに、有機ＥＬ素子を積層するための平坦な面を形成する。同面上に、透明電極として例えば酸化インジウム－錫合金（ＩＴＯ）等を含む材料からなる複数の第１の電極２と、各第１の電極２に対応する複数の有機ＥＬ層３と、アルミニウム等を含む材料からなり全面を覆う第２の電極４とが積層されてなり、各第１の電極２と第２の電極４との間に各有機ＥＬ層３が挟持され、平坦化膜１０の一部に設けたスルーホールにより第１の電極２とＴＦＴ素子１２とが接続されるように構成されている。ここで、有機ＥＬ層３の面積が第１の電極２の面積よりも大きくなるように形成されている。駆動時には、有機ＥＬ層３から第１の電極２及びガラス基板１を経て発光がなされることになる。



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図２に示すように、複数の画素２１がマトリクス状に配置されており、各画素２１は、複数の発光領域であり、Ｒ，Ｇ，Ｂに対応する発光領域１１Ｒ，１１Ｇ，１１Ｂと、発光領域毎に対応して設けられ、各発光領域の発光を制御するスイッチング回路となる複数のＴＦＴ素子１２とを含む。ここでは、第１の電極２と有機ＥＬ層３との重畳部分がそれぞれ発光領域１１Ｒ，１１Ｇ，１１Ｂとなる。各発光領域１１Ｒ，１１Ｇ，１１Ｂは、千鳥状に配置されており、各発光領域の角部位に設けられた非発光領域１３により隣接する発光領域１１Ｒ，１１Ｇ，１１Ｂと互いに非接触状態とされている。１つの画素２１はＰ×Ｐの正方形状となる。各画素２１は、縦方向２分割、横方向３分割した６つの区画２２ａ～２２ｃ，２３ａ～２３ｃに分割されており、千鳥状の３つの区画２２ａ～２２ｃに各発光領域１１Ｒ，１１Ｇ，１１Ｂが配置されるとともに、残りの３つの区画２３ａ～２３ｃに各ＴＦＴ素子１２が配置されて構成される。ここでは、同色の発光領域がＴＦＴ素子１２を介して縦（Ｙ方向）一列に配置されている。

ここで、本実施形態の比較例として、従来のボトムエミッション型のアクティブマトリクス有機ＥＬディスプレイにおける画素配置の一例を図４に示す。

このように従来では、画素１１１の構成要素である発光領域１０１Ｒ，１０１Ｇ，１０１Ｂは横（Ｘ方向）一列に配置されているため、隣接する発光領域は互いに当該発光領域の縦一辺部位に設けられた非発光領域１０３及びＴＦＴ素子１０２により隔てられている。この非発光領域１０３の面積を小さくするには必然的に限界がある。

これに比べて、本実施形態では、各発光領域１１Ｒ，１１Ｇ，１１Ｂにはそれぞれ４つの角部位に非発光領域１３として切り欠き、ここではＣ面取り形状（Ｒ形状でも良い。）の切り欠きが形成されており、この非発光領域１３及びＴＦＴ回路１２により隣接する発光領域同士が互いに非接触状態に保たれる。非発光領域１３は発光領域の角部位に形成されるために極めて小さい面積を確保すれば十分であり、図４に比べて格段に開口率を向上させることが可能となる。



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この画素配置構成を基本とし、一例として精細度１６０ｐｐｉの寸法について図３を用いて説明する。なお、この寸法は飽くまで一例であり、本発明がこれに限定されないことは言うまでもない。

精細度１６０ｐｐｉのとき、Ｐ＝１５９μｍであるから、Ｒ，Ｇ，Ｂの各色にそれぞれ占める領域を与えると、その面積は１５９μｍ×５３μｍであり、このうち各半分の７９．５μｍ×５３μｍがＴＦＴ素子１２の占める領域、残りの半分の７９．５μｍ×５３μｍが各発光領域の占める領域となる。この発光領域の占める領域の角部位において、３色の塗り分けに必要な位置合わせマージン及びスイッチング回路の各種配線スペースを確保するため、非発光領域１３として所謂Ｃ面取りを設ける。塗り分けに必要な位置合わせマージンはｄｍ＝２０μｍ(画素成膜装置の位置合わせ精度±５μｍ＋Ｒ，Ｇ，Ｂパターニング用マスクの加工精度±５μｍ）である。配線は、データ線３１、走査線３２、電源線３３、保持容量線３４が必要であり、各々５μｍ～１５μｍ幅とする。データ線３１をＹ方向に配線し、走査線３２、電源線３３及び保持容量線３４をＸ方向に配線する。ＴＦＴ素子１２におけるこれらの配線は多層膜形成によって各々異なる層で構成され、配線間の接続は層間絶縁膜に設けたスルーホール３５を介して成される。従って、各色発光領域の角部位においてＣ１５μｍの面取りを設けることで、位置合わせマージンと配線スペースを確保できる。

各発光領域を形成するには、ガラス基板上の透明電極である第１の電極２の形状を７９．５μｍ×５３μｍの矩形状とし、各角部位の面取りをＣ１５μｍとする。従って、各色の区分の面積が１５９μｍ×５３μｍ＝８４２７$\mu m^2$となるのに対して、実効的な発光領域の面積が７９．５μｍ×５３μｍ－Ｃ１５μｍ×４＝３７６３．５$\mu m^2$となり、開口率は（３７６３．５／８４２７）×１００＝４４．７％となる。

これに対して、図４の比較例では、画素のピッチＰにおける各Ｒ，Ｇ，Ｂの発光領域の区画幅はＰ／３であり、塗り分け用の位置合わせマージンｄｍを確保す



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ることで発光領域の幅はＰ／３－ｄｍとなる。塗り分け用の位置合わせマージンｄｍを下限値で設計し高精細化を図ると、ピッチＰを小さくするほどｄｍによる発光領域幅の減少割合が大きくなり、開口率が小さくなってしまう。

例えば、Ｐ＝３１８μｍ（精細度８０ｐｐｉ）、ｄｍ＝２０μｍのとき、発光領域の寸法Ｌ×Ｗ＝１５９μｍ×８６μｍ、開口率４０．６％であるが、Ｐ＝１５９μｍ（精細度１６０ｐｐｉ）、ｄｍ＝２０μｍのとき、Ｌ×Ｗ＝７９．５μｍ×３３μｍ、開口率３１．１％となり、高精細化するに従い位置合わせマージンｄｍによって開口率を大きく損失してしまう。

また、上述した構成の本実施形態による有機ＥＬディスプレイにおいて、画素の高精細化と開口率との関係について、従来例（前記比較例）との比較に基づいて調べた。結果を図５に示す。このように、塗り分けに必要な位置合わせマージンｄｍ＝２０μｍの場合において、精細度の大小に関わらず本実施形態の構成における開口率は従来の構成における開口率を大きく上回る。従って、ボトムエミッション型のアクティブマトリクス有機ＥＬパネルにおいては、本実施形態の構成が開口率を向上させるために極めて有効であることが判った。

このように、本実施形態では、当該比較例に比べて開口率を１３．６％向上させることができる。従って、本実施形態によれば、十分な開口率を効率良く確保し、高精細化を図る場合にも開口率を殆ど犠牲にすることのない画素配置を実現し、これにより必要な輝度を得るための消費電力を抑えることができ、駆動回路及び装置全体の小型化に寄与することを可能とするボトムエミッション型のアクティブマトリクス有機ＥＬディスプレイが実現する。

－有機ＥＬディスプレイの製造方法の具体例－

図６Ａ～図６Ｇは、本実施形態の有機ＥＬディスプレイを製造する際の主要工程を順に示す概略断面図である。ここで、図６Ａ～図６Ｇの各図において、紙面上で左側が図３のＩＩ－ＩＩ’に沿った断面を、右側が図３のＩＩＩ－ＩＩＩ’



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に沿った断面をそれぞれ示す。

先ず、図６Ａに示すように、透明基板として例えばガラス基板１の表面に、スイッチング回路となるＴＦＴ素子１２と、データ線３１、走査線３２、電源線３３、保持容量線３４等の各種配線とを形成した後、これらを覆うように透明樹脂からなる平坦化膜１０を形成する。ここで、ＴＦＴ素子１２は、上述のように画素２１の区画２３ａ～２３ｃに相当する部位に形成される。

続いて、図６Ｂに示すように、上述した実効的な発光部分に透明電極である酸化インジウム錫合金（ＩＴＯ）を成膜し、第１の電極２を形成する。

続いて、各画素２１を構成する発光領域１１Ｒ，１１Ｇ，１１Ｂを順次形成する。

具体的には、先ず図６Ｃに示すように、発光領域の形成領域に対応して開口５ａが設けられた蒸着マスク５を用い、開口５ａが発光領域１１Ｒに対応する有機ＥＬ層３の形成位置のみに位置するように蒸着マスク５をガラス基板１の表面に重ねて、蒸着法により発光領域１１Ｒに対応する有機ＥＬ層３を区画２２ａに形成する。このとき、第１の電極２は発光領域１１Ｒの有機ＥＬ層３により完全に覆われ、他色の第１の電極２にはこの有機ＥＬ層３は重ならない。

続いて、図６Ｄに示すように、同一の蒸着マスク５を用い、開口５ａが発光領域１１Ｇに対応する有機ＥＬ層３の形成位置のみに位置するように蒸着マスク５を移動させてガラス基板１の表面に重ね、蒸着法により発光領域１１Ｇに対応する有機ＥＬ層３を区画２２ｂに形成する。このとき、第１の電極２は発光領域１１Ｇの有機ＥＬ層３により完全に覆われ、他色の第１の電極２にはこの有機ＥＬ層３は重ならない。

続いて、図６Ｅに示すように、同一の蒸着マスク５を用い、開口５ａが発光領域１１Ｂに対応する有機ＥＬ層３の形成位置のみに位置するように蒸着マスク５



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を移動させてガラス基板１の表面に重ね、蒸着法により発光領域１１Ｂに対応する有機ＥＬ層３を区画２２ｃに形成する。このとき、第１の電極２は発光領域１１Ｂの有機ＥＬ層３により完全に覆われ、他色の第１の電極２にはこの有機ＥＬ層３は重ならない。

以上、図６Ｃ～図６Ｅの各工程を経て、各発光領域１１Ｒ，１１Ｇ，１１Ｂにはそれぞれ４つの角部位に非発光領域１３、ここではＣ面取り形状（Ｒ形状でも良い。）の非発光領域１３が形成され、これら非発光領域１３がＴＦＴ素子１２の区画２３ａ～２３ｃとともに非発光領域とされており、隣接する発光領域同士が互いに非接触状態に保たれてなる画素２１をマトリクス状に複数有するように、各有機ＥＬ層３を形成する。ここで、各発光領域１１Ｒ，１１Ｇ，１１Ｂに対応する有機ＥＬ層３をそれぞれ第１の電極２よりも面積を大きくこれを覆うように形成することにより、各発光領域を形成する際の位置合わせマージンを確保することができ、更にはＴＦＴ素子領域を高精細化における位置合わせマージンの確保に利用することにより、開口率を向上させることが可能となる。

また、各発光領域１１Ｒ，１１Ｇ，１１Ｂが互いに近接することなく面内に均一に配置するため、同色の発光領域をＴＦＴ素子１２を介して一列に配置するように形成する。

続いて、図６Ｆに示すように、全発光領域を露出させるように開口６ａが設けられた蒸着マスク６を用い、これをガラス基板１の表面に重ねて蒸着法によりアルミニウム合金膜を成膜し、全発光領域を覆うように第２の電極４を形成する。

そして、図６Ｇに示すように、第２の電極４を覆うようにガラス等からなる不透湿板７を例えば接着剤８により接着固定し、形成した有機ＥＬ層３が水分等によって劣化することを防止する。ガラス基板１上に形成された各種導電部材はＦＰＣ（Flexible Printed Circuit）の配線９を介して駆動回路（不図示）と接続される。



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しかる後、諸々の後工程を経て、例えば精細度１６０ｐｐｉで開口率４４．７％のボトムエミッション型アクティブマトリクス有機ＥＬディスプレイを完成させる。

以上説明したように、本実施形態によれば、上述した構成の有機ＥＬディスプレイを製造するに際して、各発光領域１１Ｒ，１１Ｇ，１１Ｂに対応する有機ＥＬ層３の形成にマスク蒸着法を用い、同一の蒸着マスク５を順次移動させて各発光領域を形成する手法を採ることにより、単一の蒸着マスク５を単一の成膜室で容易に形成でき、低分子有機ＥＬの蒸着形成が可能となり、容易且つ確実に上述した構成の有機ＥＬディスプレイを実現することができる。

－本実施形態の諸変形例－

以下、本実施形態のいくつかの変形例について説明する。

（変形例１）

図７は、変形例１による有機ＥＬディスプレイの主要構成をなす有機ＥＬ発光層の表面を拡大して示す概略平面図である。

この有機ＥＬディスプレイでは、各画素２１において、各発光領域１１Ｒ，１１Ｇ，１１Ｂの面積がそれぞれＴＦＴ素子１２の面積よりも大きく形成されている。この場合も、３色の塗り分けに必要な位置合わせマージンをＴＦＴ素子１２の区画に吸収させることができ、開口率を高めることができる。

（変形例２）

図８は、変形例２による有機ＥＬディスプレイの主要構成をなす有機ＥＬ発光層の表面を拡大して示す概略平面図である。

この有機ＥＬディスプレイでは、各画素２１において、各発光領域１１Ｒ，１１Ｇ，１１Ｂの面積がそれぞれＴＦＴ素子１２の面積よりも小さく形成されている。この場合、隣接（図示の例ではＴＦＴ素子１２の区画は接触している。）する



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ＴＦＴ素子１２により、隣接する発光領域間が隔てられるため、各発光領域に付随した非発光領域を設ける必要がなく、従って開口率を高めることができる。

産業上の利用可能性

本発明によれば、十分な開口率を効率良く確保し、高精細化を図る場合にも開口率を殆ど犠牲にすることのない画素配置を実現し、これにより必要な輝度を得るための消費電力を抑えることができ、駆動回路及び装置全体の小型化に寄与することを可能とするボトムエミッション型のアクティブマトリクス有機ＥＬパネルを備えた表示装置、及び当該表示装置の構成を容易且つ確実に実現する製造方法を提供することができる。



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# 請 求 の 範 囲

１．基板上に設けられた第１の電極及び第２の電極と、

前記第１の電極と前記第２の電極との間に設けられた有機ＥＬ発光層と

を有するアクティブマトリクス有機ＥＬパネルを備えた表示装置であって、

前記有機ＥＬ発光層は発光領域を含み、複数の前記各発光領域が千鳥状に配置され、隣接する前記発光領域と互いに非接触状態とされていることを特徴とする表示装置。

２．Ｒ，Ｇ，Ｂに対応する３種の前記発光領域と、３種の前記発光領域に対応した３つの前記スイッチング回路とが複数マトリクス状に配置されてなり、

縦方向２分割、横方向３分割した６つの区画において、千鳥状の３つの前記区画に前記各発光領域が配置されるとともに、残りの３つの前記区画に前記各スイッチング回路が配置されてなることを特徴とする請求項１に記載の表示装置。

３．同色の前記発光領域が前記スイッチング回路を介して一列に配置されていることを特徴とする請求項２に記載の表示装置。

４．前記有機ＥＬ発光層の面積が前記第１の電極の面積よりも大きいことを特徴とする請求項１に記載の表示装置。

５．前記発光領域の角部位に非発光領域が形成されており、前記非発光領域により隣接する前記発光領域間が隔てられていることを特徴とする請求項１に記載の表示装置。

６．前記発光領域の面積が前記スイッチング回路の面積よりも大きいことを特徴とする請求項１に記載の表示装置。

７.前記各発光領域は、その面積が前記スイッチング回路の面積よりも小さく、前記スイッチング回路を介して隣接する前記発光領域と隔てられていることを特徴とする請求項１に記載の表示装置。

８．基板上に設けられた第１の電極及び第２の電極と、

前記第１の電極と前記第２の電極との間に設けられた有機ＥＬ発光層と

を有するアクティブマトリクス有機ＥＬパネルを備えた表示装置の製造方法であって、



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前記有機ＥＬ発光層は発光領域を含んでなり、前記各発光領域を複数含むように形成するに際して、

マスク蒸着法により、前記各発光領域に対応する前記有機ＥＬ発光層を千鳥状且つ隣接する前記発光領域と互いに非接触状態となるように形成することを特徴とする表示装置の製造方法。

９．同一のマスクを順次移動させ、前記各発光領域に対応する前記有機ＥＬ発光層を形成することを特徴とする請求項８に記載の表示装置の製造方法。

１０．Ｒ，Ｇ，Ｂに対応する３種の前記発光領域と、３種の前記発光領域に対応した３つの前記スイッチング回路とを複数マトリクス状に配置し、

縦方向２分割、横方向３分割した６つの区画において、千鳥状の３つの前記区画に前記各発光領域を配置するとともに、残りの３つの前記区画に前記各スイッチング回路を配置するように形成することを特徴とする請求項８に記載の表示装置の製造方法。

１１．同色の前記発光領域を前記スイッチング回路を介して一列に配置することを特徴とする請求項１０に記載の表示装置の製造方法。

１２．前記有機ＥＬ発光層の面積を前記第１の電極の面積よりも大きく形成することを特徴とする請求項８に記載の表示装置の製造方法。

１３．前記発光領域をその角部位が非発光領域となるように形成することを特徴とする請求項８に記載の表示装置の製造方法。

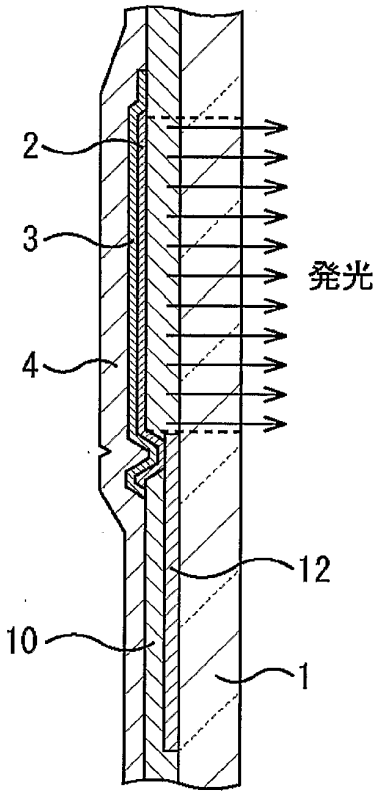
１４．前記発光領域の面積を前記スイッチング回路の面積よりも大きく形成することを特徴とする請求項８に記載の表示装置の製造方法。

１５．前記各発光領域を、その面積が前記スイッチング回路の面積よりも小さく、前記スイッチング回路を介して隣接する前記発光領域と隔てられるように形成することを特徴とする請求項８に記載の表示装置の製造方法。



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図1

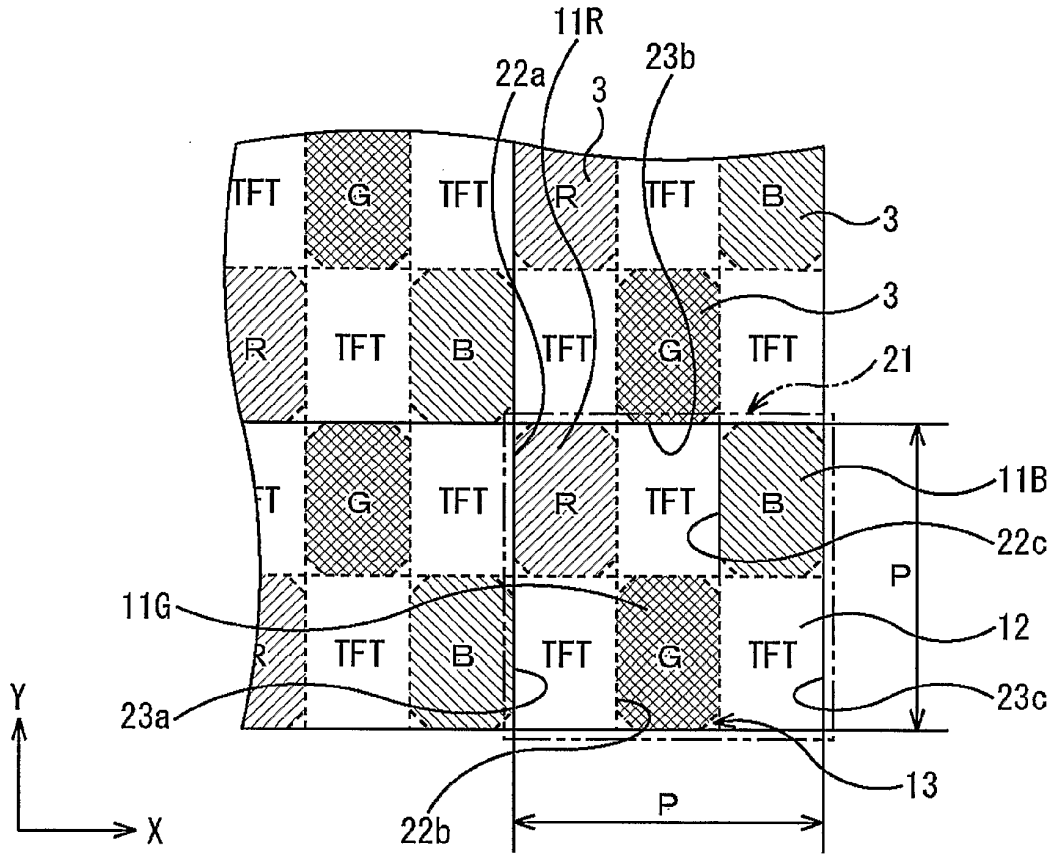



Ⅰ－Ⅰ'断面



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図2

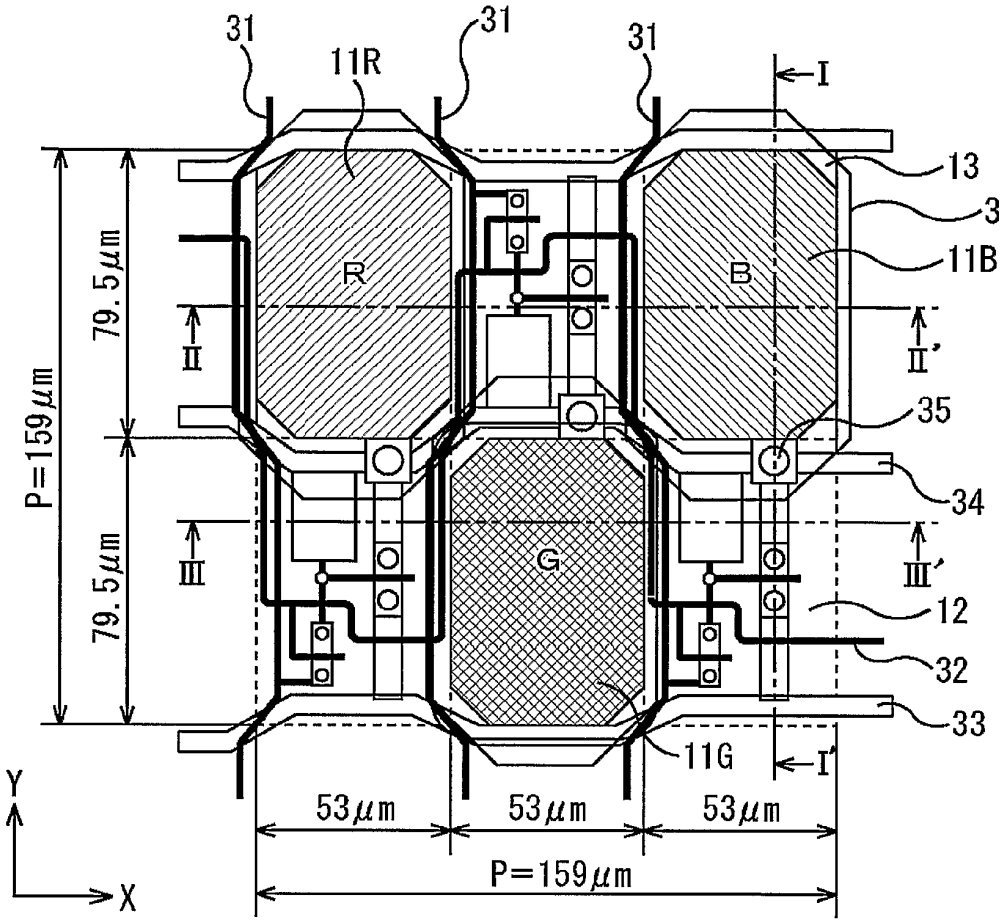





差替え用紙（規則26）

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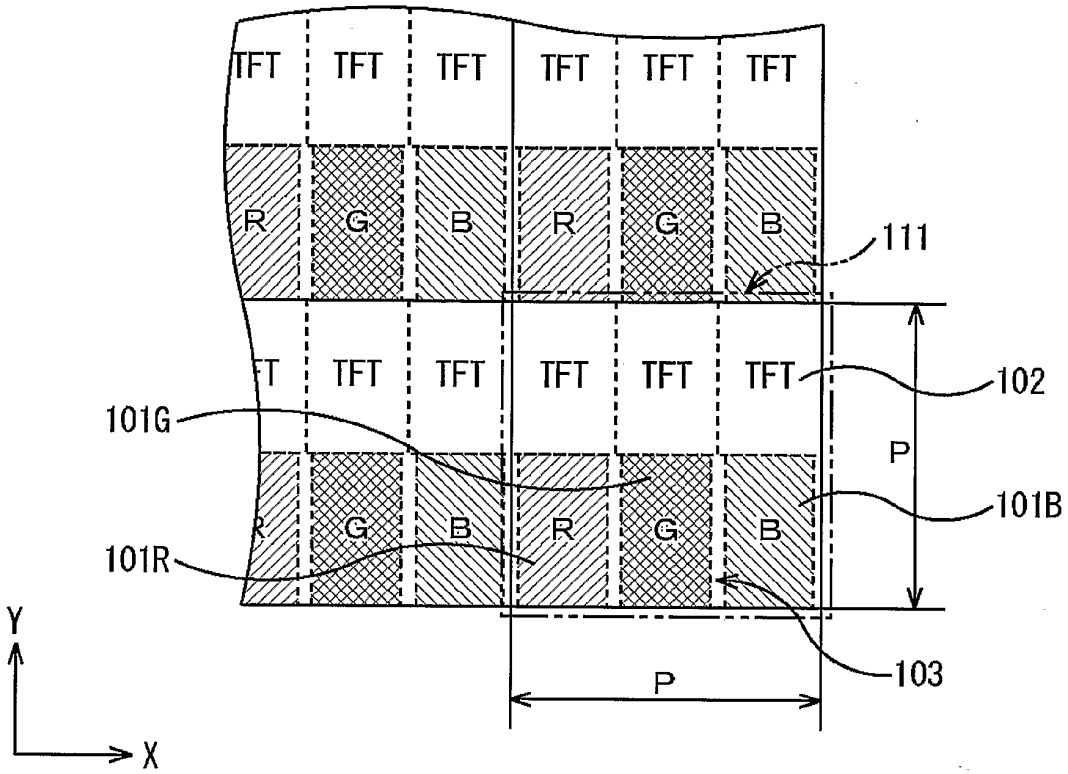
図3






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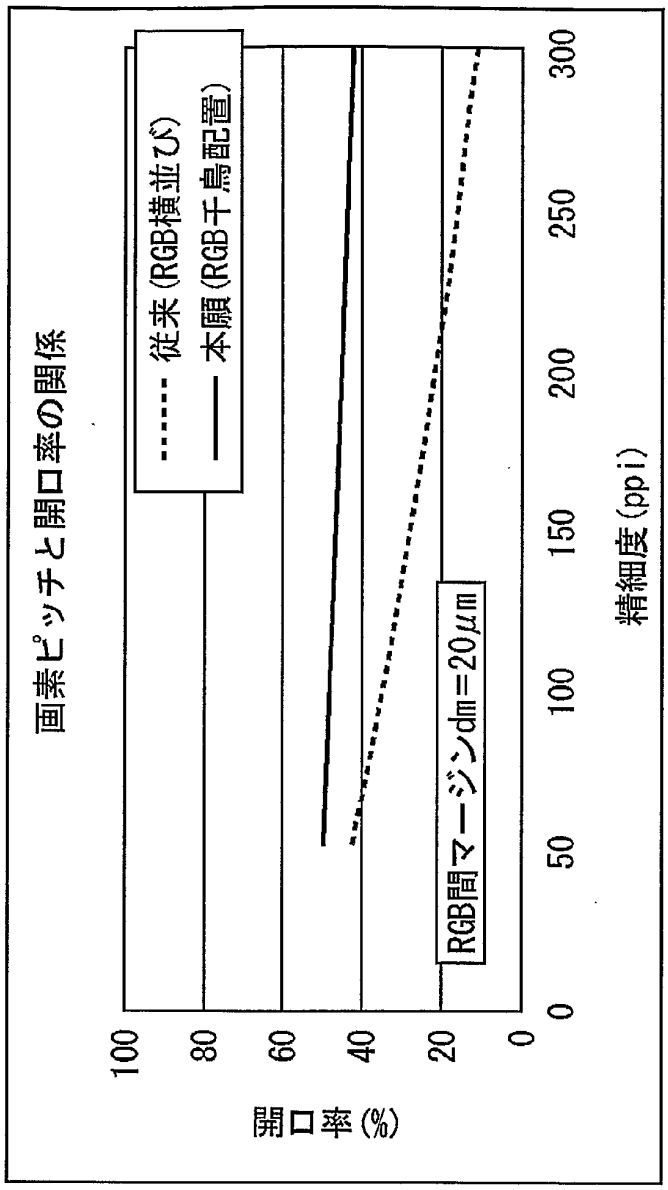
図4






Petitioner Ex 1015, p. 418
BOE et al. v. Samsung, IPR2023-00988

図5






Petitioner Ex 1015, p. 419
BOE et al. v. Samsung, IPR2023-00988

図6A

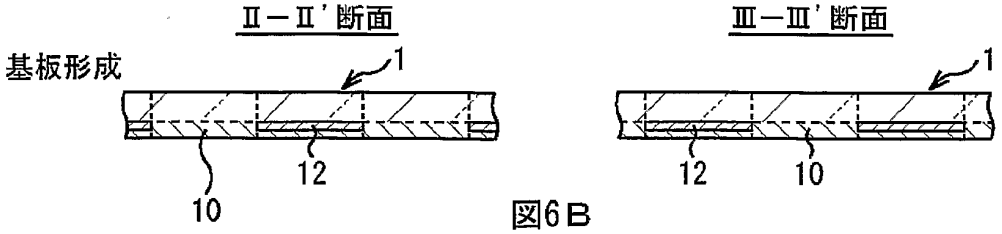



図6B

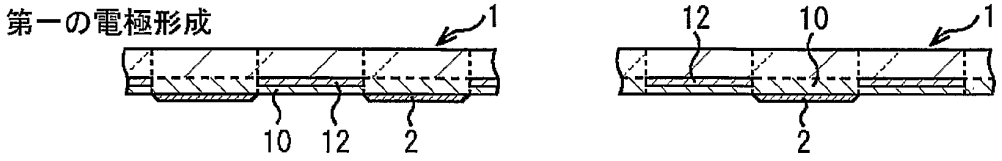



図6C

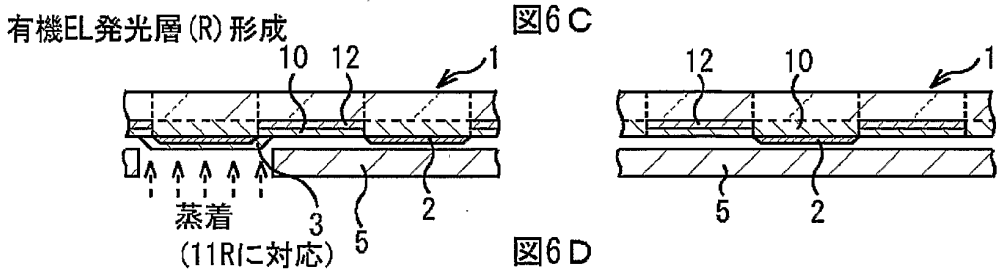



図6D

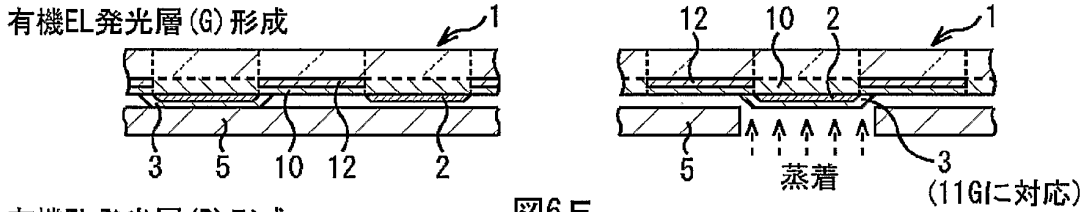



図6E

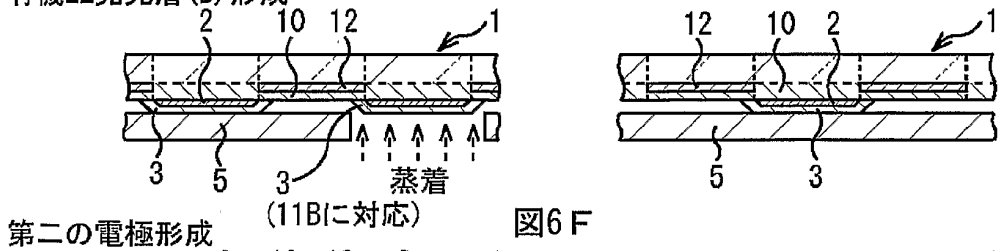



図6F

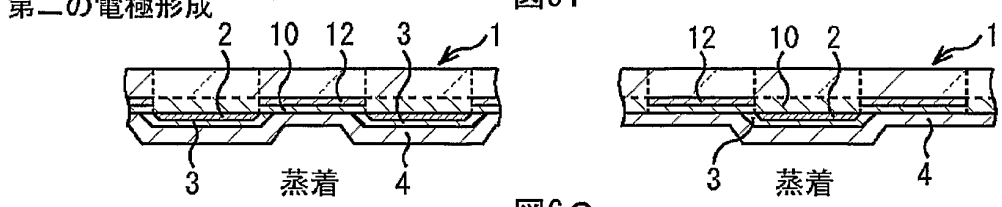
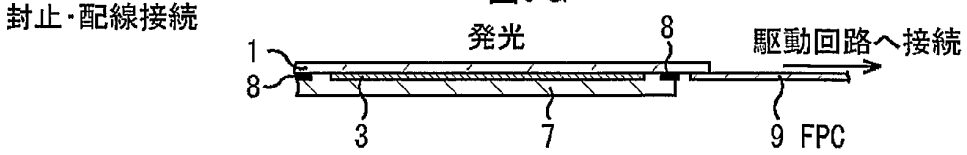


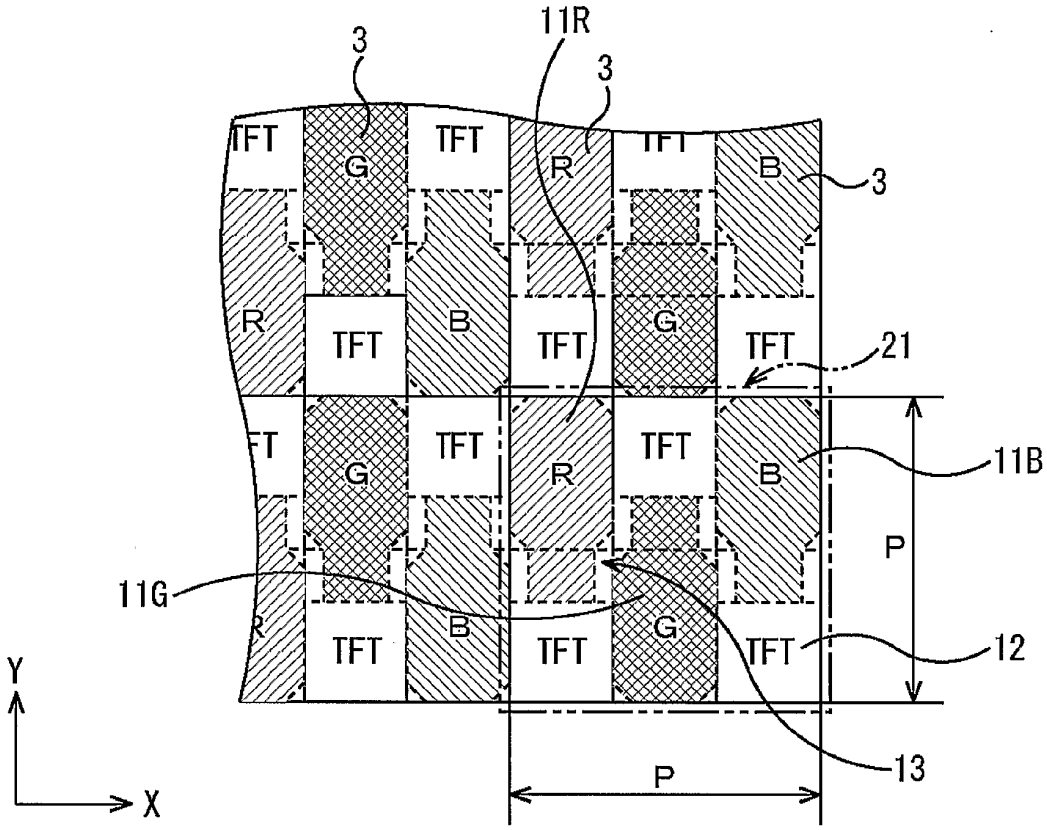

図6G






Petitioner Ex 1015, p. 420
BOE et al. v. Samsung, IPR2023-00988

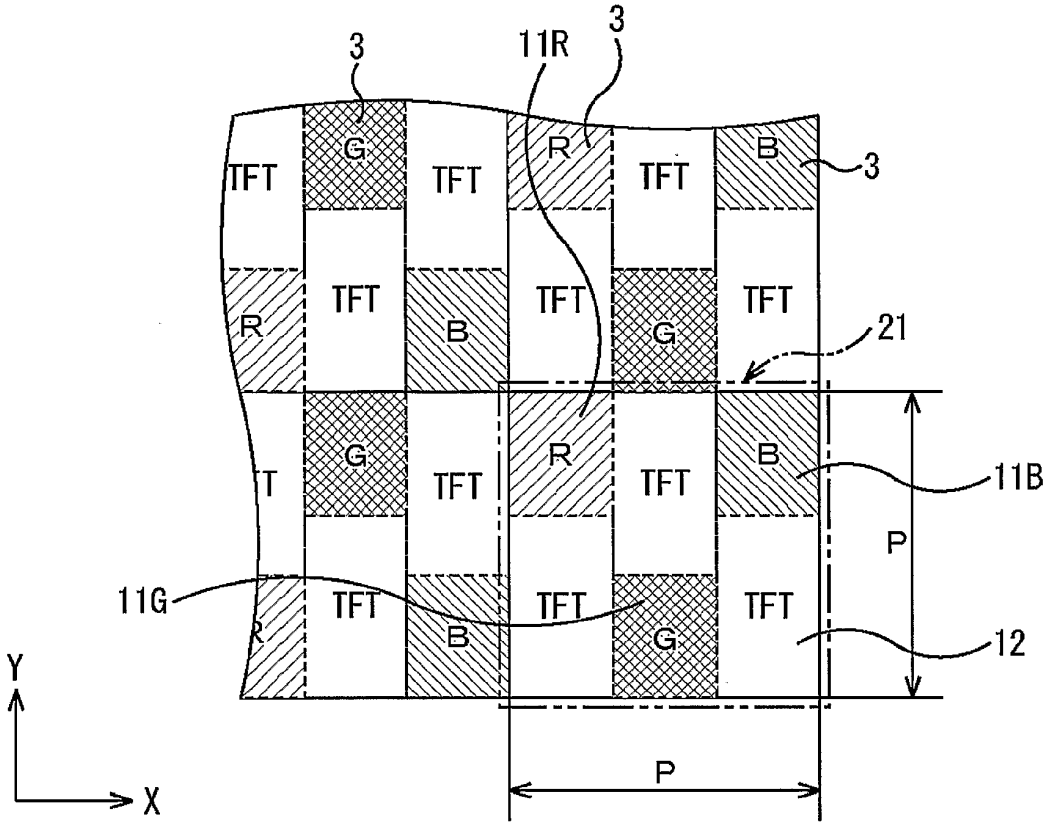
図7






Petitioner Ex 1015, p. 421
BOE et al. v. Samsung, IPR2023-00988

図8






Petitioner Ex 1015, p. 422
BOE et al. v. Samsung, IPR2023-00988

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP03/01464

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] H05B33/12, H05B33/26, G09F9/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] H05B33/00-33/28, G09F9/30

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

| | | | |
|---|---|---|---|
| Jitsuyo Shinan Koho | 1922-1996 | Jitsuyo Shinan Toroku Koho | 1996-2003 |
| Kokai Jitsuyo Shinan Koho | 1971-2003 | Toroku Jitsuyo Shinan Koho | 1994-2003 |

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X<br>Y<br>A | JP 2001-85162 A (Sharp Corp.),<br>30 March, 2001 (30.03.01),<br>Page 5, column 8, line 29 to page 6, column 9, line 15; Fig. 3<br>(Family: none) | 1,6<br>8-9,14<br>2-5,7,10-13, 15 |
| Y | WO 99/20080 A1 (Toray Industries, Inc.),<br>22 April, 1999 (22.04.99),<br>Full text<br>& EP 955791 A | 8-9,14 |
| A | JP 2002-215063 A (Sony Corp.),<br>31 July, 2002 (31.07.02),<br>(Family: none) | 1 |

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 03 April, 2003 (03.04.03) | 15 April, 2003 (15.04.03) |
| Name and mailing address of the ISA/<br>Japanese Patent Office | Authorized officer |
| Facsimile No. | Telephone No. |

Form PCT/ISA/210 (second sheet) (July 1998)

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP03/01464

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | JP 2002-221917 A (Sony Corp.),<br>09 August, 2002 (09.08.02),<br>& US 2002/0070909 A1 | 1 |
| A | JP 60-218626 A (Sharp Corp.),<br>01 November, 1985 (01.11.85),<br>(Family: none) | 1 |

Form PCT/ISA/210 (continuation of second sheet) (July 1998)

| 国際調査報告 | 国際出願番号　PCT／JP03／01464 |
|---|---|

A.　発明の属する分野の分類（国際特許分類（IPC））

Int. Cl⁷　H05B　33／12、　H05B　33／26、　G09F　9／30

B.　調査を行った分野

調査を行った最小限資料（国際特許分類（IPC））

Int. Cl⁷　H05B　33／00－33／28、　G09F　9／30

最小限資料以外の資料で調査を行った分野に含まれるもの

| | |
|---|---|
| 日本国実用新案公報 | 1922－1996年 |
| 日本国公開実用新案公報 | 1971－2003年 |
| 日本国実用新案登録公報 | 1996－2003年 |
| 日本国登録実用新案公報 | 1994－2003年 |

国際調査で使用した電子データベース（データベースの名称、調査に使用した用語）

C.　関連すると認められる文献

| 引用文献のカテゴリー＊ | 引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示 | 関連する請求の範囲の番号 |
|---|---|---|
| X<br>Y<br>A | JP　2001－85162　A（シャープ株式会社）<br>2001．03．30，第5頁8欄29行－第6頁9欄15行，第3図<br>（ファミリーなし） | 1, 6<br>8-9, 14<br>2-5, 7,<br>10-13, 15 |
| Y | WO　99／20080　A1（東レ株式会社）<br>1999．04．22，全文<br>&EP　955791　A | 8-9, 14 |

☒ C欄の続きにも文献が列挙されている。　　☐ パテントファミリーに関する別紙を参照。

＊　引用文献のカテゴリー

「A」特に関連のある文献ではなく、一般的技術水準を示すもの
「E」国際出願日前の出願または特許であるが、国際出願日以後に公表されたもの
「L」優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献（理由を付す）
「O」口頭による開示、使用、展示等に言及する文献
「P」国際出願日前で、かつ優先権の主張の基礎となる出願の日の後に公表された文献
「T」国際出願日又は優先日後に公表された文献であって出願と矛盾するものではなく、発明の原理又は理論の理解のために引用するもの
「X」特に関連のある文献であって、当該文献のみで発明の新規性又は進歩性がないと考えられるもの
「Y」特に関連のある文献であって、当該文献と他の1以上の文献との、当業者にとって自明である組合せによって進歩性がないと考えられるもの
「&」同一パテントファミリー文献

| 国際調査を完了した日 | 国際調査報告の発送日 |
|---|---|
| 03．04．03 | 15.04.03 |

| 国際調査機関の名称及びあて先 | 特許庁審査官（権限のある職員） | 2V | 9529 |
|---|---|---|---|
| 日本国特許庁（ISA／JP）<br>郵便番号100－8915<br>東京都千代田区霞が関三丁目4番3号 | 今関　雅子<br>電話番号　03－3581－1101　内線　3271 | | |

様式PCT／ISA／210（第2ページ）（1998年7月）

Ｃ（続き）．　関連すると認められる文献

| 引用文献のカテゴリー＊ | 引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示 | 関連する請求の範囲の番号 |
|---|---|---|
| Ａ | ＪＰ　２００２－２１５０６３　Ａ（ソニー株式会社）<br>２００２．０７．３１（ファミリーなし） | 1 |
| Ａ | ＪＰ　２００２－２２１９１７　Ａ（ソニー株式会社）<br>２００２．０８．０９<br>＆ＵＳ　２００２／００７０９０９　Ａ１ | 1 |
| Ａ | ＪＰ　６０－２１８６２６　Ａ（シャープ株式会社）<br>１９８５．１１．０１（ファミリーなし） | 1 |



Petitioner Ex 1015, p. 426
BOE et al. v. Samsung, IPR2023-00988

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 25134301 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Young E. Jeon/Diane Goss |
| **Filer Authorized By:** | Jun-Young E. Jeon |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 08-MAR-2016 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 14:14:48 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 69657ids.pdf | 114480<br>b834da9e0021e35ada854ea687e5fb3f60868a50 | yes | 3 |

| | Multipart Description/PDF files in .zip description | | | | |
|---|---|---|---|---|---|
| | **Document Description** | | **Start** | **End** | |
| | Transmittal Letter | | 1 | 2 | |
| | Information Disclosure Statement (IDS) Form (SB08) | | 3 | 3 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Foreign Reference | JP2004507773.pdf | 4539661<br>ff9e4800310b09f0ee07ad91b806d1e2be98b826 | no | 98 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Foreign Reference | WO2004073356.pdf | 2177290<br>e9d6fcdf506b3ef18bcce8110baade051c9ad064 | no | 27 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 4 | Non Patent Literature | JP_OfficeAction.pdf | 106607<br>2c8cee4d74e9d62e2d155e02c2f6d16dc97ff8d6 | no | 5 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 5 | Non Patent Literature | USOA2018-29FEB2016.pdf | 1307235<br>b9ae85591a9d06682740b3361767589b0a6f4308 | no | 15 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 8245273 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on March 8, 2016 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Diane L. Goss

Inventor : Sang-Shin Lee Confirmation No. 4264
Application No. : 13/614,197
Filed : September 13, 2012
Title : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

Grp./Div. : 2691
Examiner : Kwang-Su Yang

Docket No. : 69657/S1437

**INFORMATION DISCLOSURE STATEMENT**
**37 CFR § 1.97(b)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
March 8, 2016

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is an information disclosure statement listing the references that are known to applicant. Copies of each of the listed Foreign Patent Documents and Other Documents references are enclosed. This filing is timely because it is made during one of the periods described in 37 CFR § 1.97(b).

It is respectfully requested that the listed references be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of the information disclosure statement be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

**Application No.: 13/614,197**

The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
LEWIS ROCA ROTHGERBER CHRISTIE LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/dg
Enclosures: Information Disclosure Statement, w/references

DLG PAS1407353.1-*-03/8/16 8:56 AM



Petitioner Ex 1015, p. 431
BOE et al. v. Samsung, IPR2023-00988

**REQUEST FOR CONTINUED EXAMINATION (RCE) TRANSMITTAL**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on February 18, 2016 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Si Vuong

| | | | |
|---|---|---|---|
| Application Number | : | 13/614,197 | Confirmation No. 4264 |
| Filing Date | : | September 13, 2012 | |
| Inventor(s) | : | Sang-Shin Lee | |
| Title | : | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| Group Art Unit | : | 2691 | |
| Examiner Name | : | Kwang-Su Yang | |
| Docket No. | : | **69657/S1437** | Date: February 18, 2016 |

**MAIL TO: Mail Stop RCE**

This is a Request for Continued Examination (RCE) under 37 CFR § 1.114 of the above-identified application.

This application is **not** an application of the kind specified in 37 CFR § 1.114(e).

1. THE STATUS OF THE APPLICATION IS AS FOLLOWS:
   a. __X__ Pending (no review proceedings active)
      (1) __X__ An Action was mailed by the Office on December 2, 2015, as to which no appeal under 37 CFR § 1.191 has been filed and
         __X__ a response under 37 CFR § 1.116 was filed on January 26, 2016
            _____ via Express Mail
            __X__ with certificate of electronic transmission under 37 CFR § 1.8
         __X__ that Action was a Final Rejection, the finality of which is to be withdrawn by this Request
         _____ an appeal or civil action under 35 U.S.C. 141,145 or 146 has been terminated
      (2) _____ Allowed: the Notice of Allowance was mailed by the Office on
         _____ the Issue Fee has not been paid
         _____ the Issue Fee has been paid **and** a petition under 37 CFR § 1.313 was granted on
   b. _____ Pending (with review proceeding active)
      An appeal under 37 CFR § 1.191 has been filed. **Applicant(s) hereby withdraw that appeal and request reopening of the prosecution of the application.**



Petitioner Ex 1015, p. 432
BOE et al. v. Samsung, IPR2023-00988

**REQUEST FOR CONTINUED EXAMINATION (RCE)**
**TRANSMITTAL**

**Application No. 13/614,197**

2. SUBMISSION(S) REQUIRED (check at least one)
   a. Previously submitted
      __X__ Consider the amendments/reply under 37 CFR § 1.116 previously filed on January 26, 2016
      _____ Consider the arguments in the Appeal or Reply Brief previously filed on
      _____ Other:
   b. Enclosed
      _____ Amendment/Reply
      _____ Affidavit(s)/Declaration(s)
      _____ Information Disclosure Statement
      _____ Documents under 37 CFR § 1.48
      _____ Petition for Extension of Time
      _____ Other:

Please direct all correspondence to **CUSTOMER NUMBER 23363**. Direct telephone calls to 626/795-9900, **LEWIS ROCA ROTHGERBER CHRISTIE LLP, P.O. Box 29001, Glendale, CA 91209-9001**.

Respectfully submitted,

LEWIS ROCA ROTHGERBER CHRISTIE LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/smv



Petitioner Ex 1015, p. 433
BOE et al. v. Samsung, IPR2023-00988

## REQUEST FOR CONTINUED EXAMINATION (RCE)
## FEE CALCULATION SHEET

**Application No. 13/614,197**

| PART I -- BASIC FILING FEE | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | Large Entity Rate | Small Entity Rate | Micro Entity Rate | FEE |
| Basic Filing Fee | | | | 1,700.00 | 850.00 | 425.00 | 1,700.00 |
| **PART II -- ADDITIONAL CLAIMS (compared to application before RCE)** | | | | | | | |
| | Claims Remaining After Amendment | Highest Number Paid For | Number Extra Claims | Large Entity Rate | Small Entity Rate | Micro Entity Rate | FEE |
| Total Claims | 21 - | * 21 | = 0 | x 80.00 | 40.00 | 20.00 | 0 |
| Independent Claims | 1 - | ** 3 | = 0 | x 420.00 | 210.00 | 105.00 | 0 |
| First Presentation of Multiple Dependent Claims | | | | 780.00 | 390.00 | 195.00 | 0 |
| TOTAL FILING FEE | | | | | | | $1,700.00 |
| LIST INDEPENDENT CLAIMS: 1 | | | | | | | |
| * IF THE "HIGHEST NUMBER OF TOTAL CLAIMS PREVIOUSLY PAID FOR" IS 20 OR LESS, WRITE "20" IN THIS SPACE<br>** IF HIGHEST NUMBER OF INDEPENDENT CLAIMS PREVIOUSLY PAID FOR IS 3 OR LESS, WRITE "3" IN THIS SPACE | | | | | | | |

1. FEES *(The RCE fee under 37 CFR § 1.17(e) is required by 37 CFR § 1.114 when the RCE is filed.)*

   a. Amount (total from Fee Calculation Sheet)

   The fee of $1,700.00 is submitted herewith.

   b. __X__ The Commissioner is hereby authorized to charge any fees under 37 CFR 1.16 and 1.17 which may be required for this transaction to Deposit Account No. 03-1728. Please show our docket number with any charge or credit to our Deposit Account.

SMV PAS1404684.1-*-02/18/16 12:18 PM

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 13614197 |
| **Filing Date:** | 13-Sep-2012 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Filer:** | Jun-Young E. Jeon/Si Vuong |
| **Attorney Docket Number:** | 69657/S1437 |

Filed as Large Entity

**Filing Fees for Utility under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| RCE- 2nd and Subsequent Request | 1820 | 1 | 1700 | 1700 |
| | | **Total in USD ($)** | | **1700** |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 24955959 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Young E. Jeon/Si Vuong |
| **Filer Authorized By:** | Jun-Young E. Jeon |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 18-FEB-2016 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 20:20:55 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | $1700 |
| RAM confirmation Number | 6525 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Request for Continued Examination (RCE) | 69657_RCE_020516.pdf | 293250<br>324db16940cda23b57221841b8e37ea0009d798b | no | 3 |
| **Warnings:** | | | | | |
| This is not a USPTO supplied RCE SB30 form. | | | | | |
| **Information:** | | | | | |
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 30635<br>f75856a756bfaf516947b089de6e41bdd903d0ba | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 323885 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PTO/SB/06 (09-11)
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| PATENT APPLICATION FEE DETERMINATION RECORD<br>Substitute for Form PTO-875 | Application or Docket Number<br>13/614,197 | Filing Date<br>09/13/2012 | ☐ To be Mailed |
|---|---|---|---|

**ENTITY:** ☒ LARGE ☐ SMALL ☐ MICRO

## APPLICATION AS FILED – PART I

| FOR | (Column 1) NUMBER FILED | (Column 2) NUMBER EXTRA | RATE ($) | FEE ($) |
|---|---|---|---|---|
| ☐ BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | |
| ☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | |
| ☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | minus 20 = | * | X $ = | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | minus 3 = | * | X $ = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | |

## APPLICATION AS AMENDED – PART II

| AMENDMENT | 02/18/2016 | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|
| | Total (37 CFR 1.16(i)) | * 21 | Minus | ** 21 | = 0 | X $80 = | 0 |
| | Independent (37 CFR 1.16(h)) | * 1 | Minus | ***3 | = 0 | X $420 = | 0 |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | | TOTAL ADD'L FEE | 0 |

| AMENDMENT | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|
| | Total (37 CFR 1.16(i)) | * | Minus | ** | = | X $ = | |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = | X $ = | |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/MARTHA NEWMAN/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

23363 7590 02/05/2016
Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

| EXAMINER | |
|---|---|
| YANG, KWANG-SU | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2691 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 02/05/2016 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pair_cph@firsttofile.com
pto@lrrc.com



Petitioner Ex 1015, p. 440
BOE et al. v. Samsung, IPR2023-00988

| **Advisory Action Before the Filing of an Appeal Brief** | **Application No.** 13/614,197 | **Applicant(s)** LEE, SANG-SHIN | |
|---|---|---|---|
| | **Examiner** KWANG-SU YANG | **Art Unit** 2691 | **AIA (First Inventor to File) Status** No |

***--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --***

THE REPLY FILED 26 January 2016 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☒ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:
   a) ☐ The period for reply expires _____months from the mailing date of the final rejection.
   b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.
   c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires months from the mailing date of *the prior Advisory Action* or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.
   *Examiner Note*: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANT'S FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☒ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   a) ☒ They raise new issues that would require further consideration and/or search (see NOTE below);
   b) ☐ They raise the issue of new matter (see NOTE below);
   c) ☒ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.
   NOTE: *See Continuation Sheet*. (See 37 CFR 1.116 and 41.33(a)).
4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☒ For purposes of appeal, the proposed amendment(s): (a) ☒ will not be entered, or (b) ☐ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
9. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
10. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
11. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

12. ☐ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: _____.
13. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____
14. ☐ Other: _____.

STATUS OF CLAIMS

15. The status of the claim(s) is (or will be) as follows:
    Claim(s) allowed: .
    Claim(s) objected to: 17,18 and 21.
    Claim(s) rejected: 1-5, 16, 19, 20 and 22.
    Claim(s) withdrawn from consideration: 6-14.

/KWANG-SU YANG/
Primary Examiner, Art Unit 2691



**Petitioner Ex 1015, p. 441**
**BOE et al. v. Samsung, IPR2023-00988**

Continuation of 3. NOTE: The added limitation "wherein the first pixel is configured to emit green light" in claim 1 raises new issue to require further consideration and/or search since the limitation was not presented before.

Applicant's request for entry into AFCP 2.0 is acknowledged, but is denied because the response cannot be reviewed and a search conducted in the limited amount of time authorized fo this pilor program. Therefore, the response is being reviewed under pre-pilot program.



Petitioner Ex 1015, p. 442
BOE et al. v. Samsung, IPR2023-00988

NOT ENTER
/KY/
02/01/2016

PATENT
RESPONSE UNDER 37 CFR 1.116
EXPEDITED PROCEDURE
EXAMINING GROUP 2691

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on January 26, 2016 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Marti Carrillo

| | | |
|---|---|---|
| Appl No. | : 13/614,197 | Confirmation No. 4264 |
| Inventor | : Sang-Shin Lee | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| TC/A.U. | : 2691 | |
| Examiner | : Kwang-Su Yang | |
| Docket No. | : 69657/S1437 | |
| Customer No. | : 23363 | |

**AMENDMENT AFTER FINAL ACTION SUBMITTED UNDER AFCP 2.0**

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
January 26, 2016

Commissioner:

In response to the final Office action of December 2, 2015 (hereinafter "the Office action"), please amend the above-identified application as follows:

**Amendments to the Claims** are reflected in the listing of claims, which begins on page 2 of this paper.

**Remarks/Arguments** begin on page 6 of this paper.



Petitioner Ex 1015, p. 443
BOE et al. v. Samsung, IPR2023-00988

PATENT
RESPONSE UNDER 37 CFR 1.116
EXPEDITED PROCEDURE
EXAMINING GROUP 2691

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on January 26, 2016 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Marti Carrillo

| | | |
|---|---|---|
| Appl No. | : 13/614,197 | Confirmation No. 4264 |
| Inventor | : Sang-Shin Lee | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| TC/A.U. | : 2691 | |
| Examiner | : Kwang-Su Yang | |
| Docket No. | : 69657/S1437 | |
| Customer No. | : 23363 | |

**AMENDMENT AFTER FINAL ACTION SUBMITTED UNDER AFCP 2.0**

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
January 26, 2016

Commissioner:

In response to the final Office action of December 2, 2015 (hereinafter "the Office action"), please amend the above-identified application as follows:

**Amendments to the Claims** are reflected in the listing of claims, which begins on page 2 of this paper.

**Remarks/Arguments** begin on page 6 of this paper.



Petitioner Ex 1015, p. 444
BOE et al. v. Samsung, IPR2023-00988

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. (Currently amended) A pixel arrangement structure of an organic light emitting diode display, comprising:

a first pixel having a center coinciding with a center of a virtual square;

a second pixel separated from the first pixel and having a center at a first vertex of the virtual square;

another first pixel on a line defined by the center of the virtual square and the first vertex, the first pixel, the second pixel, and the other first pixel being consecutive pixels on the line; and

a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square,

wherein the second pixel has a larger area than that of the third pixel, and

wherein the first pixel is configured to emit green light.

2. (Previously presented) The pixel arrangement structure of claim 1, further comprising another second pixel separated from the first pixel and having a center at a third vertex neighboring the second vertex of the virtual square, wherein the second pixels are separated from each other by the first pixel.

3. (Previously presented) The pixel arrangement structure of claim 2, further comprising another third pixel separated from the first pixel and having a center at a fourth vertex neighboring the third vertex of the virtual square, wherein the third pixels are separated from each other by the first pixel.

4. (Original) The pixel arrangement structure of claim 3, wherein the second pixels and the third pixels enclose the first pixel in the virtual square.



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5. (Previously presented) The pixel arrangement structure of claim 4, wherein the first pixel, the second pixels, and the third pixels have polygonal shapes, and each of the second pixels and each of the third pixels has a larger area than the first pixel.

6. (Withdrawn) The pixel arrangement structure of claim 5, wherein the first pixel has a quadrilateral shape, and the second pixels and the third pixels have hexagonal or octagonal shapes.

7. (Withdrawn) The pixel arrangement structure of claim 6, wherein the second pixels and the third pixels have octagonal shapes.

8. (Withdrawn) The pixel arrangement structure of claim 7, wherein a distance between the first pixel and each of the second pixels, a distance between the first pixel and each of the third pixels, and a distance between each of the second pixels and each of the third pixels are a same first length.

9. (Withdrawn) The pixel arrangement structure of claim 8, wherein the first pixel comprises a plurality of first pixels, the plurality of first pixels have a same quadrilateral shape, and a distance between neighboring pixels of the plurality of first pixels is a second length that is longer than the first length.

10. (Withdrawn) The pixel arrangement structure of claim 6, wherein each of the second pixels has a larger area than each of the third pixels, a distance between each of the second pixels and each of the third pixels is a same first length, and a distance between the first pixel and each of the second pixels, and a distance between the first pixel and each of the third pixels are a same second length.



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BOE et al. v. Samsung, IPR2023-00988

11. (Withdrawn) The pixel arrangement structure of claim 10, wherein

the first pixel comprises a plurality of first pixels,

the plurality of first pixels have a same quadrilateral shape, and

a distance between neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

12. (Withdrawn) The pixel arrangement structure of claim 10, wherein

the first pixel comprises a plurality of first pixels,

neighboring pixels of the plurality of first pixels have quadrilateral shapes that are symmetrical to each other, and

a distance between the neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

13. (Withdrawn) The pixel arrangement structure of claim 6, wherein

the first pixel comprises a plurality of first pixels, and

neighboring pixels of the plurality of first pixels have quadrilateral shapes that are symmetrical to each other.

14. (Withdrawn) The pixel arrangement structure of claim 13, wherein each of the second pixels has a larger area than each of the third pixels.

15. (Canceled)

16. (Previously presented) The pixel arrangement structure of claim 5, wherein

the first pixel has an octagonal shape, and

the second pixels and the third pixels have quadrilateral shapes.



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BOE et al. v. Samsung, IPR2023-00988

17. (Previously presented) The pixel arrangement structure of claim 16, wherein

each of the second pixels has a larger area than each of the third pixels,

a shortest distance between each of the second pixels and each of the third pixels is a same first length, and

a shortest distance between the first pixel and each of the second pixels, and a shortest distance between the first pixel and each of the third pixels are a same second length.

18. (Previously presented) The pixel arrangement structure of claim 17, wherein

the first pixel comprises a plurality of first pixels, and

neighboring pixels of the plurality of first pixels have octagonal shapes that are symmetrical to each other.

19. (Original) The pixel arrangement structure of claim 1, wherein the first pixel, the second pixel, and the third pixel are configured to emit different color lights.

20. (Currently amended) The pixel arrangement structure of claim 19, wherein the ~~first pixel, the~~ second pixel[[,]] and the third pixel are configured to emit ~~green light,~~ blue light[[,]] and red light, respectively.

21. (Previously presented) The pixel arrangement structure of claim 18, wherein a shortest distance between the neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

22. (Previously presented) The pixel arrangement structure of claim 1, wherein the second pixel has a larger area than that of the first pixel.



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BOE et al. v. Samsung, IPR2023-00988

## REMARKS/ARGUMENTS

Claims 1–14 and 16–22 are pending in the present application, of which claim 1 is independent. Claims 6–14 were previously withdrawn. Claims 17–18 and 21 are allowable. Claim 20 is partially incorporated herein into claim 1. The Applicant respectfully requests continued allowability of claims 17–18 and 21, reconsideration and allowance of claims 1–5, 16, 19–20, and 22, and upon allowance of claim 1, rejoinder and allowance of previously withdrawn claims 6-14, which depend from claim 1.

---

**Rejection of claims 1–5 and 16–22 under 35 U.S.C. § 112 ¶ 2**

According to page 2 of the Office action, "Claims 1-5 and 16-22 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention."

With all due respect, the position of the Office action is understood, but the issue of indefiniteness is not with the claim language but rather with the English language. The two words "an" and "other" were so often used together, their pronunciation became "a" and "nother," and the two words were conjoined in written form 900 years ago. As such, "an" and "other" is written as one word, so the indefinite form of "other" is "another" and the definite form of "other" is "the other." They are the same word. Accordingly, the Applicant respectfully submits that the use of "another first pixel" in a first usage in claim 1 and "the other first pixel" in a subsequent usage in claim 1 is proper, and that claim 1 particularly points out and distinctly claims subject matter that the Applicant regards as embodiments of the present invention. For at least these reasons, the Applicant requests that the § 112 ¶ 2 rejection of claim 1 (and claims 2–5 and 16–22 through dependence from claim 1) be withdrawn.

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Petitioner Ex 1015, p. 449
BOE et al. v. Samsung, IPR2023-00988

**Rejection of claims 1–4, 19, and 22 under 35 U.S.C. § 103(a) over Smith/Ghosh**

**Rejection of claim 5 under 35 U.S.C. § 103(a) over Smith/Ghosh/Brown Elliot**

**Rejection of claim 16 under 35 U.S.C. § 103(a) over Smith/Ghosh/Brown Elliot/Cok/Ko**

**Rejection of claim 20 under 35 U.S.C. § 103(a) over Smith/Ghosh/Kim**

According to page 3 of the Office action, "Claims 1-4, 19, and 22 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Smith (U.S. Pub. No. US 2009/0302331 A1) in view of Ghosh (U.S[.] Pub. No. US 2012/0319564 A1)." According to page 6 of the Office action, "Claim 5 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Smith, in view of Ghosh as applied to claim 4 above, and further in view of [Brown] Elliot (U.S[.] Patent No. US 7,274,383 B1)." According to page 7 of the Office action, "Claim[] 16 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Smith, in view of Ghosh as applied to claim 5 above, in view of Elliot as applied to claim 5 above, in view of Cok (U.S. Patent No. US 6,867,549 B2), and further in view of Ko (U.S[.] Patent No. US 8,350,468 B2)." According to page 8 of the Office action, "Claim 20 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Smith in view of Ghosh as applied to claim 19 above, and further in view of Kim (U.S[.] Pub. No. US 2011/0012820 A1)." The Applicant amends claim 1 and respectfully argues as follows.

Independent claim 1 now recites:

> 1. A pixel arrangement structure of an organic light emitting diode display, comprising:
> a first pixel having a center coinciding with a center of a virtual square;
> a second pixel separated from the first pixel and having a center at a first vertex of the virtual square;
> another first pixel on a line defined by the center of the virtual square and the first vertex, the first pixel, the second pixel, and the other first pixel being consecutive pixels on the line; and
> a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square,
> wherein the second pixel has a larger area than that of the third pixel, and
> wherein the first pixel is configured to emit green light. (Emphasis added.)

The cited references, alone or in combination, do not disclose or suggest at least the claim 1 limitation, "wherein the first pixel is configured to emit green light," in combination with the

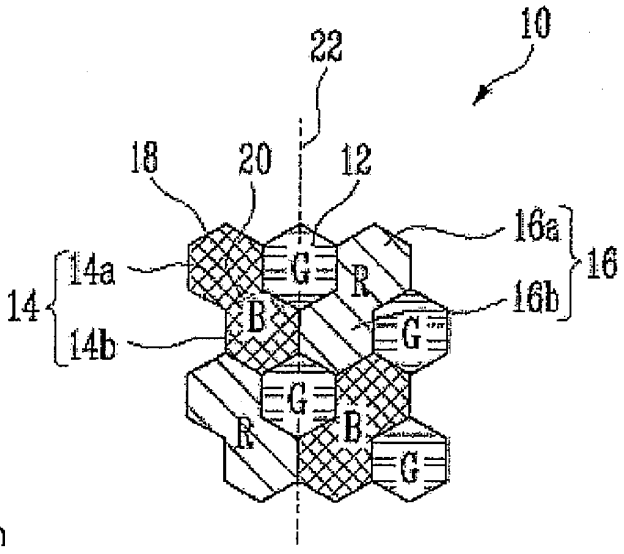


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BOE et al. v. Samsung, IPR2023-00988

other limitations of claim 1, such as "a first pixel having a center coinciding with a center of a virtual square," "a second pixel separated from the first pixel and having a center at a first vertex of the virtual square," and "a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square." By way of example, Smith only appears to disclose a central blue sub-pixel, Ghosh appears to be silent regarding a colored pixel arrangement, Brown Elliott appears to be directed to having a central blue emitter as part of any three-color pixel element, Cok only illustrates a central blue rectangular light emitting element, and Ko only appears to illustrate traditional (by column) colored pixel arrangements.

Finally, while pages 8–9 of the Office action (in rejecting the previous claim 20) assert that Kim FIG. 4 (reproduced below) discloses the first pixel is configured to emit green light, there are at least two significant shortcomings in this conclusion.

FIG. 4




Kim

To begin with, the arrangement of sub-pixels in Kim FIG. 4 is by hexagons and not "a virtual square" as recited in claim 1, so there does not appear to be a way for a green sub-pixel of Kim FIG. 4 to be at a center of such a virtual square. In addition, the sub-pixels in Kim FIG. 4



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abut each other, and are thus not "separated" as recited in claim 1. This makes such pixels, for example, unsuitable for fabrication with a fine metal mask (as described in, e.g., ¶ [0045] of the specification as filed).

For at least these reasons, Kim (and the other cited references, as discussed above) do not disclose the claim 1 limitation, "wherein the first pixel is configured to emit green light," in combination with the other limitations of claim 1, such as "a first pixel having a center coinciding with a center of a virtual square," "a second pixel separated from the first pixel and having a center at a first vertex of the virtual square," and "a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square," and there is no apparent reason why one of ordinary skill at the time of the present invention would have combined Smith and Ghosh together with one or more of Brown Elliott, Cok, Ko, and Kim to arrive at the claimed embodiment of claim 1. As, such, claim 1 is patentably distinguishable over Smith and Ghosh together with one or more of Brown Elliott, Cok, Ko, and Kim.

Claims 2–5, 16, 19–20, and 22 depend from claim 1, such that they incorporate all of the terms and limitations of claim 1 in addition to other limitations, which together further patentably distinguish these claims over the art of record. Accordingly, the Applicant respectfully requests that the § 103(a) rejections of claims 2–5, 16, 19–20, and 22 be withdrawn and that these claims be allowed.

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BOE et al. v. Samsung, IPR2023-00988

**Concluding remarks**

In view of the foregoing amendments and remarks, the Applicant earnestly solicits a timely issuance of a Notice of Allowance for claims 1–14 and 16–22. If there are any remaining issues that can be addressed over the telephone, the Examiner is cordially invited to call the Applicant's attorney at the number listed below.

Respectfully submitted,
CHRISTIE, PARKER & HALE, LLP

By Bruce A. Wagar
Bruce A. Wagar, Ph.D.
Reg. No. 72,186
626/795-9900

BAW/dst

MAC PAS1393975.3-*-01/26/16 6:12 PM



Petitioner Ex 1015, p. 453
BOE et al. v. Samsung, IPR2023-00988

Doc Code: A.NE.AFCP
Document Description: After Final Consideration Pilot Program Request

PTO/SB/434 (05-13)

## CERTIFICATION AND REQUEST FOR CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0

| Practitioner Docket No.: | Application No.: | Filing Date: |
|---|---|---|
| 69657/S1437 | 13/614,197 | September 13, 2012 |
| **First Named Inventor:** | **Title:** | |
| Sang-Shin Lee | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0 (AFCP 2.0) OF THE ACCOMPANYING RESPONSE UNDER 37 CFR 1.116.

1. The above-identified application is (i) an original utility, plant, or design nonprovisional application filed under 35 U.S.C. 111(a) [a continuing application (*e.g.*, a continuation or divisional application) is filed under 35 U.S.C. 111(a) and is eligible under (i)], or (ii) an international application that has entered the national stage in compliance with 35 U.S.C. 371(c).
2. The above-identified application contains an outstanding final rejection.
3. Submitted herewith is a response under 37 CFR 1.116 to the outstanding final rejection. The response includes an amendment to at least one independent claim, and the amendment does not broaden the scope of the independent claim in any aspect.
4. This certification and request for consideration under AFCP 2.0 is the only AFCP 2.0 certification and request filed in response to the outstanding final rejection.
5. Applicant is willing and available to participate in any interview requested by the examiner concerning the present response.
6. This certification and request is being filed electronically using the Office's electronic filing system (EFS-Web).
7. Any fees that would be necessary consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, extension of time fees, are being concurrently filed herewith. [There is no additional fee required to request consideration under AFCP 2.0.]
8. By filing this certification and request, applicant acknowledges the following:
   - Reissue applications and reexamination proceedings are not eligible to participate in AFCP 2.0.
   - The examiner will verify that the AFCP 2.0 submission is compliant, *i.e.*, that the requirements of the program have been met (see items 1 to 7 above). For compliant submissions:
     - The examiner will review the response under 37 CFR 1.116 to determine if additional search and/or consideration (i) is necessitated by the amendment and (ii) could be completed within the time allotted under AFCP 2.0. If additional search and/or consideration is required but cannot be completed within the allotted time, the examiner will process the submission consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, by mailing an advisory action.
     - If the examiner determines that the amendment does not necessitate additional search and/or consideration, or if the examiner determines that additional search and/or consideration is required and could be completed within the allotted time, then the examiner will consider whether the amendment places the application in condition for allowance (after completing the additional search and/or consideration, if required). If the examiner determines that the amendment does not place the application in condition for allowance, then the examiner will contact the applicant and request an interview.
       - The interview will be conducted by the examiner, and if the examiner does not have negotiation authority, a primary examiner and/or supervisory patent examiner will also participate.
       - If the applicant declines the interview, or if the interview cannot be scheduled within ten (10) calendar days from the date that the examiner first contacts the applicant, then the examiner will proceed consistent with current practice concerning responses after final rejection under 37 CFR 1.116.

| Signature | Date |
|---|---|
| Bruce A. Wagar | January 26, 2016 |
| **Name (Print/Typed)** Bruce A. Wagar | **Practitioner Registration No.** 72186 |

***Note:*** *This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.*

[✓] * Total of 1 forms are submitted.

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 24731476 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Bruce A. Wagar/Marti Carrillo |
| **Filer Authorized By:** | Bruce A. Wagar |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 26-JAN-2016 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 22:00:09 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 69657_Amendment-AFCP.PDF | 339796<br>b62d20f545666a7e7a42832513fb5c57d90242ab | yes | 13 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Transmittal Letter | 1 | 2 |
| | Response After Final Action | 3 | 3 |
| | Claims | 4 | 7 |
| | Applicant Arguments/Remarks Made in an Amendment | 8 | 12 |
| | After Final Consideration Program Request | 13 | 13 |
| **Warnings:** | | | |
| **Information:** | | | |
| | **Total Files Size (in bytes):** | 339796 | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**<u>New Applications Under 35 U.S.C. 111</u>**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**<u>National Stage of an International Application under 35 U.S.C. 371</u>**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**<u>New International Application Filed with the USPTO as a Receiving Office</u>**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**
**AMENDMENT TRANSMITTAL LETTER**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on January 26, 2016 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Marti Carrillo

Inventor : Sang-Shin Lee
Application No. : 13/614,197
Filed : September 13, 2012
Title : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

Confirmation No. 4264

Grp./Div. : 2691
Examiner : Kwang-Su Yang

Docket No. : 69657/S1437

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
January 26, 2016

Commissioner:

Enclosed is an amendment to the above-identified application.

| CLAIMS AS AMENDED | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Claims Remaining After Amendment | Highest Number Previously Paid For | Number Extra Claims | Large Entity Rate | Small Entity Rate | Micro Entity Rate | FEE |
| Total Claims | 21 - | * 21 | = 0 | 0 x $80.00 | $40.00 | $20.00 | $0.00 |
| Independent Claims | 1 - | ** 3 | = 0 | 0 x $420.00 | $210.00 | $105.00 | $0.00 |
| Multiple Dependent Claims*** | | | | $780.00 | $390.00 | $195.00 | $0.00 |
| | | | | | | Total Additional Fee | $0.00 |
| List Independent Claims: 1 | | | | | | | |
| * If the "Highest Number of Total Claims Previously Paid For" is less than 20, enter "20" in this space<br>** If the "Highest Number of Independent Claims Previously Paid For" is less than 3, enter "3" in this space<br>*** Pay this fee only when "Multiple Dependent Claims" are added for the first time | | | | | | | |

__X__ No additional fee is required.

_____ A Petition for Extension of Time and the required fee are enclosed.

__X__ Other enclosures: AFCP 2.0



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BOE et al. v. Samsung, IPR2023-00988

The Commissioner is hereby authorized to charge any fees under 37 CFR 1.16 and 1.17 which may be required by or to give effect to this paper to Deposit Account No. 03-1728. Please show our docket number with any charge or credit to our Deposit Account.

Respectfully submitted,

LEWIS ROCA ROTHGERBER CHRISTIE LLP

By Bruce A. Wagar

Bruce A. Wagar, Ph.D.
Reg. No. 72,186
626/795-9900

BAW/mac

MAC PAS1400979.1-*-01/26/16 6:21 PM

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

| PATENT APPLICATION FEE DETERMINATION RECORD<br>Substitute for Form PTO-875 | Application or Docket Number<br>13/614,197 | Filing Date<br>09/13/2012 | ☐ To be Mailed |
|---|---|---|---|

**ENTITY:** ☒ LARGE ☐ SMALL ☐ MICRO

## APPLICATION AS FILED – PART I

| FOR | (Column 1) NUMBER FILED | (Column 2) NUMBER EXTRA | RATE ($) | FEE ($) |
|---|---|---|---|---|
| ☐ BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | |
| ☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | |
| ☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | minus 20 = | * | X $ = | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | minus 3 = | * | X $ = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | |

## APPLICATION AS AMENDED – PART II

AMENDMENT **01/26/2016**

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * 21 | Minus | ** 21 | = 0 | X $80 = | 0 |
| Independent (37 CFR 1.16(h)) | * 1 | Minus | ***3 | = 0 | X $420 = | 0 |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | TOTAL ADD'L FEE | 0 |

AMENDMENT

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * | Minus | ** | = | X $ = | |
| Independent (37 CFR 1.16(h)) | * | Minus | *** | = | X $ = | |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/LAWANDA MILTON/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 69657/S1437 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | U.S. Office action dated October 16, 2015, for cross reference U.S. Patent application 13/872,018, (16 pages) |
| | | |
| | | |
| | | |

DLG PAS1394628.1-*-12/16/15 12:13 PM

| EXAMINER SIGNATURE | | DATE CONSIDERED | |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

JEJ/dg



Petitioner Ex 1015, p. 460
BOE et al. v. Samsung, IPR2023-00988

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 13614197 |
| **Filing Date:** | 13-Sep-2012 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Filer:** | Jun-Young E. Jeon/Diane Goss |
| **Attorney Docket Number:** | 69657/S1437 |

Filed as Large Entity

**Filing Fees for Utility under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| Submission- Information Disclosure Stmt | 1806 | 1 | 180 | 180 |
| | | **Total in USD ($)** | | **180** |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 24386059 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Young E. Jeon/Diane Goss |
| **Filer Authorized By:** | Jun-Young E. Jeon |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 16-DEC-2015 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 17:54:47 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | $180 |
| RAM confirmation Number | 5286 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 69657ids.pdf | 119053<br>bac484a9d25f36059d9c81341bb22406c7ce5866 | yes | 3 |
| | **Multipart Description/PDF files in .zip description** | | | | |
| | **Document Description** | | **Start** | **End** | |
| | Transmittal Letter | | 1 | 2 | |
| | Information Disclosure Statement (IDS) Form (SB08) | | 3 | 3 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Non Patent Literature | USOA2018-16OCT2015.pdf | 1448526<br>b03a6298a91d6975841f2da46dd129253b7e0dc4 | no | 16 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Fee Worksheet (SB06) | fee-info.pdf | 30884<br>b29d8ee7e6485513516e5b5f25659823159045f8 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 1598463 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on December 16, 2015 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Diane L. Goss

| | | |
|---|---|---|
| Inventor | : Sang-Shin Lee | Confirmation No. 4264 |
| Application No. | : 13/614,197 | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| Grp./Div. | : 2691 | |
| Examiner | : Kwang-Su Yang | |
| Docket No. | : 69657/S1437 | |

**INFORMATION DISCLOSURE STATEMENT WITH FEE UNDER 37 CFR §§ 1.97(d) AND 1.17(p)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
December 16, 2015

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is an information disclosure statement listing a reference that is known to applicant. A copy of the listed Other Documents reference is enclosed.

It is respectfully requested that the listed reference be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of the information disclosure statement be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

Applicant's undersigned attorney hereby certifies, in accordance with 37 CFR § 1.97(e)(2), that no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in Section 1.56(c) more than three months prior to the filing of the information disclosure statement.

The processing fee of $180.00 as required by 37 CFR § 1.17(p) is submitted herewith. The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
CHRISTIE, PARKER & HALE, LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/dg
Enclosures: Information Disclosure Statement, w/reference

DLG PAS1394631.1-*-12/16/15 12:23 PM



Petitioner Ex 1015, p. 467
BOE et al. v. Samsung, IPR2023-00988

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UNITED STATES DEPARTMENT OF COMMERCE
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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

23363 7590 12/02/2015

CHRISTIE, PARKER & HALE, LLP
PO BOX 29001
Glendale, CA 91209-9001

| EXAMINER | |
|---|---|
| YANG, KWANG-SU | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2691 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 12/02/2015 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pto@cph.com
pair_cph@firsttofile.com



Petitioner Ex 1015, p. 468
BOE et al. v. Samsung, IPR2023-00988

| Office Action Summary | Application No. 13/614,197 | Applicant(s) LEE, SANG-SHIN | |
|---|---|---|---|
| | Examiner KWANG-SU YANG | Art Unit 2691 | AIA (First Inventor to File) Status No |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *10/15/2015*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims***

5)☒ Claim(s) *1-14 and 16-22* is/are pending in the application.

5a) Of the above claim(s) *6-14* is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-5,16,19,20 and 22* is/are rejected.

8)☒ Claim(s) *17,18 and 21* is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

**Application Papers**

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

## DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.

### *Response to Amendment*

2. The amendment filed on 10/15/2015 has been entered and considered by examiner.

### *Claim Rejections - 35 USC § 112*

3. The following is a quotation of 35 U.S.C. 112(b):

> (b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-5 and 16-22 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

- In claim 1, a limitation “another first pixel” and a limitation "the other first pixel" appear to designate the same pixel. However, two different limitations are used. Therefore, claim 1 is indefinite.

### *Claim Rejections - 35 USC § 103*

5. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been

obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-4, 19, and 22 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Smith (U.S. Pub. No. US 2009/0302331 A1) in view of Ghosh (U.S Pub. No. US 2012/0319564 A1).

**As to claim 1,** Smith (Figs. 3 and 11) teaches **a pixel arrangement structure** (a sub-pixel arrangement; Fig. 11; a sub-pixel corresponds to a pixel in an instant application) **of an organic light emitting diode display** (an OLED device; Fig. 3)**, comprising:**

- **a first pixel** (a blue sub-pixel 52; at bottom half middle location) **having a center coinciding with a center of a virtual square** (a virtual square with two red sub-pixels 54 and two green sub-pixels 56) (Fig. 11)**;**

- **a second pixel** (a green sub-pixel 56; at bottom right location) **separated from the first pixel** (the blue sub-pixel 52; at bottom half middle location) (Fig. 11) **and having a center at a first vertex of the virtual square** (Fig. 11)**;**

- **another first pixel** (another blue sub-pixel 52) **on a line defined by the center of the virtual square** (the center of the blue sub-pixel 52 (at the bottom half middle location)) **and the first vertex** (the center of the green sub-pixel 56 (at bottom right location))**, the first pixel** (the blue sub-pixel 52; at bottom half middle location)**, the second pixel** (a green sub-pixel 56; at bottom right location)**, and the other first pixel** (another blue sub-pixel 52; located at the extending line of the center of the blue sub-pixel 52and the center of green sub-pixel 56; not shown in Fig. 11) **being consecutive pixels on the line** (Fig. 11)**; and**

- **a third pixel** (a red sub-pixel 54; at bottom left location) **separated from the first pixel** (the blue sub-pixel 52; at bottom half middle location **and the second pixel** (the green sub-pixel 56; at bottom right location) (Fig. 11)**, and having a center at a second vertex** (a center of the red sub-pixel 56; at bottom left location) **neighboring the first vertex of the virtual square** (the center of the green sub-pixel 56 (at middle left location)) (Fig. 11)**.**

Smith does not teach **wherein the second pixel has a larger area than that of the third pixel and that of the first pixel.**

Ghosh (Fig. 4) teaches

- **wherein the second pixel has a larger area than that of the third pixel and that of the first pixel** (the green subpixel (112) is greater in size than the red (111) and blue (113) subpixels; [0022], lines 3-5; Fig. 4)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used largest green subpixel in size as taught by Ghosh for an arrangement of Smith because the human visual system is most sensitive to the green part of the visible spectrum in order to improve the contrast of the sensed image.

**As to claim 2,** Smith teaches **further comprising**

- **another second pixel** (a green sub-pixel 56; at middle left location)) **separated from the first pixel** (the blue sub-pixel 52; at bottom half middle location) **and having a center at a third vertex neighboring the second vertex of the virtual square** (a center of the green sub-pixel 56 (at middle left location)) (Fig. 11)**,**

- **wherein the second pixels** (the green sub-pixels 56) **are separated from each other by the first pixel** (the blue sub-pixel 52; at bottom half middle location) (Fig. 11).

**As to claim 3,** Smith teaches **further comprising**

- **another third pixel** (a red sub-pixel 54; at middle right location) **separated from the first pixel** (the blue sub-pixel 52; at bottom half middle location) **and having a center at a fourth vertex neighboring the third vertex of the virtual square** (a center of the red sub-pixel 54 (at middle right location)) (Fig. 11),
- **wherein the third pixels** (the red sub-pixels 54) **are separated from each other by the first pixel** (the blue sub-pixel 52; at bottom half middle location) (Fig. 11).

**As to claim 4,** Smith teaches

- **wherein the second pixels** (the green sub-pixels 56) **and the third pixels** (the red sub-pixels 54) **enclose the first pixel** (the blue sub-pixel 52; at bottom half middle location) **in the virtual square** (Fig. 11).

**As to claim 19,** Smith teaches

- **wherein the first pixel, the second pixel, and the third pixel are configured to emit different color lights** (blue, green and red) (Fig. 11).

**As to claim 22,** Ghosh teaches

- **wherein the second pixel has a larger area than that of the first pixel** (the green subpixel (112) is greater in size than the red (111) subpixel; [0022], lines 3-5; Fig. 4))**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used largest green subpixel in size as taught by Ghosh for an arrangement of Smith because the human visual system is most sensitive to the green part of the visible spectrum in order to improve the contrast of the sensed image.

5. Claim 5 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Smith, in view of Ghosh as applied to claim 4 above, and further in view of Elliot (U.S Patent No. US 7,274,383 B1).

**As to claim 5,** Smith and Ghosh teach **the pixel arrangement structure of claim 4.**

Smith (Fig. 11) and Ghosh do not expressly teach **wherein the first pixel, the second pixels, and the third pixels have polygonal shapes, and each of the second pixels and each of the third pixels has a larger area than the first pixel.**

Elliot (Figs. 1-3) teaches **wherein**

- **the first pixel, the second pixels, and the third pixels have polygonal shapes** (Fig. 1A)**, and**
- **each of the second pixels and each of the third pixels has a larger area than the first pixel** (Fig. 1A)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used different sizes with polygon shapes as taught by Elliot in an pixel arrangement of Smith as modified by Ghosh because the size of blue emitter can be reduced due to its drive-to-luminance gain larger than the red or green emitter.

6. Claims 16 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Smith, in view of Ghosh as applied to claim 5 above, in view of Elliot as applied to claim 5 above, in view of Cok (U.S. Patent No. US 6,867,549 B2), and further in view of Ko (U.S Patent No. US 8,350,468 B2).

**As to claim 16,** Smith, Ghosh and Elliot teach **the pixel arrangement structure of claim 5.**

Smith, Ghosh and Elliot do not teach **where the first pixel has an octagonal shape, and the second pixels and the third pixels have quadrilateral shapes.**

Cok (Fig. 2) teaches

- **the second pixels and the third pixels** (the green and red emitters 14 and 12) **have quadrilateral shapes** (Fig. 2)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used rectangular shapes as taught by Cok for an pixel arrangement of Smith as modified by Ghosh and Elliot because the rectangular-shaped pixel are easy to design and manufacture.

Smith, Ghosh, Elliot and Cok do not teach **the first pixel has an octagonal shape.**

Ko (Fig. 2B) teaches

- **the first pixel has an octagonal shape** (other shapes of pixels may be implemented, such as octagon-shaped pixels; col. 4, lines 40-42; Fig. 2B).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have replaced an octagon-shaped pixel as taught by Ko for a central pixel of Smith as modified by Ghosh, Elliot and Cok because the octagon-shaped pixel provides a user with a visually smoothing feature for a display device.

6. Claim 20 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Smith in view of Ghosh as applied to claim 19 above, and further in view of Kim (U.S Pub. No. US 2011/0012820 A1).

**As to claim 20,** Smith and Ghosh teach **the pixel arrangement structure of claim 19.**

Smith also teaches **wherein the third pixel is configured to emit red light** (the red sub-pixel 54; at bottom left location; Fig. 11).

Smith and Ghosh do not teach **wherein the first pixel and the second pixel are configured to emit green light and blue light, respectively.**

Kim (Figs. 1, 2 and 4) teaches

- **wherein the first pixel and the second pixel are configured to emit green light and blue light, respectively** (first sub-pixels G 12 and a second sub-pixels B 14; Figs. 1, 2 and 4).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have exchange blue pixels and green pixels

as taught by Kim in a pixel arrangement of Smith as modified by Ghosh because the exchange of pixels may be changed based on the factors, for example, the life of materials respectively utilized in each color sub-pixel for balancing the lives of sub-pixels.

***Allowable Subject Matter***

7. Claims 17-18 and 21 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

***Response to Arguments***

8. Applicants' arguments with respect to claims 1-5, 16, 19-20 and 22 have been considered but are moot in view of the new grounds of rejection.

In view of amendment, references of Smith, Ghosh, Elliot, Cok, Ko, and Kim have been used for the new grounds of rejection.

Therefore, the Office maintains the rejections as recited above.

***Conclusion***

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

***Inquiry***

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kwang-Su Yang whose telephone number is 571-270-7307. The examiner can normally be reached on Mon-Fri during 9:00am-6:00pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chanh Nguyen can be reached on 571-272-7772. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/KWANG-SU YANG/
Primary Examiner, Art Unit 2691

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | Examiner | Art Unit |
| | KWANG-SU YANG | 2691 |

| CPC- SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
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| CPC COMBINATION SETS - SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| US CLASSIFICATION SEARCHED | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
| 345 | 82 419 | 10/24/2014 | KY |

| SEARCH NOTES | | |
|---|---|---|
| Search Notes | Date | Examiner |
| EAST: Inventor Search | 10/24/2014 | KY |
| EAST: Text Search | 10/24/2014; 10/27/2014 | KY |
| EAST: Updated Text Search | 02/27/2015 | KY |
| EAST: IDS Search | 03/07/2015 | KY |
| EAST: IDS Search | 07/09/2015 | KY |
| EAST: Updated Text Search | 07/09/2015 | KY |
| EAST: Updated Text Search | 11/25/2015; 11/27/2015 | KY |

| INTERFERENCE SEARCH | | | |
|---|---|---|---|
| US Class/ CPC Symbol | US Subclass / CPC Group | Date | Examiner |
| | | | |

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| | /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691 |

| FORM PTO/SB/08A/B (10-01)<br>Substitute for PTO-1449A/B<br><br>**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**<br><br>(use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 69657/S1437 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
| | | 2012/0056531 A1 | 03-08-2012 | Park et al. |
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**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
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**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | U.S. Office action dated June 30, 2015, for cross reference U.S. Patent application 13/872,018, (22 pages) |
| | | |
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DLG PAS1367189.1-*-07/15/15 8:48 AM

| EXAMINER SIGNATURE | /Kwang-Su Yang/ | DATE CONSIDERED | 11/25/2015 |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

JEJ/dg



ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KY/

**EAST Search History**

**EAST Search History (Prior Art)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| S85 | 3 | "20120056531".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/25 12:55 |
| S86 | 0 | ("7236196").URPN. | USPAT | OR | ON | 2015/11/25 13:38 |
| S87 | 232 | (organic adj light OLED) and honeycomb adj pattern | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/25 13:41 |
| S88 | 2 | (organic adj light OLED) and honeycomb adj pattern same red same green same blue | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/25 13:42 |
| S89 | 1273 | (organic adj light OLED) and honeycomb | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/25 13:42 |
| S90 | 33 | (organic adj light OLED) and honeycomb same red same green same blue | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/25 13:42 |
| S91 | 123 | (organic adj light OLED) and honeycomb and "345".clas. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/25 13:52 |
| S92 | 44 | (organic adj light OLED) and honeycomb with pixel | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; | OR | ON | 2015/11/25 14:04 |



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|---|---|---|---|---|---|---|
| | | | IBM_TDB | | | |
| S93 | 2275 | (organic adj light OLED) and (pixel sub$1pixel) adj (pattern arrangement) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/25 14:10 |
| S94 | 167 | (organic adj light OLED) same (pixel sub$1pixel) adj (pattern arrangement) same red same green same blue | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/25 14:11 |
| S95 | 22 | ("20130021552" \| "20060158095" \| "20090039773" \| "20090315458" \| "5311337" \| "6727964" \| "20130001533" \| "20070108899").PN. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/25 14:38 |
| S96 | 6 | ("20110019748" \| "20120068185").PN. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/25 14:41 |
| S97 | 12 | ("20020025406" \| "20040003775" \| "20050109273" \| "20060024444").PN. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/25 14:43 |
| S100 | 12 | ("20090121983" \| "20020015110" \| "7646430" \| "7525526" \| "6867549").PN. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/25 14:48 |
| S101 | 2 | "20120313844".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/25 17:04 |
| S102 | 11 | ("2010/0171440").URPN. | USPAT | OR | ON | 2015/11/25 17:07 |
| S103 | 0 | ("8552635").URPN. | USPAT | OR | ON | 2015/11/25 17:31 |
| S104 | 0 | ("8552635").URPN. | USPAT | OR | ON | 2015/11/25 17:31 |
| S105 | 16 | "2011061489" | US-PGPUB; USPAT; USOCR; FPRS; EPO; | OR | ON | 2015/11/25 17:49 |



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|---|---|---|---|---|---|---|
| | | | JPO; DERWENT; IBM_TDB | | | |
| S106 | 902 | organic adj light and (pixel sub$1pixel) adj (arrangement pattern structure) same red same green same blue | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/27 13:30 |
| S107 | 57 | organic adj light and (pixel sub$1pixel) adj (arrangement pattern structure) same red same green same blue same square | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/27 13:31 |
| S108 | 201 | organic adj light same (pixel sub$1pixel) adj (arrangement pattern structure) same red same green same blue | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/27 13:45 |
| S109 | 8 | organic adj light same (pixel sub$1pixel) adj (arrangement pattern structure) with square | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/27 14:04 |
| S110 | 8 | "2008001525".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/27 14:06 |
| S111 | 4 | "20080001525".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/27 14:06 |
| S112 | 23 | ("2008/0001525").URPN. | USPAT | OR | ON | 2015/11/27 14:07 |
| S113 | 0 | ("8552635").URPN. | USPAT | OR | ON | 2015/11/27 14:10 |
| S114 | 0 | ("8803417").URPN. | USPAT | OR | ON | 2015/11/27 14:11 |
| S115 | 30 | ("20020101152" \| "20040188687" \| "20050035353" \| "20060124940" \| "20130112960" \| "20050017650" \| "20070035225" \| "20080001525" \| "20060097631" \| "20080116787" \| "6555420").PN. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/11/27 14:13 |
| S116 | 2 | "8350468".pn. | US-PGPUB; USPAT; | OR | ON | 2015/11/27 16:55 |



Petitioner Ex 1015, p. 483
BOE et al. v. Samsung, IPR2023-00988

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | |

**EAST Search History (Interference)**

< This search history is empty>

**11/ 27/ 2015 6:16:17 PM**
**C:\ Users\ kyang\ Documents\ EAST\ Workspaces\ 13614197.wsp**



Petitioner Ex 1015, p. 484
BOE et al. v. Samsung, IPR2023-00988

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | Examiner | Art Unit |
| | KWANG-SU YANG | 2691 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 10/27/2014 | 03/07/2015 | 07/09/2015 | 11/27/2015 | | | | | |
| | 1 | ✓ | ✓ | ✓ | ✓ | | | | | |
| | 2 | ✓ | ✓ | ✓ | ✓ | | | | | |
| | 3 | ✓ | ✓ | ✓ | ✓ | | | | | |
| | 4 | ✓ | ✓ | ✓ | ✓ | | | | | |
| | 5 | ✓ | ✓ | ✓ | ✓ | | | | | |
| | 6 | N | N | N | N | | | | | |
| | 7 | N | N | N | N | | | | | |
| | 8 | N | N | N | N | | | | | |
| | 9 | N | N | N | N | | | | | |
| | 10 | N | N | N | N | | | | | |
| | 11 | N | N | N | N | | | | | |
| | 12 | N | N | N | N | | | | | |
| | 13 | N | N | N | N | | | | | |
| | 14 | N | N | N | N | | | | | |
| | 15 | N | - | - | - | | | | | |
| | 16 | ✓ | ✓ | ✓ | ✓ | | | | | |
| | 17 | O | ✓ | O | O | | | | | |
| | 18 | O | O | O | O | | | | | |
| | 19 | ✓ | ✓ | ✓ | ✓ | | | | | |
| | 20 | ✓ | ✓ | ✓ | ✓ | | | | | |
| | 21 | | | | O | | | | | |
| | 22 | | | | ✓ | | | | | |

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on October 15, 2015 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Signature

| | | |
|---|---|---|
| Appl No. | : 13/614,197 | Confirmation No. 4264 |
| Inventor | : Sang-Shin Lee | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| TC/A.U. | : 2691 | |
| Examiner | : Kwang-Su Yang | |
| Docket No. | : 69657/S1437 | |
| Customer No. | : 23363 | |

**AMENDMENT**

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
October 15, 2015

Commissioner:

In response to the non-final Office action of July 15, 2015 (hereinafter "the Office action"), please amend the above-identified application as follows:

**Amendments to the Claims** are reflected in the listing of claims, which begins on page 2 of this paper.

**Remarks/Arguments** begin on page 6 of this paper.



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**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. (Currently amended) A pixel arrangement structure of an organic light emitting diode display, comprising:

a first pixel having a center coinciding with a center of a virtual square;

a second pixel separated from the first pixel and having a center at a first vertex of the virtual square;

another first pixel on a line defined by the center of the virtual square and the first vertex, the first pixel, the second pixel, and the other first pixel being consecutive pixels on the line; and

a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square,

wherein the second pixel has a larger area than that of the third pixel ~~and that of the first pixel~~.

2. (Previously presented) The pixel arrangement structure of claim 1, further comprising another second pixel separated from the first pixel and having a center at a third vertex neighboring the second vertex of the virtual square, wherein the second pixels are separated from each other by the first pixel.

3. (Previously presented) The pixel arrangement structure of claim 2, further comprising another third pixel separated from the first pixel and having a center at a fourth vertex neighboring the third vertex of the virtual square, wherein the third pixels are separated from each other by the first pixel.

4. (Original) The pixel arrangement structure of claim 3, wherein the second pixels and the third pixels enclose the first pixel in the virtual square.



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5. (Previously presented) The pixel arrangement structure of claim 4, wherein the first pixel, the second pixels, and the third pixels have polygonal shapes, and each of the second pixels and each of the third pixels has a larger area than the first pixel.

6. (Withdrawn) The pixel arrangement structure of claim 5, wherein the first pixel has a quadrilateral shape, and the second pixels and the third pixels have hexagonal or octagonal shapes.

7. (Withdrawn) The pixel arrangement structure of claim 6, wherein the second pixels and the third pixels have octagonal shapes.

8. (Withdrawn) The pixel arrangement structure of claim 7, wherein a distance between the first pixel and each of the second pixels, a distance between the first pixel and each of the third pixels, and a distance between each of the second pixels and each of the third pixels are a same first length.

9. (Withdrawn) The pixel arrangement structure of claim 8, wherein the first pixel comprises a plurality of first pixels, the plurality of first pixels have a same quadrilateral shape, and a distance between neighboring pixels of the plurality of first pixels is a second length that is longer than the first length.

10. (Withdrawn) The pixel arrangement structure of claim 6, wherein each of the second pixels has a larger area than each of the third pixels, a distance between each of the second pixels and each of the third pixels is a same first length, and a distance between the first pixel and each of the second pixels, and a distance between the first pixel and each of the third pixels are a same second length.

11. (Withdrawn) The pixel arrangement structure of claim 10, wherein the first pixel comprises a plurality of first pixels,



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the plurality of first pixels have a same quadrilateral shape, and

a distance between neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

12. (Withdrawn) The pixel arrangement structure of claim 10, wherein

the first pixel comprises a plurality of first pixels,

neighboring pixels of the plurality of first pixels have quadrilateral shapes that are symmetrical to each other, and

a distance between the neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

13. (Withdrawn) The pixel arrangement structure of claim 6, wherein

the first pixel comprises a plurality of first pixels, and

neighboring pixels of the plurality of first pixels have quadrilateral shapes that are symmetrical to each other.

14. (Withdrawn) The pixel arrangement structure of claim 13, wherein each of the second pixels has a larger area than each of the third pixels.

15. (Canceled)

16. (Previously presented) The pixel arrangement structure of claim 5, wherein

the first pixel has an octagonal shape, and

the second pixels and the third pixels have quadrilateral shapes.

17. (Previously presented) The pixel arrangement structure of claim 16, wherein

each of the second pixels has a larger area than each of the third pixels,

a shortest distance between each of the second pixels and each of the third pixels is a same first length, and



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a shortest distance between the first pixel and each of the second pixels, and a shortest distance between the first pixel and each of the third pixels are a same second length.

18. (Currently amended) The pixel arrangement structure of claim 17, wherein

the first pixel comprises a plurality of first pixels, and

neighboring pixels of the plurality of first pixels have octagonal shapes that are symmetrical to each other~~, and~~

~~a shortest distance between the neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length~~.

19. (Original) The pixel arrangement structure of claim 1, wherein the first pixel, the second pixel, and the third pixel are configured to emit different color lights.

20. (Original) The pixel arrangement structure of claim 19, wherein the first pixel, the second pixel, and the third pixel are configured to emit green light, blue light, and red light, respectively.

21. (New) The pixel arrangement structure of claim 18, wherein a shortest distance between the neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

22. (New) The pixel arrangement structure of claim 1, wherein the second pixel has a larger area than that of the first pixel.



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## REMARKS/ARGUMENTS

Claims 1–14 and 16–22 are pending in the present application, of which claim 1 is independent. Claims 6–14 were previously withdrawn. Claims 17–18 are allowable. Claims 21–22 are new and recite claim language moved from previous claims 18 and 1, respectively. Claim 1 is further amended herein and finds support in at least FIG. 5 of the application as filed. The Applicant respectfully requests examination on the merits and allowance of claims 21–22, continued allowability of claims 17–18, reconsideration and allowance of claims 1–5, 16, and 19-20, and upon allowance of claim 1, rejoinder and allowance of withdrawn claims 6-14, which depend from claim 1.

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**Rejection of claims 1–5 and 19 under 35 U.S.C. § 103(a) over Brown Elliot/Ghosh**
**Rejection of claim 16 under 35 U.S.C. § 103(a) over Brown Elliot/Ghosh/Cok/Ko**
**Rejection of claims 20 under 35 U.S.C. § 103(a) over Brown Elliot/Ghosh/Kim**

According to page 2 of the Office action, "Claims 1-5 and 19 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over [Brown] Elliot (U.S. Patent No. US 7,274,383 B1) in view of Ghosh (U.S[.] Pub. No. US 2012/0319564 A1)." According to page 5 of the Office action, "Claim[] 16 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over [Brown] Elliot, in view of Ghosh as applied to claim 5 above, in view of Cok (U.S. Patent No. US 6,867,549 B2), and further in view of Ko (U.S[.] Patent No. US 8,350,468 B2)." According to page 6 of the Office action, "Claim 20 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over [Brown] Elliot in view of Ghosh as applied to claim 19 above, and further in view of Kim (U.S. Pub. No. US 2011/0012820 A1)." The Applicant amends claim 1 and respectfully argues as follows.

Independent claim 1 now recites:

> 1. A pixel arrangement structure of an organic light emitting diode display, comprising:
> a first pixel having a center coinciding with a center of a virtual square;
> a second pixel separated from the first pixel and having a center at a first vertex of the virtual square;



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another first pixel on a line defined by the center of the virtual square and the first vertex, the first pixel, the second pixel, and the other first pixel being consecutive pixels on the line; and

a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square,

wherein the second pixel has a larger area than that of the third pixel. (Emphasis added.)

The cited references, alone or in combination, do not disclose or suggest at least the claim 1 limitation, "another first pixel on a line defined by the center of the virtual square and the first vertex, the first pixel, the second pixel, and the other first pixel being consecutive pixels on the line." (Emphasis added.) By way of example, Brown Elliott does not disclose this limitation of claim 1. All of the illustrated, described, and claimed embodiments of Brown Elliott appear to be directed to having a central blue emitter 12, 22, or 36 as part of any three-color pixel element (which pages 2–3 of the Office action appear to equate to "a first pixel" and "a virtual square," respectively, as recited in claim 1). Further, as apparent from Brown Elliott FIG. 2, any line going through diagonally arranged blue emitters is going to go through two red or green emitters. For at least these reasons, Brown Elliott does not disclose the claim 1 limitation, "another first pixel on a line defined by the center of the virtual square and the first vertex, the first pixel, the second pixel, and the other first pixel being consecutive pixels on the line."

Further, the addition of Ghosh, Cok, Ko, or Kim does not cure this deficiency of Brown Elliott to support a § 103(a) rejection of claim 1. Ghosh, Cok, Ko, and Kim appear to be silent with respect to the claim 1 limitation, "another first pixel on a line defined by the center of the virtual square and the first vertex, the first pixel, the second pixel, and the other first pixel being consecutive pixels on the line," and there is no apparent reason why one of ordinary skill in the art at the time of the present invention would have combined Brown Elliott, Ghosh, Cok, Ko, and Kim to arrive at the claimed embodiment of claim 1. Accordingly, claim 1 is patentably distinguishable over Brown Elliott, Ghosh, Cok, Ko, and Kim. Furthermore, claims 2–5, 16, and 19–20 depend from claim 1, such that they incorporate all of the terms and limitations of claim 1 in addition to other limitations, which together further patentably distinguish these claims over the art of record. Accordingly, the Applicant respectfully requests that the § 103(a) rejections of claims 2–5, 16, and 19–20 be withdrawn and that these claims be allowed.



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**New claims 21–22**

Claims 21–22 depend from claim 1, such that they incorporate all of the terms and limitations of claim 1 in addition to other limitations, which together further patentably distinguish these claims over the art of record. Accordingly, the Applicant respectfully requests allowance of claims 21–22.

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**Concluding remarks**

In view of the foregoing amendments and remarks, the Applicant earnestly solicits a timely issuance of a Notice of Allowance for claims 1–14 and 16–22. If there are any remaining issues that can be addressed over the telephone, the Examiner is cordially invited to call the Applicant's attorney at the number listed below.

Respectfully submitted,
CHRISTIE, PARKER & HALE, LLP

By Bruce A. Wagar
Bruce A. Wagar, Ph.D.
Reg. No. 72,186
626/795-9900

BAW/dst

DST PAS1370805.4-*-10/15/15 5:12 PM



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BOE et al. v. Samsung, IPR2023-00988

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 13614197 |
| **Filing Date:** | 13-Sep-2012 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Filer:** | Bruce A. Wagar/Marti Carrillo |
| **Attorney Docket Number:** | 69657/S1437 |

Filed as Large Entity

**Filing Fees for Utility under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| Claims in Excess of 20 | 1202 | 1 | 80 | 80 |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Extension-of-Time:** | | | | |
| **Miscellaneous:** | | | | |
| | | **Total in USD ($)** | | **80** |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 23801301 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Bruce A. Wagar/Marti Carrillo |
| **Filer Authorized By:** | Bruce A. Wagar |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 15-OCT-2015 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 21:47:41 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | $80 |
| RAM confirmation Number | 6666 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 69657_Amendment.PDF | 251268<br>8a085fa3ef78ae235d2245c55d1383e1c9eead65 | yes | 10 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Transmittal Letter | 1 | 2 |
| | Amendment/Req. Reconsideration-After Non-Final Reject | 3 | 3 |
| | Claims | 4 | 7 |
| | Applicant Arguments/Remarks Made in an Amendment | 8 | 10 |

| | | | | | |
|---|---|---|---|---|---|
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 31039<br>76087a4ca5cc3355deb37a489e27fc084931e53f | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 282307 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
# AMENDMENT TRANSMITTAL LETTER

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on October 15, 2015 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Signature

Inventor : Sang-Shin Lee Confirmation No. 4264
Application No. : 13/614,197
Filed : September 13, 2012
Title : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

Grp./Div. : 2691
Examiner : Kwang-Su Yang

Docket No. : 69657/S1437

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
October 15, 2015

Commissioner:

Enclosed is an amendment to the above-identified application.

| CLAIMS AS AMENDED | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Claims Remaining After Amendment | Highest Number Previously Paid For | Number Extra Claims | Large Entity Rate | Small Entity Rate | Micro Entity Rate | FEE |
| Total Claims | 21 - | * 20 | = 1 | 1 x $80.00 | $40.00 | $20.00 | $80.00 |
| Independent Claims | 1 - | ** 3 | = 0 | 0 x $420.00 | $210.00 | $105.00 | $0.00 |
| Multiple Dependent Claims*** | | | | $780.00 | $390.00 | $195.00 | $0.00 |
| | | | | | | Total Additional Fee | $80.00 |
| List Independent Claims: 1 | | | | | | | |

* If the "Highest Number of Total Claims Previously Paid For" is less than 20, enter "20" in this space
** If the "Highest Number of Independent Claims Previously Paid For" is less than 3, enter "3" in this space
*** Pay this fee only when "Multiple Dependent Claims" are added for the first time

__X__ Submitted herewith is $80.00 to pay the fees calculated above

_____ A Petition for Extension of Time and the required fee are enclosed.

_____ Other enclosures: _____



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BOE et al. v. Samsung, IPR2023-00988

**Amendment Transmittal Letter**
**Application No. 13/614,197**

The Commissioner is hereby authorized to charge any fees under 37 CFR 1.16 and 1.17 which may be required by or to give effect to this paper to Deposit Account No. 03-1728. Please show our docket number with any charge or credit to our Deposit Account.

Respectfully submitted,

CHRISTIE, PARKER & HALE, LLP

By Bruce A. Wagar

Bruce A. Wagar, Ph.D.
Reg. No. 72,186
626/795-9900

BAW/dst

DST PAS1384231.1-*-10/15/15 5:21 PM



Petitioner Ex 1015, p. 499
BOE et al. v. Samsung, IPR2023-00988

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

| PATENT APPLICATION FEE DETERMINATION RECORD<br>Substitute for Form PTO-875 | Application or Docket Number<br>13/614,197 | Filing Date<br>09/13/2012 | ☐ To be Mailed |
|---|---|---|---|

**ENTITY:** ☒ LARGE ☐ SMALL ☐ MICRO

## APPLICATION AS FILED – PART I

| FOR | (Column 1) NUMBER FILED | (Column 2) NUMBER EXTRA | RATE ($) | FEE ($) |
|---|---|---|---|---|
| ☐ BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | |
| ☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | |
| ☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | minus 20 = | * | X $ = | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | minus 3 = | * | X $ = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | |

## APPLICATION AS AMENDED – PART II

| AMENDMENT | 10/15/2015 | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|
| | Total (37 CFR 1.16(i)) | * 21 | Minus | ** 21 | = 0 | X $80 = | 0 |
| | Independent (37 CFR 1.16(h)) | * 1 | Minus | ***3 | = 0 | X $420 = | 0 |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | | TOTAL ADD'L FEE | 0 |

| AMENDMENT | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|
| | Total (37 CFR 1.16(i)) | * | Minus | ** | = | X $ = | |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = | X $ = | |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/DENISE T. LILES/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

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Alexandria, Virginia 22313-1450
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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

23363 7590 07/15/2015
CHRISTIE, PARKER & HALE, LLP
PO BOX 29001
Glendale, CA 91209-9001

| EXAMINER | |
|---|---|
| YANG, KWANG-SU | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2691 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 07/15/2015 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pto@cph.com
pair_cph@firsttofile.com



Petitioner Ex 1015, p. 501
BOE et al. v. Samsung, IPR2023-00988

| Office Action Summary | Application No. 13/614,197 | Applicant(s) LEE, SANG-SHIN | |
|---|---|---|---|
| | Examiner KWANG-SU YANG | Art Unit 2691 | AIA (First Inventor to File) Status No |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *06/10/2015*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims***

5)☒ Claim(s) *1-14 and 16-20* is/are pending in the application.

5a) Of the above claim(s) *6-14* is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-5,16,19 and 20* is/are rejected.

8)☒ Claim(s) *17 and 18* is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

**Application Papers**

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.



**Petitioner Ex 1015, p. 502**
**BOE et al. v. Samsung, IPR2023-00988**

## DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.

### *Continued Examination Under 37 CFR 1.114*

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 06/10/2015 has been entered.

### *Claim Rejections - 35 USC § 103*

3. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-5 and 19 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Elliot (U.S. Patent No. US 7,274,383 B1) in view of Ghosh (U.S Pub. No. US 2012/0319564 A1).

**As to claim 1,** Elliot (Figs. 1-3) teaches **a pixel arrangement structure** (an arrangement of a three-color pixel element; Fig. 1B) **of an organic light emitting diode display** (an organic light emitting diode display; col. 10, lines 24-

27)**, comprising:**

- **a first pixel** (a blue emitter 22) **having a center coinciding with a center of a virtual square** (Fig. 1B)**;**

- **a second pixel** (a green emitter 26) **separated from the first pixel** (the blue emitter 22) (Fig. 1B) **and having a center at a first vertex of the virtual square** (Fig. 1B)**; and**

- **a third pixel** (a red emitter 24) **separated from the first pixel** (the blue emitter 22) **and the second pixel** (the blue emitter 22) (Fig. 1B)**, and having a center at a second vertex neighboring the first vertex of the virtual square** (Fig. 1B)**.**

Elliot does not teach **wherein the second pixel has a larger area than that of the third pixel and that of the first pixel.**

Ghosh (Fig. 4) teaches

- **wherein the second pixel has a larger area than that of the third pixel and that of the first pixel** (the green subpixel (112) is greater in size than the red (111) and blue (113) subpixels; [0022], lines 3-5; Fig. 4)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used largest green subpixel in size as taught by Ghosh for an arrangement of Elliot because the human visual system is most sensitive to the green part of the visible spectrum in order to improve the contrast of the sensed image.

**As to claim 2,** Elliot teaches **further comprising**

- **another second pixel** (another green emitter 26 at the left bottom corner) **separated from the first pixel** (the blue emitter 22) **and having a center at a third vertex neighboring the second vertex of the virtual square** (Fig. 1B)**,**
- **wherein the second pixels** (the green emitters 26) **are separated from each other the first pixel** (Fig. 1B)**.**

**As to claim 3,** Elliot teaches **further comprising**

- **another third pixel** (another red emitter 24 at the right bottom corner) **separated from the first pixel** (the blue emitter 22) **and having a center at a fourth vertex neighboring the third vertex of the virtual square** (Fig. 1B)**,**
- **wherein the third pixels** (the red emitters 24) **are separated from each other the first pixel** (Fig. 1B)**.**

**As to claim 4,** Elliot teaches

- **wherein the second pixels** (the green emitters 26) **and the third pixels** (the red emitters 24) **enclose the first pixel** (the blue emitter 22) **in the virtual square** (Fig. 2)**.**

**As to claim 5,** Elliot teaches**, wherein**

- **the first pixel, the second pixels, and the third pixels have polygonal shapes** (Fig. 1B)**, and**
- each of **the second pixels and each of the third pixels has a larger area than the first pixel** (Fig. 1A)**.**

**As to claim 19,** Elliot teaches

- **wherein the first pixel, the second pixel, and the third pixel are configured to emit different color lights** (blue, green and blue) (Fig. 1B)**.**

5. Claims 16 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Elliot, in view of Ghosh as applied to claim 5 above, in view of Cok (U.S. Patent No. US 6,867,549 B2), and further in view of Ko (U.S Patent No. US 8,350,468 B2).

**As to claim 16,** Elliot and Ghosh teach **the pixel arrangement structure of claim 5.**

Elliot and Ghosh do not teach **where the first pixel has an octagonal shape, and the second pixels and the third pixels have quadrilateral shapes.**

Cok (Fig. 2) teaches

- **the second pixels and the third pixels** (the green and red emitters 14 and 12) **have quadrilateral shapes** (Fig. 2)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used rectangular shapes as taught by Cok for pixels of Elliot as modified by Ghosh because the rectangular-shaped pixel are easy to design and manufacture.

Elliot, Ghosh and Cok do not teach **the first pixel has an octagonal shape.**

Ko (Fig. 2B) teaches

- **the first pixel has an octagonal shape** (other shapes of pixels may be implemented, such as octagon-shaped pixels; col. 4, lines 40-42; Fig. 2B)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have replaced an octagon-shaped pixel as taught by Ko for a central pixel of Elliot as modified by Ghosh and Cok because the octagon-shaped pixel provides a user with a visually smoothing feature for a display device.

6. Claim 20 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Elliot in view of Ghosh as applied to claim 19 above, and further in view of Kim (U.S Pub. No. US 2011/0012820 A1).

**As to claim 20,** Elliot and Ghosh teach **the pixel arrangement structure of claim 19.**

Elliot also teaches **wherein the third pixel is configured to emit red light** (the red emitter 24; Fig. 1B)**.**

Elliot and Ghosh do not teach **wherein the first pixel and the second pixel are configured to emit green light and blue light, respectively.**

Kim (Figs. 1, 2 and 4) teaches

- **wherein the first pixel and the second pixel are configured to emit green light and blue light, respectively** (first sub-pixels G 12 and a second sub-pixels B 14; Figs. 1, 2 and 4)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have exchange blue pixels and green pixels as taught by Kim in a pixel arrangement of Elliot as modified by Ghosh because the exchange of pixels may be changed based on the factors, for example, the

life of materials respectively utilized in each color sub-pixel for balancing the lives of sub-pixels.

***Allowable Subject Matter***

7. Claims 17-18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

***Response to Arguments***

8. Applicants' arguments with respect to claims 1-5, 16 and 19-20 have been considered but are moot in view of the new grounds of rejection.

In view of amendment, references of Elliot, Ghosh, Cok, Ko, and Kim have been used for the new grounds of rejection.

Therefore, the Office maintains the rejections as recited above.

***Conclusion***

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Sung (U.S. Patent No. US 8,330,352 B2) is cited to teach an organic light emitting device including a plurality of first, second, and third pixels for displaying different colors, wherein the plurality of first and second pixels are alternately arranged in a first column, the plurality of third pixels are continuously arranged in a second column, and an interval between the third pixels is larger than an interval between the first pixel and the second pixel.

- Kawasaki (U.S. Patent No. US 8,026,669 B2) is cited to teach a display device including a display unit in which display elements provided with pixel circuits are arranged so as to have a sequence of three different colors in a row direction and the colors are shifted in a column direction by 1.5 columns.

***Inquiry***

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kwang-Su Yang whose telephone number is 571-270-7307. The examiner can normally be reached on Mon-Fri during 9:00am-6:00pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chanh Nguyen can be reached on 571-272-7772. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/KWANG-SU YANG/
Primary Examiner, Art Unit 2691

| Notice of References Cited | Application/Control No. 13/614,197 | Applicant(s)/Patent Under Reexamination LEE, SANG-SHIN | |
|---|---|---|---|
| | Examiner KWANG-SU YANG | Art Unit 2691 | Page 1 of 1 |

**U.S. PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Name | Classification |
|---|---|---|---|---|---|
| * | A | US-2012/0319564 A1 | 12-2012 | Ghosh et al. | 313/500 |
| * | B | US-8,330,352 B2 | 12-2012 | Sung et al. | 313/504 |
| * | C | US-8,026,669 B2 | 09-2011 | Kawasaki et al. | 315/169.3 |
| | D | US- | | | |
| | E | US- | | | |
| | F | US- | | | |
| | G | US- | | | |
| | H | US- | | | |
| | I | US- | | | |
| | J | US- | | | |
| | K | US- | | | |
| | L | US- | | | |
| | M | US- | | | |

**FOREIGN PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Country | Name | Classification |
|---|---|---|---|---|---|---|
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| | O | | | | | |
| | P | | | | | |
| | Q | | | | | |
| | R | | | | | |
| | S | | | | | |
| | T | | | | | |

**NON-PATENT DOCUMENTS**

| * | | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|---|---|
| | U | |
| | V | |
| | W | |
| | X | |

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.



**Petitioner Ex 1015, p. 510**
**BOE et al. v. Samsung, IPR2023-00988**

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | **Examiner** | **Art Unit** |
| | KWANG-SU YANG | 2691 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 10/27/2014 | 03/07/2015 | 07/09/2015 | | | | | | |
| | 1 | ✓ | ✓ | ✓ | | | | | | |
| | 2 | ✓ | ✓ | ✓ | | | | | | |
| | 3 | ✓ | ✓ | ✓ | | | | | | |
| | 4 | ✓ | ✓ | ✓ | | | | | | |
| | 5 | ✓ | ✓ | ✓ | | | | | | |
| | 6 | N | N | N | | | | | | |
| | 7 | N | N | N | | | | | | |
| | 8 | N | N | N | | | | | | |
| | 9 | N | N | N | | | | | | |
| | 10 | N | N | N | | | | | | |
| | 11 | N | N | N | | | | | | |
| | 12 | N | N | N | | | | | | |
| | 13 | N | N | N | | | | | | |
| | 14 | N | N | N | | | | | | |
| | 15 | N | - | - | | | | | | |
| | 16 | ✓ | ✓ | ✓ | | | | | | |
| | 17 | O | ✓ | O | | | | | | |
| | 18 | O | O | O | | | | | | |
| | 19 | ✓ | ✓ | ✓ | | | | | | |
| | 20 | ✓ | ✓ | ✓ | | | | | | |



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BOE et al. v. Samsung, IPR2023-00988

| FORM PTO/SB/08A/B (10-01)<br>Substitute for PTO-1449A/B<br><br>**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**<br><br>(use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 69657/S1437 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

| U.S. PATENT DOCUMENTS | | | | |
|---|---|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER<br>Number - Kind Code[2] (If Known) | PUBLICATION DATE<br>MM-DD-YYYY | NAME OF PATENTEE |
| | | 6,366,025 B1 | 04-02-2002 | Yamada |
| | | 2005/0162079 A1 | 07-28-2005 | Sakamoto |
| | | 2010/0033084 A1 | 02-11-2010 | Ko et al. |
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| FOREIGN PATENT DOCUMENTS | | | | | |
|---|---|---|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document<br>Country Code[3] - Number[4] - Kind Code[5]<br>(If Known) | Publication Date<br>MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
| | | | | | |
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| OTHER DOCUMENTS | | |
|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
| | | SIPO Office action dated March 11, 2015, for corresponding Chinese Patent application 201310035429.X, (7 pages) |
| | | Taiwan Office action dated March 30, 2015, for corresponding Taiwanese Patent application 102101000, (7 pages) |
| | | |
| | | |

DLG PAS1356556.1-*-05/13/15 2:57 PM

| EXAMINER SIGNATURE | /Kwang-Su Yang/ | DATE CONSIDERED | 07/09/2015 |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

JEJ/dg

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KY/



Petitioner Ex 1015, p. 512
BOE et al. v. Samsung, IPR2023-00988

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | Examiner | Art Unit |
| | KWANG-SU YANG | 2691 |

| CPC- SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| CPC COMBINATION SETS - SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| US CLASSIFICATION SEARCHED | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
| 345 | 82 419 | 10/24/2014 | KY |

| SEARCH NOTES | | |
|---|---|---|
| Search Notes | Date | Examiner |
| EAST: Inventor Search | 10/24/2014 | KY |
| EAST: Text Search | 10/24/2014; 10/27/2014 | KY |
| EAST: Updated Text Search | 02/27/2015 | KY |
| EAST: IDS Search | 03/07/2015 | KY |
| EAST: IDS Search | 07/09/2015 | KY |
| EAST: Updated Text Search | 07/09/2015 | KY |

| INTERFERENCE SEARCH | | | |
|---|---|---|---|
| US Class/ CPC Symbol | US Subclass / CPC Group | Date | Examiner |
| | | | |

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|---|---|
| | /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691 |

**EAST Search History**

**EAST Search History (Prior Art)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L4 | 7 | ("6366025" "20050162079" "20100033084").pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/07/09 19:22 |
| S85 | 4 | ("6366025" "20050162079").pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/07/09 16:14 |
| S86 | 74 | ("6867549").URPN. | USPAT | OR | ON | 2015/07/09 16:27 |
| S87 | 22 | (pixel sub$1pixel dot) same regular adj (pattern arrangement) with (area size) with differ$4 | USPAT | OR | ON | 2015/07/09 16:37 |
| S88 | 21 | (pixel sub$1pixel) same regular adj (pattern arrangement) same (area size) with differ$4 | USPAT | OR | ON | 2015/07/09 16:39 |
| S89 | 16072 | (pixel sub$1pixel) same (polygon square) same (area size) | USPAT | OR | ON | 2015/07/09 16:42 |
| S90 | 4 | (pixel sub$1pixel) same virtual adj square same (area size) | USPAT | OR | ON | 2015/07/09 16:43 |
| S91 | 18 | (pixel sub$1pixel) same virtual adj square | USPAT | OR | ON | 2015/07/09 16:44 |
| S92 | 179 | (pixel sub$1pixel) same polygon near3 (pattern arrangement) | USPAT | OR | ON | 2015/07/09 16:52 |
| S93 | 813 | (pixel sub$1pixel) same delta adj (pattern arrangement) | USPAT | OR | ON | 2015/07/09 17:03 |
| S94 | 0 | (pixel sub$1pixel) same delta adj (pattern arrangement) same virtual adj square | USPAT | OR | ON | 2015/07/09 17:04 |
| S95 | 101 | (pixel sub$1pixel) same delta adj (pattern arrangement) same square | USPAT | OR | ON | 2015/07/09 17:04 |
| S96 | 196 | (pixel sub$1pixel) same delta adj (pattern arrangement) same square | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/07/09 17:05 |
| S97 | 13 | ("2005/0068281").URPN. | USPAT | OR | ON | 2015/07/09 17:26 |
| S98 | 729 | (OLED organic adj light) and (green) with (larg$3 great$3) with red with blue with (pixel sub$1pixel) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/07/09 18:04 |
| S99 | 89 | (OLED organic adj light) and | US-PGPUB; | OR | ON | 2015/07/09 |



Petitioner Ex 1015, p. 514
BOE et al. v. Samsung, IPR2023-00988

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| | | (green) near3 (area size) with (larg$3 great$3) with red with blue with (pixel sub$1pixel) | USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | 18:05 |

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**C:\ Users\ kyang\ Documents\ EAST\ Workspaces\ 13614197.wsp**



Petitioner Ex 1015, p. 515
BOE et al. v. Samsung, IPR2023-00988

| FORM PTO/SB/08A/B (10-01)<br>Substitute for PTO-1449A/B<br><br>**INFORMATION DISCLOSURE**<br><br>**STATEMENT BY APPLICANT**<br><br>(use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 69657/S1437 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

| U.S. PATENT DOCUMENTS | | | | |
|---|---|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER<br>Number - Kind Code[2] (If Known) | PUBLICATION DATE<br>MM-DD-YYYY | NAME OF PATENTEE |
| | | 2012/0056531 A1 | 03-08-2012 | Park et al. |
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| FOREIGN PATENT DOCUMENTS | | | | | |
|---|---|---|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document<br>Country Code[3] - Number[4] - Kind Code[5]<br>(If Known) | Publication Date<br>MM-DD-YYYY | Name of Patentee or<br>Applicant of Cited Document | T[6]<br>(✓) |
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| OTHER DOCUMENTS | | |
|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
| | | U.S. Office action dated June 30, 2015, for cross reference U.S. Patent application 13/872,018, (22 pages) |
| | | |
| | | |
| | | |

DLG PAS1367189.1-*-07/15/15 8:48 AM

| EXAMINER SIGNATURE | | DATE CONSIDERED | |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

JEJ/dg



Petitioner Ex 1015, p. 516
BOE et al. v. Samsung, IPR2023-00988

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 13614197 |
| **Filing Date:** | 13-Sep-2012 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Filer:** | Jun-Young E. Jeon/Diane Goss |
| **Attorney Docket Number:** | 69657/S1437 |

Filed as Large Entity

**Filing Fees for Utility under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| Submission- Information Disclosure Stmt | 1806 | 1 | 180 | 180 |
| | | **Total in USD ($)** | | **180** |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 22927510 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Young E. Jeon/Diane Goss |
| **Filer Authorized By:** | Jun-Young E. Jeon |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 15-JUL-2015 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 16:11:13 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | $180 |
| RAM confirmation Number | 2722 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 69657ids.pdf | 105170<br>2e8b608920afee3bada324ce046acb06e4d1f9fd | yes | 3 |
| | **Multipart Description/PDF files in .zip description** | | | | |
| | **Document Description** | | **Start** | **End** | |
| | Transmittal Letter | | 1 | 2 | |
| | Information Disclosure Statement (IDS) Form (SB08) | | 3 | 3 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Non Patent Literature | USOA2018-30JUN2015.pdf | 927055<br>2ff438d4e5e2a68368f6c18cc04e9c7777b9f19b | no | 22 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Fee Worksheet (SB06) | fee-info.pdf | 30884<br>5e7f26a499fb076576fcd9f0edf768791426561e | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 1063109 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on July 15, 2015 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Diane L. Goss

| | | |
|---|---|---|
| Inventor | : Sang-Shin Lee | Confirmation No. 4264 |
| Application No. | : 13/614,197 | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| Grp./Div. | : 2691 | |
| Examiner | : Kwang-Su Kang | |
| Docket No. | : 69657/S1437 | |

**INFORMATION DISCLOSURE STATEMENT WITH FEE UNDER 37 CFR §§ 1.97(c) AND 1.17(p)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
July 15, 2015

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is FORM PTO/SB/08A/B listing the references that are known to applicant. A copy of the listed Other Documents reference is enclosed.

It is respectfully requested that the listed references be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of FORM PTO/SB/08A/B be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

The processing fee of $180.00 as required by 37 CFR § 1.17(p) is submitted herewith. The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
CHRISTIE, PARKER & HALE, LLP

By _____
Jun Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/dg
Enclosures: Form PTO/SB/08A/B, w/references

DLG PAS1367212.1-*-07/15/15 10:02 AM



Petitioner Ex 1015, p. 523
BOE et al. v. Samsung, IPR2023-00988

**REQUEST FOR CONTINUED EXAMINATION (RCE) TRANSMITTAL**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on June 10, 2015 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Si Vuong

| | | | |
|---|---|---|---|
| Application Number | : | 13/614,197 | Confirmation No. 4264 |
| Filing Date | : | September 13, 2012 | |
| Inventor(s) | : | Sang-Shin Lee | |
| Title | : | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| Group Art Unit | : | 2691 | |
| Examiner Name | : | Kwang-Su Yang | |
| Docket No. | : | **69657/S1437** | Date: June 10, 2015 |

**MAIL TO: Mail Stop RCE**

This is a Request for Continued Examination (RCE) under 37 CFR § 1.114 of the above-identified application.

This application is **not** an application of the kind specified in 37 CFR § 1.114(e).

1. THE STATUS OF THE APPLICATION IS AS FOLLOWS:
   a. __X__ Pending (no review proceedings active)
      (1) __X__ An Action was mailed by the Office on March 12, 2015, as to which no appeal under 37 CFR § 1.191 has been filed and
         __X__ a response under 37 CFR § 1.116 was filed on May 11, 2015
            ____ via Express Mail
            __X__ with certificate of electronic transmission under 37 CFR § 1.8
         __X__ that Action was a Final Rejection, the finality of which is to be withdrawn by this Request
         ____ an appeal or civil action under 35 U.S.C. 141,145 or 146 has been terminated
      (2) ____ Allowed: the Notice of Allowance was mailed by the Office on
         ____ the Issue Fee has not been paid
         ____ the Issue Fee has been paid **and** a petition under 37 CFR § 1.313 was granted on
   b. ____ Pending (with review proceeding active)
      An appeal under 37 CFR § 1.191 has been filed. **Applicant(s) hereby withdraw that appeal and request reopening of the prosecution of the application.**



Petitioner Ex 1015, p. 524
BOE et al. v. Samsung, IPR2023-00988

**REQUEST FOR CONTINUED EXAMINATION (RCE)**
**TRANSMITTAL**

**Application No. 13/614,197**

2. SUBMISSION(S) REQUIRED (check at least one)
   a. Previously submitted
      __X__ Consider the amendments/reply under 37 CFR § 1.116 previously filed on May 11, 2015
      _____ Consider the arguments in the Appeal or Reply Brief previously filed on
      _____ Other:
   b. Enclosed
      _____ Amendment/Reply
      _____ Affidavit(s)/Declaration(s)
      _____ Information Disclosure Statement
      _____ Documents under 37 CFR § 1.48
      _____ Petition for Extension of Time
      _____ Other:

Please direct all correspondence to **CUSTOMER NUMBER 23363**. Direct telephone calls to 626/795-9900, **CHRISTIE, PARKER & HALE, LLP, P.O. Box 29001, Glendale, CA 91209-9001**.

Respectfully submitted,

CHRISTIE, PARKER & HALE, LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/smv



Petitioner Ex 1015, p. 525
BOE et al. v. Samsung, IPR2023-00988

## REQUEST FOR CONTINUED EXAMINATION (RCE)
## FEE CALCULATION SHEET

**Application No. 13/614,197**

| PART I -- BASIC FILING FEE | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | Large Entity Rate | Small Entity Rate | Micro Entity Rate | FEE |
| Basic Filing Fee | | | | 1,200.00 | 600.00 | 300.00 | 1,200.00 |
| **PART II -- ADDITIONAL CLAIMS (compared to application before RCE)** | | | | | | | |
| | Claims Remaining After Amendment | Highest Number Paid For | Number Extra Claims | Large Entity Rate | Small Entity Rate | Micro Entity Rate | FEE |
| Total Claims | 19 - | * 20 | = 0 | x 80.00 | 40.00 | 20.00 | 0 |
| Independent Claims | 1 - | ** 3 | = 0 | x 420.00 | 210.00 | 105.00 | 0 |
| First Presentation of Multiple Dependent Claims | | | | 780.00 | 390.00 | 195.00 | 0 |
| TOTAL FILING FEE | | | | | | | $0 |
| LIST INDEPENDENT CLAIMS: 1 | | | | | | | |
| * IF THE "HIGHEST NUMBER OF TOTAL CLAIMS PREVIOUSLY PAID FOR" IS 20 OR LESS, WRITE "20" IN THIS SPACE<br>** IF HIGHEST NUMBER OF INDEPENDENT CLAIMS PREVIOUSLY PAID FOR IS 3 OR LESS, WRITE "3" IN THIS SPACE | | | | | | | |

1. FEES *(The RCE fee under 37 CFR § 1.17(e) is required by 37 CFR § 1.114 when the RCE is filed.)*

   a. Amount (total from Fee Calculation Sheet)

   The fee of $1,200.00 is submitted herewith.

   b. X The Commissioner is hereby authorized to charge any fees under 37 CFR 1.16 and 1.17 which may be required for this transaction to Deposit Account No. 03-1728. Please show our docket number with any charge or credit to our Deposit Account.

SMV PAS1361092.1-*-06/10/15 12:27 PM



Petitioner Ex 1015, p. 526
BOE et al. v. Samsung, IPR2023-00988

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 13614197 |
| **Filing Date:** | 13-Sep-2012 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Filer:** | Jun-Young E. Jeon/Si Vuong |
| **Attorney Docket Number:** | 69657/S1437 |

Filed as Large Entity

**Filing Fees for Utility under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| Request for Continued Examination | 1801 | 1 | 1200 | 1200 |
| | | **Total in USD ($)** | | **1200** |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 22594609 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Young E. Jeon/Si Vuong |
| **Filer Authorized By:** | Jun-Young E. Jeon |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 10-JUN-2015 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 19:21:26 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | $1200 |
| RAM confirmation Number | 5763 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Request for Continued Examination (RCE) | 69657_RCE_051815.pdf | 320690<br>3379a622763fff25f62ff6ba4b2fb9bfc114a1e5 | no | 3 |
| **Warnings:** | | | | | |
| This is not a USPTO supplied RCE SB30 form. | | | | | |
| **Information:** | | | | | |
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 30812<br>cbbeba7ce6adb2f1111c00a1d376b56bff3f5156 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 351502 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

| PATENT APPLICATION FEE DETERMINATION RECORD<br>Substitute for Form PTO-875 | Application or Docket Number<br>13/614,197 | Filing Date<br>09/13/2012 | ☐ To be Mailed |
|---|---|---|---|

**ENTITY**: ☒ LARGE ☐ SMALL ☐ MICRO

## APPLICATION AS FILED – PART I

| | (Column 1) | (Column 2) | | |
|---|---|---|---|---|
| FOR | NUMBER FILED | NUMBER EXTRA | RATE ($) | FEE ($) |
| ☐ BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | |
| ☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | |
| ☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | minus 20 = | * | X $ = | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | minus 3 = | * | X $ = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | |

## APPLICATION AS AMENDED – PART II

| AMENDMENT | 06/10/2015 | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|
| | Total (37 CFR 1.16(i)) | * 19 | Minus | ** 20 | = 0 | X $80 = | 0 |
| | Independent (37 CFR 1.16(h)) | * 1 | Minus | ***3 | = 0 | X $420 = | 0 |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | | TOTAL ADD'L FEE | 0 |

| AMENDMENT | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|
| | Total (37 CFR 1.16(i)) | * | Minus | ** | = | X $ = | |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = | X $ = | |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/ANTHONY WILLIAMS/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

23363 7590 05/18/2015
CHRISTIE, PARKER & HALE, LLP
PO BOX 29001
Glendale, CA 91209-9001

| EXAMINER | |
|---|---|
| YANG, KWANG-SU | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2691 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 05/18/2015 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pto@cph.com
pair_cph@firsttofile.com



Petitioner Ex 1015, p. 532
BOE et al. v. Samsung, IPR2023-00988

| **Advisory Action Before the Filing of an Appeal Brief** | **Application No.** 13/614,197 | **Applicant(s)** LEE, SANG-SHIN | |
|---|---|---|---|
| | **Examiner** KWANG-SU YANG | **Art Unit** 2691 | **AIA (First Inventor to File) Status** No |

***--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --***

THE REPLY FILED 11 May 2015 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☒ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:
   a) ☐ The period for reply expires _____months from the mailing date of the final rejection.
   b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.
   c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires months from the mailing date of *the prior Advisory Action* or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.
   *Examiner Note*: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANT'S FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☒ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   a) ☒ They raise new issues that would require further consideration and/or search (see NOTE below);
   b) ☐ They raise the issue of new matter (see NOTE below);
   c) ☒ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.
   NOTE: *See Continuation Sheet*. (See 37 CFR 1.116 and 41.33(a)).
4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☒ For purposes of appeal, the proposed amendment(s): (a) ☒ will not be entered, or (b) ☐ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
9. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
10. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
11. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

12. ☐ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: _____.
13. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____
14. ☐ Other: _____.

STATUS OF CLAIMS

15. The status of the claim(s) is (or will be) as follows:
    Claim(s) allowed: .
    Claim(s) objected to: 18.
    Claim(s) rejected: 1-5,16,17,19 and 20.
    Claim(s) withdrawn from consideration: 6-14.

/KWANG-SU YANG/
Primary Examiner, Art Unit 2691



Petitioner Ex 1015, p. 533
BOE et al. v. Samsung, IPR2023-00988

Continuation of 3. NOTE: Applicant's request for entry into AFCP 2.0 is acknowledged, but is denied because the response cannot be reviewed and a search conducted in the limited amount of time authorized for this pilot program. Therefore, the response is being reviewed under pre-pilot practice. The amended limitation "wherein the second pixel has a larger area than that of the third pixel and that of the first pixel" in claim 1 would require further consideration and/or search.



Petitioner Ex 1015, p. 534
BOE et al. v. Samsung, IPR2023-00988

NOT ENTER
/KY/
05/13/2015

PATENT
RESPONSE UNDER 37 CFR 1.116
EXPEDITED PROCEDURE
EXAMINING GROUP 2691

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on May 11, 2015 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Marian M. Liu

| | | |
|---|---|---|
| Appl No. | : 13/614,197 | Confirmation No. 4264 |
| Inventor | : Sang-Shin Lee | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| TC/A.U. | : 2691 | |
| Examiner | : YANG, Kwang-Su | |
| Docket No. | : 69657/S1437 | |
| Customer No. | : 23363 | |

**AMENDMENT AFTER FINAL WITH AFCP 2.0**

**Mail Stop AF**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
May 11, 2015

Commissioner:

In response to the Office action of March 12, 2015, please amend the above-identified application as follows:

**Amendments to the Claims** are reflected in the listing of claims, which begins on page 2 of this paper.

**Remarks/Arguments** begin on page 6 of this paper.



Petitioner Ex 1015, p. 535
BOE et al. v. Samsung, IPR2023-00988

| FORM PTO/SB/08A/B (10-01)<br>Substitute for PTO-1449A/B<br><br>**INFORMATION DISCLOSURE**<br><br>**STATEMENT BY APPLICANT**<br><br>(use as many sheets as necessary) | **Attorney Docket Number** | 69657/S1437 |
|---|---|---|
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

| U.S. PATENT DOCUMENTS | | | | |
|---|---|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER<br>Number - Kind Code[2] (If Known) | PUBLICATION DATE<br>MM-DD-YYYY | NAME OF PATENTEE |
| | | 6,366,025 B1 | 04-02-2002 | Yamada |
| | | 2005/0162079 A1 | 07-28-2005 | Sakamoto |
| | | 2010/0033084 A1 | 02-11-2010 | Ko et al. |
| | | | | |
| | | | | |

| FOREIGN PATENT DOCUMENTS | | | | | |
|---|---|---|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document<br>Country Code[3] - Number[4] - Kind Code[5]<br>(If Known) | Publication Date<br>MM-DD-YYYY | Name of Patentee or<br>Applicant of Cited Document | T[6]<br>(✓) |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| OTHER DOCUMENTS | | |
|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
| | | SIPO Office action dated March 11, 2015, for corresponding Chinese Patent application 201310035429.X, (7 pages) |
| | | Taiwan Office action dated March 30, 2015, for corresponding Taiwanese Patent application 102101000, (7 pages) |
| | | |
| | | |

DLG PAS1356556.1-*-05/13/15 2:57 PM

| EXAMINER SIGNATURE | | DATE CONSIDERED | |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

JEJ/dg



Petitioner Ex 1015, p. 536
BOE et al. v. Samsung, IPR2023-00988

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 13614197 |
| **Filing Date:** | 13-Sep-2012 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Filer:** | Jun-Young E. Jeon/Diane Goss |
| **Attorney Docket Number:** | 69657/S1437 |

Filed as Large Entity

**Filing Fees for Utility under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| Submission- Information Disclosure Stmt | 1806 | 1 | 180 | 180 |
| | | **Total in USD ($)** | | **180** |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 22349707 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Young E. Jeon/Diane Goss |
| **Filer Authorized By:** | Jun-Young E. Jeon |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 14-MAY-2015 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 15:36:09 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | $180 |
| RAM confirmation Number | 1973 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 69657ids.pdf | 120021<br>a60d9f601ce6bdef009d5a05c1003bcc21fcc66b | yes | 3 |
| | **Multipart Description/PDF files in .zip description** | | | | |
| | **Document Description** | | **Start** | **End** | |
| | Transmittal Letter | | 1 | 2 | |
| | Information Disclosure Statement (IDS) Form (SB08) | | 3 | 3 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Non Patent Literature | CN_OfficeAction.pdf | 221618<br>1deeba2a024cd76d95aa13eb58b7cc82763a9e45 | no | 7 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Non Patent Literature | TW_OfficeAction.pdf | 180539<br>ea68d98883a62ce5de5ce271bdb76f51bc62c0eb | no | 7 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 4 | Fee Worksheet (SB06) | fee-info.pdf | 30884<br>36cfec5449731b77be9f53fa1cd68406edb09c12 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 553062 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on May 14, 2015 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Diane L. Goss

| | | |
|---|---|---|
| Inventor | : Sang-Shin Lee | Confirmation No. 4264 |
| Application No. | : 13/614,197 | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| Grp./Div. | : 2691 | |
| Examiner | : Kwang-Su Yang | |
| Docket No. | : 69657/S1437 | |

**INFORMATION DISCLOSURE STATEMENT WITH FEE UNDER 37 CFR §§ 1.97(d) AND 1.17(p)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
May 14, 2015

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is FORM PTO/SB/08A/B listing the references that are known to applicant. Copies of each of the listed Other Documents references are enclosed.

It is respectfully requested that the listed references be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of FORM PTO/SB/08A/B be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

Applicant's undersigned attorney hereby certifies, in accordance with 37 CFR § 1.97(e)(1), that each item of information contained in the information disclosure statement was first cited in a communication from any foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement.

The processing fee of $180.00 as required by 37 CFR § 1.17(p) is submitted herewith. The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
CHRISTIE, PARKER & HALE, LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/dg
Enclosures: Form PTO/SB/08A/B, w/references

DLG PAS1356845.1-*-05/14/15 8:09 AM



Petitioner Ex 1015, p. 543
BOE et al. v. Samsung, IPR2023-00988

Doc Code: A.NE.AFCP
Document Description: After Final Consideration Pilot Program Request

PTO/SB/434 (05-13)

## CERTIFICATION AND REQUEST FOR CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0

| Practitioner Docket No.: | Application No.: | Filing Date: |
|---|---|---|
| 69657/S1437 | 13/614,197 | September 13, 2012 |
| **First Named Inventor:** | **Title:** | |
| Sang-Shin Lee | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0 (AFCP 2.0) OF THE ACCOMPANYING RESPONSE UNDER 37 CFR 1.116.

1. The above-identified application is (i) an original utility, plant, or design nonprovisional application filed under 35 U.S.C. 111(a) [a continuing application (*e.g.*, a continuation or divisional application) is filed under 35 U.S.C. 111(a) and is eligible under (i)], or (ii) an international application that has entered the national stage in compliance with 35 U.S.C. 371(c).
2. The above-identified application contains an outstanding final rejection.
3. Submitted herewith is a response under 37 CFR 1.116 to the outstanding final rejection. The response includes an amendment to at least one independent claim, and the amendment does not broaden the scope of the independent claim in any aspect.
4. This certification and request for consideration under AFCP 2.0 is the only AFCP 2.0 certification and request filed in response to the outstanding final rejection.
5. Applicant is willing and available to participate in any interview requested by the examiner concerning the present response.
6. This certification and request is being filed electronically using the Office's electronic filing system (EFS-Web).
7. Any fees that would be necessary consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, extension of time fees, are being concurrently filed herewith. [There is no additional fee required to request consideration under AFCP 2.0.]
8. By filing this certification and request, applicant acknowledges the following:
   - Reissue applications and reexamination proceedings are not eligible to participate in AFCP 2.0.
   - The examiner will verify that the AFCP 2.0 submission is compliant, *i.e.*, that the requirements of the program have been met (see items 1 to 7 above). For compliant submissions:
     - The examiner will review the response under 37 CFR 1.116 to determine if additional search and/or consideration (i) is necessitated by the amendment and (ii) could be completed within the time allotted under AFCP 2.0. If additional search and/or consideration is required but cannot be completed within the allotted time, the examiner will process the submission consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, by mailing an advisory action.
     - If the examiner determines that the amendment does not necessitate additional search and/or consideration, or if the examiner determines that additional search and/or consideration is required and could be completed within the allotted time, then the examiner will consider whether the amendment places the application in condition for allowance (after completing the additional search and/or consideration, if required). If the examiner determines that the amendment does not place the application in condition for allowance, then the examiner will contact the applicant and request an interview.
       - The interview will be conducted by the examiner, and if the examiner does not have negotiation authority, a primary examiner and/or supervisory patent examiner will also participate.
       - If the applicant declines the interview, or if the interview cannot be scheduled within ten (10) calendar days from the date that the examiner first contacts the applicant, then the examiner will proceed consistent with current practice concerning responses after final rejection under 37 CFR 1.116.

| Signature | Date |
|---|---|
| /J. Y. K/ for/ Jun-Young Jeon Reg. No. 43,163 | May 11, 2015 |
| **Name (Print/Typed)** | **Practitioner Registration No.** |
| Jimmy Y. Kwun | 66,490 |

*Note: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.*

[✓] * Total of 1 forms are submitted.

PATENT

# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
# AMENDMENT TRANSMITTAL LETTER

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on May 11, 2015 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Marian M. Liu

Inventor : Sang-Shin Lee Confirmation No. 4264
Application No. : 13/614,197
Filed : September 13, 2012
Title : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

Grp./Div. : 2691
Examiner : YANG, Kwang-Su

Docket No. : 69657/S1437

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
May 11, 2015

Commissioner:

Enclosed is an amendment to the above-identified application.

| CLAIMS AS AMENDED | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Claims Remaining After Amendment | Highest Number Previously Paid For | Number Extra Claims | Large Entity Rate | Small Entity Rate | Micro Entity Rate | FEE |
| Total Claims | 19 - | * 20 | = 0 | 0 x $80.00 | $40.00 | $20.00 | $0.00 |
| Independent Claims | 1 - | ** 3 | = 0 | 0 x $420.00 | $210.00 | $105.00 | $0.00 |
| Multiple Dependent Claims*** | | | | $780.00 | $390.00 | $195.00 | $0.00 |
| | | | | | | Total Additional Fee | $0.00 |
| List Independent Claims: 1 | | | | | | | |
| * If the "Highest Number of Total Claims Previously Paid For" is less than 20, enter "20" in this space<br>** If the "Highest Number of Independent Claims Previously Paid For" is less than 3, enter "3" in this space<br>*** Pay this fee only when "Multiple Dependent Claims" are added for the first time | | | | | | | |

__X__ No additional fee is required.

_____ A Petition for Extension of Time and the required fee are enclosed.

__X__ Other enclosures: AFCP Program 2.0



Petitioner Ex 1015, p. 545
BOE et al. v. Samsung, IPR2023-00988

**Amendment Transmittal Letter**
**Application No. 13/614,197**

The Commissioner is hereby authorized to charge any fees under 37 CFR 1.16 and 1.17 which may be required by or to give effect to this paper to Deposit Account No. 03-1728. Please show our docket number with any charge or credit to our Deposit Account.

Respectfully submitted,

CHRISTIE, PARKER & HALE, LLP

By _____ for /
Jimmy Y. Kwun
Reg. No. 66,490
626/795-9900

Jun-Young Jeon
Reg. No. 43,693

JYK/mml

MML PAS1356274.1-*-05/11/15 11:39 AM



Petitioner Ex 1015, p. 546
BOE et al. v. Samsung, IPR2023-00988

PATENT
RESPONSE UNDER 37 CFR 1.116
EXPEDITED PROCEDURE
EXAMINING GROUP 2691

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on May 11, 2015 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Marian M. Liu

| | | |
|---|---|---|
| Appl No. | : 13/614,197 | Confirmation No. 4264 |
| Inventor | : Sang-Shin Lee | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| TC/A.U. | : 2691 | |
| Examiner | : YANG, Kwang-Su | |
| Docket No. | : 69657/S1437 | |
| Customer No. | : 23363 | |

**AMENDMENT AFTER FINAL WITH AFCP 2.0**

**Mail Stop AF**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
May 11, 2015

Commissioner:

In response to the Office action of March 12, 2015, please amend the above-identified application as follows:

**Amendments to the Claims** are reflected in the listing of claims, which begins on page 2 of this paper.

**Remarks/Arguments** begin on page 6 of this paper.



Petitioner Ex 1015, p. 547
BOE et al. v. Samsung, IPR2023-00988

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. (Currently Amended) A pixel arrangement structure of an organic light emitting diode display, comprising:

a first pixel having a center coinciding with a center of a virtual square;

a second pixel separated from the first pixel and having a center at a first vertex of the virtual square; and

a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square,

wherein the second pixel has a larger area than that of the third pixel and that of the first pixel.

2. (Previously Presented) The pixel arrangement structure of claim 1, further comprising another second pixel separated from the first pixel and having a center at a third vertex neighboring the second vertex of the virtual square, wherein the second pixels are separated from each other by the first pixel.

3. (Previously Presented) The pixel arrangement structure of claim 2, further comprising another third pixel separated from the first pixel and having a center at a fourth vertex neighboring the third vertex of the virtual square, wherein the third pixels are separated from each other by the first pixel.

4. (Original) The pixel arrangement structure of claim 3, wherein the second pixels and the third pixels enclose the first pixel in the virtual square.

5. (Previously Presented) The pixel arrangement structure of claim 4, wherein the first pixel, the second pixels, and the third pixels have polygonal shapes, and



Petitioner Ex 1015, p. 548
BOE et al. v. Samsung, IPR2023-00988

each of the second pixels and each of the third pixels [[have]] has a larger area than the first pixel.

6. (Withdrawn) The pixel arrangement structure of claim 5, wherein
the first pixel has a quadrilateral shape, and
the second pixels and the third pixels have hexagonal or octagonal shapes.

7. (Withdrawn) The pixel arrangement structure of claim 6, wherein the second pixels and the third pixels have octagonal shapes.

8. (Withdrawn) The pixel arrangement structure of claim 7, wherein a distance between the first pixel and each of the second pixels, a distance between the first pixel and each of the third pixels, and a distance between each of the second pixels and each of the third pixels are a same first length.

9. (Withdrawn) The pixel arrangement structure of claim 8, wherein
the first pixel comprises a plurality of first pixels,
the plurality of first pixels have a same quadrilateral shape, and
a distance between neighboring pixels of the plurality of first pixels is a second length that is longer than the first length.

10. (Withdrawn) The pixel arrangement structure of claim 6, wherein
each of the second pixels has a larger area than each of the third pixels,
a distance between each of the second pixels and each of the third pixels is a same first length, and
a distance between the first pixel and each of the second pixels, and a distance between the first pixel and each of the third pixels are a same second length.

11. (Withdrawn) The pixel arrangement structure of claim 10, wherein
the first pixel comprises a plurality of first pixels,
the plurality of first pixels have a same quadrilateral shape, and



Petitioner Ex 1015, p. 549
BOE et al. v. Samsung, IPR2023-00988

a distance between neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

12. (Withdrawn) The pixel arrangement structure of claim 10, wherein

the first pixel comprises a plurality of first pixels,

neighboring pixels of the plurality of first pixels have quadrilateral shapes that are symmetrical to each other, and

a distance between the neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

13. (Withdrawn) The pixel arrangement structure of claim 6, wherein

the first pixel comprises a plurality of first pixels, and

neighboring pixels of the plurality of first pixels have quadrilateral shapes that are symmetrical to each other.

14. (Withdrawn) The pixel arrangement structure of claim 13, wherein each of the second pixels has a larger area than each of the third pixels.

15. (Canceled)

16. (Previously Presented) The pixel arrangement structure of claim 5, wherein

the first pixel has an octagonal shape, and

the second pixels and the third pixels have quadrilateral shapes.

17. (Currently Amended) The pixel arrangement structure of claim 16, wherein

each of the second pixels has a larger area than each of the third pixels,

a shortest distance between each of the second pixels and each of the third pixels is a same first length, and

a shortest distance between the first pixel and each of the second pixels, and a shortest distance between the first pixel and each of the third pixels are a same second length.



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18. (Currently Amended) The pixel arrangement structure of claim 17, wherein

the first pixel comprises a plurality of first pixels,

neighboring pixels of the plurality of first pixels have octagonal shapes that are symmetrical to each other, and

a shortest distance between the neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

19. (Original) The pixel arrangement structure of claim 1, wherein the first pixel, the second pixel, and the third pixel are configured to emit different color lights.

20. (Original) The pixel arrangement structure of claim 19, wherein the first pixel, the second pixel, and the third pixel are configured to emit green light, blue light, and red light, respectively.



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## REMARKS/ARGUMENTS

Claims 1–14 and 16–20 are pending in the present application, of which claim 1 is independent. Claim 15 was previously canceled without prejudice. Claims 6–14 were previously withdrawn. Claims 1, 17, and 18 are amended herein. No new matter has been introduced. Applicant thanks the Examiner for indicating that claim 18 would be allowable if rewritten or amended to overcome the 112 rejections. Applicant respectfully requests reconsideration and allowance of claims 1-5, 16-17, and 19-20, while maintaining the allowablity of claim 18.

### Claim Rejections Under 35 U.S.C. § 112

Claims 17-18 were rejected under 35 U.S.C. § 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

Claims 17 and 18 have been respectively amended to recite, in relevant part, "a shortest distance." (Emphasis added). Support for the amendments may be found in at least para. [0044] of the original specification as filed (e.g., "It should be noted that L1, L2, L3, . . . may be used throughout to represent shortest distances between corresponding pixels").

In rejecting claim 17, page 2 of the Office action alleges that "when the closest point is applied to the distance between two pixels, a limitation 'a distance between the first pixel and each of the second pixels, and a distance between the first pixel and each of the third pixels are a same second length' is inconsistent with the distance shown in Fig. 5." (Emphasis added).

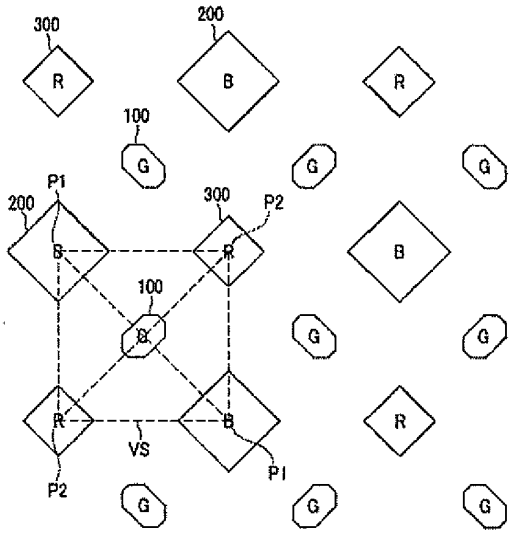
Applicant respectively submits that the features of claim 17 as amended are clearly shown in the original specification and drawings as filed. For example, as shown in the non-limiting embodiment of FIG. 5 of the original drawings as filed, reproduced below, the shortest distance between a pixel 100 and each of the adjacent pixels 200 is the same as the shortest distance between the pixel 100 and each of the adjacent pixels 300. Accordingly, the non-limiting embodiment of FIG. 5 clearly shows an example of "a shortest distance between the first



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pixel and each of the second pixels, and a shortest distance between the first pixel and each of the third pixels are a same second length" as now recited in amended claim 17.

FIG.5




(FIG. 5 of the present application)

Applicant, therefore, respectfully requests that the 112 rejections of claims 17-18 be withdrawn in view of the present amendments to those claims.

**Claim Rejections Under 35 U.S.C. § 103**

Claims 1-5 and 19 were rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Brown Elliot (U.S. Patent No. 7,274,383, hereinafter referred to as "Elliot") in view of Cok et al. (U.S. Patent No. 6,867,549, hereinafter referred to as "Cok").

Claims 16 and 17 were rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Elliot in view of Cok and further in view of Ko et al. (U.S. Patent No. 8,350,468, hereinafter referred to as "Ko").



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Claim 20 was rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Elliot in view of Cok, as applied to claim 9, and further in view of Kim et al. (U.S. Patent No. 2011/0012820, hereinafter referred to as "Kim").

Independent claim 1 of the present application has been amended and recites, in relevant part (emphasis added):

> a first pixel having a center coinciding with a center of a virtual square;
> a second pixel separated from the first pixel and having a center at a first vertex of the virtual square; and
> a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square,
> wherein the second pixel has a larger area than that of the third pixel and that of the first pixel.

Applicant respectfully submits that the cited references, alone or in any combination, do not appear to disclose or even suggest at least the above-recited features of amended claim 1. To establish a *prima facie* case of obviousness, there should be provided some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness demonstrating why one of ordinary skill in the art at the time the invention was made would have combined the disclosures of these references to arrive at the claimed embodiment. *See KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Furthermore, there should be some explanation why any differences between the cited references and the claimed invention would have been obvious to one of ordinary skill in the art. *See* MPEP § 2141.

Here, for example, none of the figures in Elliot nor Cok appear to show or even suggest at least "wherein the second pixel has a larger area than that of the third pixel **and** that of the first pixel" as now recited in amended claim 1. (Emphasis added). Further, the other remaining cited references do not appear to cure the deficiencies of Elliot and Cok to disclose or even suggest at least the above-recited features of amended claim 1, and there is no apparent reason why a person having ordinary skill in the art at the time of the invention would have combined/modified the cited references to arrive at the embodiment recited in amended claim 1.



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Applicant, therefore, respectfully requests that the rejection of claim 1 be withdrawn, and that claim 1 be allowed. Further, because claims 2-5, 16-17, and 19-20 depend, directly or indirectly, from claim 1, these claims each incorporate all of the terms and limitations of claim 1, in addition to other limitations, which together further patentably distinguish these claims over the art of record when considered as a whole. Applicant, therefore, respectfully requests that the rejection of claims 2-5, 16-17, and 19-20 be withdrawn, and that these claims be allowed as well.

**Allowable Claims**

Applicant thanks the Examiner for indicating that claim 18 would be allowable if rewritten or amended to overcome the 112 rejections. As discussed above, the amendments to claim 18 appear to overcome the 112 rejections. Further, as Applicant believes that the rejection of claim 1 has been overcome herein, and because claim 18 depends indirectly from claim 1, Applicant respectfully requests that claim 18 be allowed upon the allowance of claim 1, and any intervening claims.

**Concluding Remarks**

In view of the foregoing amendments and remarks, Applicant earnestly solicits a timely issuance of a Notice of Allowance. If there are any remaining issues that can be addressed over the telephone, the Examiner is cordially invited to call Applicant's attorney at the number listed below.

Respectfully submitted,
CHRISTIE, PARKER & HALE, LLP

By _____ for /
Jimmy Y. Kwun
Reg. No. 66,490
626/795-9900

Jun-Young Jeon
Reg. No. 43,693

JYK/mml

MML PAS1353969.1-*-05/11/15 11:34 AM



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# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 22311156 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Yong J. Kwun/Marian Liu |
| **Filer Authorized By:** | Yong J. Kwun |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 11-MAY-2015 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 17:55:00 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

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|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | After Final Consideration Program Request | 69657-AFCP.PDF | 48364<br>58f6f0353dee74e4c81a005dd0c12aec90049402 | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |

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|---|---|---|---|---|---|
| 2 | Transmittal Letter | 69657-Transmittal.PDF | 37121<br>d865f4823de1a1f47fb07e1ba3bc23eaf55178bf | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | | 69657-AAF.PDF | 240473<br>aa9e4a225a84b0ee7ed34fc9e1926c5bad99f2b3 | yes | 9 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Response After Final Action | 1 | 1 |
| | Claims | 2 | 5 |
| | Applicant Arguments/Remarks Made in an Amendment | 6 | 9 |

| | |
|---|---|
| **Warnings:** | |
| **Information:** | |
| **Total Files Size (in bytes):** | 325958 |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

| PATENT APPLICATION FEE DETERMINATION RECORD<br>Substitute for Form PTO-875 | Application or Docket Number<br>13/614,197 | Filing Date<br>09/13/2012 | ☐ To be Mailed |
|---|---|---|---|

**ENTITY:** ☒ LARGE ☐ SMALL ☐ MICRO

## APPLICATION AS FILED – PART I

| FOR | (Column 1) NUMBER FILED | (Column 2) NUMBER EXTRA | RATE ($) | FEE ($) |
|---|---|---|---|---|
| ☐ BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | |
| ☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | |
| ☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | minus 20 = | * | X $ = | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | minus 3 = | * | X $ = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | |

## APPLICATION AS AMENDED – PART II

AMENDMENT 05/11/2015

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * 19 | Minus | ** 20 | = 0 | X $80 = | 0 |
| Independent (37 CFR 1.16(h)) | * 1 | Minus | ***3 | = 0 | X $420 = | 0 |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | TOTAL ADD'L FEE | 0 |

AMENDMENT

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * | Minus | ** | = | X $ = | |
| Independent (37 CFR 1.16(h)) | * | Minus | *** | = | X $ = | |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/ALLYSON PURNELL/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

23363 7590 03/12/2015
CHRISTIE, PARKER & HALE, LLP
PO BOX 29001
Glendale, CA 91209-9001

| EXAMINER | |
|---|---|
| YANG, KWANG-SU | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2691 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 03/12/2015 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pto@cph.com
pair_cph@firsttofile.com



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| Office Action Summary | Application No. 13/614,197 | Applicant(s) LEE, SANG-SHIN | |
|---|---|---|---|
| | Examiner KWANG-SU YANG | Art Unit 2691 | AIA (First Inventor to File) Status No |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *02/02/2015*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims***

5)☒ Claim(s) *1-20* is/are pending in the application.

5a) Of the above claim(s) *6-14* is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-5,16,17,19 and 20* is/are rejected.

8)☒ Claim(s) *18* is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

**Application Papers**

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.



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## DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.

### *Response to Amendment*

2. The amendment filed on 02/02/2015 has been entered and considered by examiner.

### *Claim Rejections - 35 USC § 112*

3 The following is a quotation of 35 U.S.C. 112(b):

> (b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 17-18 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

- In claim 17-18, the limitations ”distance between two pixels" are indefinite since the reference point for the distance is not defined, for example, the center of the pixel or the closest point. In claim 17, when the closest point is applied to the distance between two pixels, a limitation “a distance between the first pixel and each of the second pixels, and a distance between the first pixel and each of the third pixels are a same second length” is inconsistent with the distance shown in Fig. 5. In claim 18, when the center point is applied to the distance between two neighboring first pixels, a limitation “a distance

between the neighboring pixels of the plurality of first pixels is a third length that is longer than the first length and the second length" is inconsistent with the distance shown in Fig. 5 since the third length is the same as the first length.

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-5 and 19 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Elliot (U.S. Patent No. US 7,274,383 B1) in view of Cok (Fig. 5) (U.S Patent No. US 6,867,549 B2).

**As to claim 1,** Elliot (Figs. 1-3) teaches **a pixel arrangement structure** (an arrangement of a three-color pixel element; Fig. 1B) **of an organic light emitting diode display** (an organic light emitting diode display; col. 10, lines 24-27)**, comprising:**

- **a first pixel** (a blue emitter 22) **having a center coinciding with a center of a virtual square** (Fig. 1B)**;**
- **a second pixel** (a green emitter 26) **separated from the first pixel** (the blue emitter 22) (Fig. 1B) **and having a center at a first vertex of the virtual square** (Fig. 1B)**; and**
- **a third pixel** (a red emitter 24) **separated from the first pixel** (the blue emitter 22) **and the second pixel** (the blue emitter 22) (Fig. 1B)**, and having a**

**center at a second vertex neighboring the first vertex of the virtual square** (Fig. 1B)**.**

Elliot does not teach **wherein the second pixel has a larger area than the third pixel.**

Cok (Fig. 5) teaches

- **wherein the second pixel** (a green light emitting element 14) **has a larger area than the third pixel** (a red light emitting element 12) (Fig. 5)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have replaced an arrangement of a three-color pixel element as taught by Cok (Fig. 5) for an arrangement of Elliot because the pixel size of the blue component relative to the red or green may be larger to cause the pixel elements to age at a common rate.

**As to claim 2,** Elliot teaches **further comprising**

- **another second pixel** (another green emitter 26 at the left bottom corner) **separated from the first pixel** (the blue emitter 22) **and having a center at a third vertex neighboring the second vertex of the virtual square** (Fig. 1B)**,**
- **wherein the second pixels** (the green emitters 26) **are separated from each other the first pixel** (Fig. 1B)**.**

**As to claim 3,** Elliot teaches **further comprising**

- **another third pixel** (another red emitter 24 at the right bottom corner) **separated from the first pixel** (the blue emitter 22) **and having a center at a fourth vertex neighboring the third vertex of the virtual square** (Fig. 1B)**,**
- **wherein the third pixels** (the red emitters 24) **are separated from each other the first pixel** (Fig. 1B)**.**

**As to claim 4,** Elliot teaches

- **wherein the second pixels** (the green emitters 26) **and the third pixels** (the red emitters 24) **enclose the first pixel** (the blue emitter 22) **in the virtual square** (Fig. 2)**.**

**As to claim 5,** Elliot teaches**, wherein**

- **the first pixel, the second pixels, and the third pixels have polygonal shapes** (Fig. 1B)**, and**
- each of **the second pixels and each of the third pixels has a larger area than the first pixel** (Fig. 1A)**.**

**As to claim 19,** Elliot teaches

- **wherein the first pixel, the second pixel, and the third pixel are configured to emit different color lights** (blue, green and blue) (Fig. 1B)**.**

7. Claims 16-17 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Elliot, in view of Cok (Fig. 5) as applied to claim 5 above, in view of Cok (Fig. 2), and further in view of Ko (U.S Patent No. US 8,350,468 B2).

**As to claim 16,** Elliot and Cok (Fig. 5) teach **the pixel arrangement structure of claim 5.**

Elliot and Cok (Fig. 5) do not teach **where the first pixel has an octagonal shape, and the second pixels and the third pixels have quadrilateral shapes.**

Cok (Fig. 2) teaches

- **the second pixels and the third pixels** (the green and red emitters 14 and 12) **have quadrilateral shapes** (Fig. 2)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used rectangular shapes as taught by Cok (Fig. 2) for pixels of Elliot as modified by Cok (Fig. 5) because the rectangular-shaped pixel are easy to design and manufacture.

Elliot, Cok (Fig. 5) and Cok (Fig. 2) do not teach **the first pixel has an octagonal shape.**

Ko (Fig. 2B) teaches

- **the first pixel has an octagonal shape** (other shapes of pixels may be implemented, such as octagon-shaped pixels; col. 4, lines 40-42; Fig. 2B)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have replaced an octagon-shaped pixel as taught by Ko for a central pixel of Elliot as modified by Cok (Fig. 5) and Cok (Fig. 2) because the octagon-shaped pixel provides a user with a visually smoothing feature for a display device.

**As to claim 17,** Elliot, Cok (Fig. 5), Cok (Fig. 2) and Ko teach **the pixel arrangement structure of claim 16.**

Elliot also teaches

- **a distance between each of the second pixels and each of the third pixels is a same first length** (a distance between the center of green emitter 26 and the center of red emitter 24 has a same length; Fig. 1B)**, and**
- **a distance between the first pixel and each of the second pixels, and a distance between the first pixel and each of the third pixels are a same second length** (a distance between the center of blue emitter 22 and the center of green emitter 26, and a distance between the center of blue emitter 22 and the center of red emitter 24 are a same length; Fig. 1B)**.**

Cok (Fig. 5) also teaches

- **each of the second pixels** (the green light emitting element 14) **has a larger area than each of the third pixels** (the red light emitting element 12) (Fig. 5)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have replaced an arrangement of a three-color pixel element as taught by Cok (Fig. 5) for an arrangement of Elliot as modified by Cok (Fig. 2) and Ko because the pixel size of the blue component relative to the red or green may be larger to cause the pixel elements to age at a common rate.

8. Claim 20 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Elliot in view of Cok (Fig. 5) as applied to claim 19 above, and further in view of Kim (U.S Pub. No. US 2011/0012820 A1).

**As to claim 20,** Elliot and Cok (Fig. 5) teach **the pixel arrangement structure of claim 19.**

Elliot also teaches **wherein the third pixel is configured to emit red light** (the red emitter 24; Fig. 1B)**.**

Elliot and Cok (Fig. 5) do not teach **wherein the first pixel and the second pixel are configured to emit green light and blue light, respectively.**

Kim (Figs. 1, 2 and 4) teaches

- **wherein the first pixel and the second pixel are configured to emit green light and blue light, respectively** (first sub-pixels G 12 and a second sub-pixels B 14; Figs. 1, 2 and 4)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have exchange blue pixels and green pixels as taught by Kim in a pixel arrangement of Elliot as modified by Cok (Fig. 5) because the exchange of pixels may be changed based on the factors, for example, the life of materials respectively utilized in each color sub-pixel for balancing the lives of sub-pixels.

***Allowable Subject Matter***

9, Claim18 would be allowable if rewritten or amended to overcome the rejections under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), 2nd paragraph, set forth in this Office action.

As allowable subject matter has been indicated, applicant's reply must either comply with all formal requirements or specifically traverse each requirement not complied with. See 37 CFR 1.111(b) and MPEP § 707.07(a).

***Response to Arguments***

10. Applicants' arguments with respect to claims 1-5, 16-17 and 19-20 have been considered but are moot in view of the new grounds of rejection.

In view of amendment, references of Elliot, Cok (Fig. 5), Cok (Fig. 2), Ko, and Kim have been used for the new grounds of rejection.

Therefore, the Office maintains the rejections as recited above.

***Conclusion***

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

***Inquiry***

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kwang-Su Yang whose telephone number is 571-270-7307. The examiner can normally be reached on Mon-Fri during 9:00am-6:00pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chanh Nguyen can be reached on 571-272-7772. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/KWANG-SU YANG/
Primary Examiner, Art Unit 2691

| Notice of References Cited | Application/Control No. 13/614,197 | Applicant(s)/Patent Under Reexamination LEE, SANG-SHIN | |
|---|---|---|---|
| | Examiner KWANG-SU YANG | Art Unit 2691 | Page 1 of 1 |

**U.S. PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Name | Classification |
|---|---|---|---|---|---|
| * | A | US-7,274,383 B1 | 09-2007 | Brown Elliot, Candice Hellen | 345/694 |
| * | B | US-6,867,549 B2 | 03-2005 | Cok et al. | 315/169.3 |
| | C | US- | | | |
| | D | US- | | | |
| | E | US- | | | |
| | F | US- | | | |
| | G | US- | | | |
| | H | US- | | | |
| | I | US- | | | |
| | J | US- | | | |
| | K | US- | | | |
| | L | US- | | | |
| | M | US- | | | |

**FOREIGN PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Country | Name | Classification |
|---|---|---|---|---|---|---|
| | N | | | | | |
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| | R | | | | | |
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| | T | | | | | |

**NON-PATENT DOCUMENTS**

| * | | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|---|---|
| | U | |
| | V | |
| | W | |
| | X | |

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.



Petitioner Ex 1015, p. 570
BOE et al. v. Samsung, IPR2023-00988

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | Examiner | Art Unit |
| | KWANG-SU YANG | 2691 |

| CPC- SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| CPC COMBINATION SETS - SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| US CLASSIFICATION SEARCHED | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
| 345 | 82 419 | 10/24/2014 | KY |

| SEARCH NOTES | | |
|---|---|---|
| Search Notes | Date | Examiner |
| EAST: Inventor Search | 10/24/2014 | KY |
| EAST: Text Search | 10/24/2014; 10/27/2014 | KY |
| EAST: Updated Text Search | 02/27/2015 | KY |
| EAST: IDS Search | 03/07/2015 | KY |

| INTERFERENCE SEARCH | | | |
|---|---|---|---|
| US Class/ CPC Symbol | US Subclass / CPC Group | Date | Examiner |
| | | | |

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| | /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691 |

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | **Examiner** | **Art Unit** |
| | KWANG-SU YANG | 2691 |

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|---|---|---|---|---|---|---|---|
| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 10/27/2014 | 03/07/2015 | | | | | | | |
| | 1 | ✓ | ✓ | | | | | | | |
| | 2 | ✓ | ✓ | | | | | | | |
| | 3 | ✓ | ✓ | | | | | | | |
| | 4 | ✓ | ✓ | | | | | | | |
| | 5 | ✓ | ✓ | | | | | | | |
| | 6 | N | N | | | | | | | |
| | 7 | N | N | | | | | | | |
| | 8 | N | N | | | | | | | |
| | 9 | N | N | | | | | | | |
| | 10 | N | N | | | | | | | |
| | 11 | N | N | | | | | | | |
| | 12 | N | N | | | | | | | |
| | 13 | N | N | | | | | | | |
| | 14 | N | N | | | | | | | |
| | 15 | N | - | | | | | | | |
| | 16 | ✓ | ✓ | | | | | | | |
| | 17 | O | ✓ | | | | | | | |
| | 18 | O | O | | | | | | | |
| | 19 | ✓ | ✓ | | | | | | | |
| | 20 | ✓ | ✓ | | | | | | | |

**EAST Search History**

**EAST Search History (Prior Art)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L5 | 2 | "8350468".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/03/07 13:19 |
| L6 | 6 | ("20120086330" "20130037827").pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/03/07 14:55 |
| S49 | 2 | ("2009/0302331").URPN. | USPAT | OR | ON | 2015/02/27 13:13 |
| S50 | 262 | (organic adj light OLED) and (pixel sub$1pixel) near (arrangment pattern) same green same blue same red | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/02/27 17:26 |
| S51 | 2 | "20020113195".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/02/27 18:22 |
| S52 | 4 | ("2002/0113195").URPN. | USPAT | OR | ON | 2015/02/27 18:22 |
| S53 | 0 | ("7728881").URPN. | USPAT | OR | ON | 2015/02/27 18:23 |
| S54 | 1 | ("7470881").URPN. | USPAT | OR | ON | 2015/02/27 18:24 |
| S55 | 2 | "6882364".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/02/27 18:26 |
| S56 | 68 | ("6882364").URPN. | USPAT | OR | ON | 2015/02/27 18:26 |
| S57 | 2 | S56 and (organic OLED) | USPAT | OR | ON | 2015/02/27 18:26 |
| S58 | 0 | "20100171440".pn. | USPAT | OR | ON | 2015/02/27 18:27 |



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BOE et al. v. Samsung, IPR2023-00988

| | | | | | | |
|---|---|---|---|---|---|---|
| S59 | 2 | "20100171440".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/02/27 18:27 |
| S60 | 9 | ("2010/0171440").URPN. | USPAT | OR | ON | 2015/02/27 18:28 |
| S61 | 97 | S50 and (larg$3 small$2 great$2 less differ$3) | USPAT | OR | ON | 2015/02/27 18:30 |
| S62 | 73 | ("6867549").URPN. | USPAT | OR | ON | 2015/02/27 18:37 |
| S63 | 52 | S62 and (organic OLED) | USPAT | OR | ON | 2015/02/27 18:37 |
| S64 | 0 | ("8598784").URPN. | USPAT | OR | ON | 2015/02/27 18:39 |
| S65 | 0 | ("8405692").URPN. | USPAT | OR | ON | 2015/02/27 18:40 |
| S66 | 5 | ("20020015110" \| "20090121983" \| "6867549" \| "7525526" \| "7646430").PN. OR ("8354789").URPN. | US-PGPUB; USPAT; USOCR | OR | ON | 2015/02/27 18:41 |
| S67 | 26 | (organic adj light OLED) and (pixel sub$1pixel) with (arrangment pattern) same green with (center central) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/02/27 18:46 |
| S68 | 7 | ("7701476").URPN. | USPAT | OR | ON | 2015/02/27 18:51 |
| S69 | 1 | ("20020015110" \| "20020070909" \| "20120086330" \| "20100171440" \| "20040108818" \| "20020015110" \| "20100033084" \| "20080001525" \| "20120313844" \| "20020113195" \| "8350468" \| "20090302331" \| "20110012820" \| "20050001542" \| "20130037827").PN. | USPAT | OR | ON | 2015/02/27 19:05 |
| S70 | 37 | ("20020015110" \| "20020070909" \| "20120086330" \| "20100171440" \| "20040108818" \| "20020015110" \| "20100033084" \| "20080001525" \| "20120313844" \| "20020113195" \| "8350468" \| "20090302331" \| "20110012820" \| "20050001542" \| "20130037827").PN. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/02/27 19:05 |
| S71 | 3 | "20130002911".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/02/27 19:27 |
| S72 | 2 | "6867549".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; | OR | ON | 2015/02/27 19:43 |



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| | | | DERWENT; IBM_TDB | | | |
| S73 | 73 | ("6867549").URPN. | USPAT | OR | ON | 2015/02/27 19:43 |
| S74 | 73 | ("6867549").URPN. | USPAT | OR | ON | 2015/02/27 19:44 |
| S75 | 52 | S74 and (organic OLED) | USPAT | OR | ON | 2015/02/27 19:44 |
| S76 | 0 | ("8598784").URPN. | USPAT | OR | ON | 2015/02/27 19:45 |
| S77 | 0 | ("20030117423" "20040080479").pn. | USPAT | OR | ON | 2015/02/27 19:53 |
| S78 | 5 | ("20030117423" "20040080479").pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/02/27 19:53 |
| S79 | 2 | "20070273626".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/02/27 20:07 |
| S80 | 4 | "6903724".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/02/27 20:13 |
| S81 | 4 | "6903754".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/02/27 20:14 |
| S82 | 132 | ("20010017515" \| "20010040645" \| "20020012071" \| "20020015110" \| "20020017645" \| "20020122160" \| "20020140831" \| "20020190648" \| "20030011613" \| "20030043567" \| "20030071826" \| "20030071943" \| "20030218618" \| "3971065" \| "4353062" \| "4593978" \| "4642619" \| "4651148" \| "4751535" \| "4773737" \| "4786964" \| "4792728" \| "4800375" \| "4853592" \| "4874986" \| "4886343" \| "4908609" \| "4920409" \| "4965565" \| "4966441" \| "4967264" \| "5006840" \| "5052785" \| "5113274" \| "5115274" \| "5132674" \| "5144288" \| "5184114" \| "5189404" \| "5233385" \| "5311337" \| "5315418" \| "5334996" \| "5341153" \| "5398066" \| "5436747" \| "5461503" \| "5535028" \| "5541653" \| "5561460" \| "5563621" \| "5579027" \| "5646702" \| "5648793" \| | US-PGPUB; USPAT; USOCR | OR | ON | 2015/02/27 20:15 |



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BOE et al. v. Samsung, IPR2023-00988

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|---|---|---|---|---|---|---|
| | | "5729244" \| "5754226" \| "5792579" \| "5815101" \| "5821913" \| "5949496" \| "5973664" \| "6002446" \| "6005692" \| "6008868" \| "6034666" \| "6038031" \| "6049626" \| "6061533" \| "6064363" \| "6097367" \| "6108122" \| "6144352" \| "6147664" \| "6151001" \| "6160535" \| "6184903" \| "6188385" \| "6198507" \| "6219025" \| "6225967" \| "6225973" \| "6236390" \| "6239783" \| "6243055" \| "6243070" \| "6262710" \| "6271891" \| "6299329" \| "6327008" \| "6346972" \| "6360023" \| "6377262" \| "6392717" \| "6393145" \| "6441867" \| "6453067" \| "6466618" \| "6600495" \| "6628068" \| "6661429" \| "6738526").PN. OR ("6903754").URPN. | | | | |
| S83 | 24 | S82 and (organic OLED) | USPAT | OR | ON | 2015/02/27 20:15 |
| S84 | 13 | "8405692".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2015/02/27 20:29 |

**EAST Search History (Interference)**

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**C:\Users\kyang\Documents\EAST\Workspaces\13614197.wsp**



Petitioner Ex 1015, p. 576
BOE et al. v. Samsung, IPR2023-00988

| FORM PTO/SB/08A/B (10-01)<br>Substitute for PTO-1449A/B<br><br>**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**<br><br>(use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 69657/S1437 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang -Su Yang |

| U.S. PATENT DOCUMENTS | | | | |
|---|---|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER<br>Number - Kind Code[2] (If Known) | PUBLICATION DATE<br>MM-DD-YYYY | NAME OF PATENTEE |
| | | 2012/0086330 A1 | 04-12-2012 | Umeda et al. |
| | | 2013/0037827 A1 | 02-14-2013 | Levermore et al. |
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| FOREIGN PATENT DOCUMENTS | | | | | |
|---|---|---|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document<br>Country Code[3] - Number[4] - Kind Code[5]<br>(If Known) | Publication Date<br>MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
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| OTHER DOCUMENTS | | |
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| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
| | | U.S. Office action dated August 29, 2014, for cross reference U.S. Patent application 14/059,356, (18 pages) |
| | | |
| | | |
| | | |

DLG PAS1327990.1-*-11/18/14 10:20 AM

| EXAMINER SIGNATURE | /Kwang-Su Yang/ | DATE CONSIDERED | 03/07/2015 |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

JEJ/dg

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KY/

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on February 2, 2015 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Marti Carrillo

| | | |
|---|---|---|
| Appl No. | : 13/614,197 | Confirmation No. 4264 |
| Inventor | : Sang-Shin Lee | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| TC/A.U. | : 2691 | |
| Examiner | : YANG, KWANG-SU | |
| Docket No. | : 69657/S1437 | |
| Customer No. | : 23363 | |

**AMENDMENT**

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
February 2, 2015

Commissioner:

In response to the non-final Office action of November 7, 2014 (hereinafter "the Office action"), please amend the above-identified application as follows:

**Amendments to the Claims** are reflected in the listing of claims, which begins on page 2 of this paper.

**Remarks/Arguments** begin on page 6 of this paper.



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**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. (Currently amended) A pixel arrangement structure of an organic light emitting diode display, comprising:

a first pixel having a center coinciding with a center of a virtual square;

a second pixel separated from the first pixel and having a center at a first vertex of the virtual square; and

a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square,

wherein the second pixel has a larger area than the third pixel.

2. (Currently amended) The pixel arrangement structure of claim 1, further comprising another second pixel separated from the first pixel and having a center at a third vertex neighboring the second vertex of the virtual square, wherein ~~the second pixel comprises a pair of second pixels, and~~ the second pixels are separated from each other by the first pixel.

3. (Currently amended) The pixel arrangement structure of claim 2, further comprising another third pixel separated from the first pixel and having a center at a fourth vertex neighboring the third vertex of the virtual square, wherein ~~the third pixel comprises a pair of third pixels, and~~ the third pixels are separated from each other by the first pixel.

4. (Original) The pixel arrangement structure of claim 3, wherein the second pixels and the third pixels enclose the first pixel in the virtual square.

5. (Currently amended) The pixel arrangement structure of claim 4, wherein the first pixel, the second pixels, and the third pixels have polygonal shapes, and



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each of the second pixels and each of the third pixels [[have]] has a larger area than the first pixel.

6. (Withdrawn) The pixel arrangement structure of claim 5, wherein

the first pixel has a quadrilateral shape, and

the second pixels and the third pixels have hexagonal or octagonal shapes.

7. (Withdrawn) The pixel arrangement structure of claim 6, wherein the second pixels and the third pixels have octagonal shapes.

8. (Withdrawn – Currently amended) The pixel arrangement structure of claim 7, wherein:

~~the second pixels and the third pixels have a same area, and~~

a distance between the first pixel and each of the second pixels, a distance between the first pixel and each of the third pixels, and a distance between each of the second pixels and each of the third pixels [[is]] are a same first length.

9. (Withdrawn – Currently amended) The pixel arrangement structure of claim 8, wherein

the first pixel comprises a plurality of first pixels,

the plurality of first pixels have a same quadrilateral shape, and

a distance between neighboring [[ones]] pixels of the plurality of first pixels is a second length that is longer than the first length.

10. (Withdrawn – Currently amended) The pixel arrangement structure of claim 6, wherein

each of the second pixels [[have]] has a larger area than each of the third pixels,

a distance between each of the second pixels and each of the third pixels is a same first length, and



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a distance between the first pixel and each of the second pixels, and a distance between the first pixel and each of the third pixels [[is]] are a same second length.

11. (Withdrawn – Currently amended) The pixel arrangement structure of claim 10, wherein

the first pixel comprises a plurality of first pixels,

the plurality of first pixels have a same quadrilateral shape, and

a distance between neighboring [[ones]] pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

12. (Withdrawn – Currently amended) The pixel arrangement structure of claim 10, wherein

the first pixel comprises a plurality of first pixels,

neighboring [[ones]] pixels of the plurality of first pixels have quadrilateral shapes that are symmetrical to each other, and

a distance between the neighboring [[ones]] pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

13. (Withdrawn – Currently amended) The pixel arrangement structure of claim 6, wherein

the first pixel comprises a plurality of first pixels, and

neighboring [[ones]] pixels of the plurality of first pixels have quadrilateral shapes that are symmetrical to each other.

14. (Withdrawn – Currently amended) The pixel arrangement structure of claim 13, wherein each of the second pixels [[have]] has a larger area than each of the third pixels.

15. (Canceled)



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16. (Currently amended) The pixel arrangement structure of claim 5, wherein

the first pixel has [[a]] an octagonal shape, and

the second pixels and the third pixels have quadrilateral shapes.

17. (Currently amended) The pixel arrangement structure of claim 16, wherein

each of the second pixels [[have]] has a larger area than each of the third pixels,

a distance between each of the second pixels and each of the third pixels is a same first length, and

a distance between the first pixel and each of the second pixels, and a distance between the first pixel and each of the third pixels [[is]] are a same second length.

18. (Currently amended) The pixel arrangement structure of claim 17, wherein

the first pixel comprises a plurality of first pixels,

neighboring [[ones]] pixels of the plurality of first pixels have octagonal shapes that are symmetrical to each other, and

a distance between the neighboring [[ones]] pixels of the plurality of first pixels is a third length that is longer than the first length and the second length.

19. (Original) The pixel arrangement structure of claim 1, wherein the first pixel, the second pixel, and the third pixel are configured to emit different color lights.

20. (Original) The pixel arrangement structure of claim 19, wherein the first pixel, the second pixel, and the third pixel are configured to emit green light, blue light, and red light, respectively.



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## REMARKS/ARGUMENTS

Claims 1–14 and 16–20 are pending in the present application, of which claim 1 is independent. Claim 15 is canceled herein without prejudice. Claims 6–14 were previously withdrawn. Claims 17–18 are allowable. Claims 1 and 5 are amended herein and find support in at least FIG. 5 of the application as filed. Each of claims 8–14 and 16–18 is amended herein to correct informalities identified on pages 2–3 of the Office action or to keep the claim compatible with amended claim 1. Claims 2–3 and 17 are amended herein to address indefinite concerns identified on page 3 of the Office action. The Applicant respectfully requests continued allowability of claims 17–18, reconsideration and allowance of claims 1–5, 16, and 19–20, and upon allowance of claim 1, rejoinder and allowance of withdrawn claims 6-14, which depend from claim 1.

---

**Priority of claims directed to FIG. 5**

According to page 3 of the Office action, "since the certified copies of papers do not include Fig. 5 of an instant application, the claims directed to Fig. 5 of the instant application do not obtain a foreign priority filing date." The Applicant respectfully disagrees with this conclusion and directs attention to MPEP § 216 [Entitlement to Priority], which recites "The subject matter of the [foreign priority] application is not examined to determine whether the applicant is actually entitled to the benefit of the foreign filing date on the basis of the disclosure thereof." Accordingly, the Applicant requests that this conclusion be withdrawn and that any challenge of the entitlement to priority of the present claims be done in accordance with MPEP § 216.

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**Rejection of claims 2–5 and 16–18 under 35 U.S.C. § 112 ¶ 2**

According to page 3 of the Office action, "Claims 2-5 and 16-18 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint



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inventor, or for pre-AIA the applicant regards as the invention." The Applicant amends claims 2–3 and 17, and respectfully submits that claims 2–3 and 17 (and all claims that depend from claims 2–3 and 17, including claims 4–14, 16, and 18), particularly point out and distinctly claim subject matter that the Applicant regards as embodiments of the present invention. Accordingly, the Applicant requests that the § 112 ¶ 2 rejection of claims 2–5 and 16–18 be withdrawn.

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**Rejection of claims 1–5 and 19 under 35 U.S.C. § 102(a) by Smith**

According to page 4 of the Office action, "Claims 1-5 and 19 are rejected under pre-AIA 35 U.S.C. 102(a) as being anticipated by Smith (U.S. Pub. No. US 2009/03302331 A1)." The Applicant amends claim 1 and respectfully argues as follows.

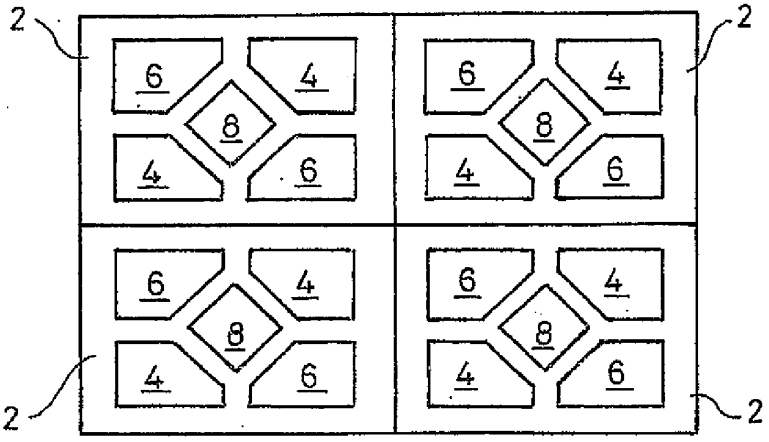
Independent claim 1 now recites:

> 1. A pixel arrangement structure of an organic light emitting diode display, comprising:
> a first pixel having a center coinciding with a center of a virtual square;
> a second pixel separated from the first pixel and having a center at a first vertex of the virtual square; and
> a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square,
> wherein the second pixel has a larger area than the third pixel. (Emphasis added.)

Smith does not disclose at least the claim 1 limitation, "wherein the second pixel has a larger area than the third pixel." By way of example, Smith does not disclose this limitation of claim 1 in FIG. 2 (reproduced below and cited on page 4 of the Office action).



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Smith

*Fig. 2*

In rejecting the previous claim 1, page 4 of the Office action equates a central portion of pixel 2, blue sub-pixel 8, green sub-pixel 6, and red sub-pixel 4 of Smith FIG. 2 with "a virtual square," "a first pixel," "a second pixel," and "a third pixel," respectively, as recited in claim 1. However, the green sub-pixel 6 of Smith FIG. 2 (the equated "second pixel" of claim 1) does not "ha[ve] a larger area than the" red sub-pixel 4 ("third pixel"), which is different from claim 1 as now amended. For at least these reasons, Smith does not disclose the claim 1 limitation, "wherein the second pixel has a larger area than the third pixel."

To establish a prima facie case of anticipation, the cited reference must disclose every limitation of the rejected claim. Since Smith does not disclose at least one limitation of claim 1, Smith does not anticipate claim 1. Furthermore, claims 2–5 and 19 depend from claim 1, such that they incorporate all of the terms and limitations of claim 1 in addition to other limitations, which together further patentably distinguish these claims over the art of record. Accordingly, the Applicant respectfully requests that the § 102(a) rejection of claims 1–5 and 19 be withdrawn and that these claims be allowed.

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**Rejection of claim 16 under 35 U.S.C. §103(a) over Smith/Ko**

According to page 6 of the Office action, "Claim 16 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Smith in view of Ko (U.S Patent No. US 8,350,468 B2)." The Applicant respectfully argues as follows.

Claim 1 is patentably distinguishable over Smith for at least the reasons discussed above. Further, the addition of Ko does not cure the above deficiency of Smith to support a § 103(a) rejection of claim 1. According to page 6 of the Office action, "Ko (Fig. 2B) teaches the first pixel has a octagonal shape." However, Ko, like Smith, appears to be silent regarding the claim 1 limitation, "wherein the second pixel has a larger area than the third pixel," and there is no apparent reason why one of ordinary skill in the art at the time of the present invention would have combined Smith and Ko to arrive at the claimed embodiment of claim 1. Accordingly, claim 1 is patentably distinguishable over Smith and Ko.

Claim 16 depends from claim 1, such that it incorporate all of the terms and limitations of claim 1 in addition to other limitations, which together further patentably distinguish this claim over the art of record. Accordingly, the Applicant respectfully requests that the § 103(a) rejection of claim 16 be withdrawn and that this claim be allowed.

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**Rejection of Claim 20 under pre-AIA 35 U.S.C. 103(a) by Smith/Kim**

According to page 7 of the Office action, "Claim 20 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Smith in view of Kim (U.S Pub. No. US 2011/0012820 A1)." The Applicant respectfully argues as follows.

Claim 1 is patentably distinguishable over Smith as discussed above. Further, the addition of Kim does not cure the above deficiency of Smith to support a § 103(a) rejection of claim 1. According to page 7 of the Office action, "Kim (Figs. 1, 2 and 4) teaches wherein the first pixel and the second pixel are configured to emit green light and blue light, respectively" However, Kim, like Smith, appears to be silent regarding the claim 1 limitation, "wherein the second pixel has a larger area than the third pixel," and there is no apparent reason why one of ordinary skill in the art at the time of the present invention would have combined Smith and Kim



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to arrive at the claimed embodiment of claim 1. Accordingly, claim 1 is patentably distinguishable over Smith and Kim.

Claim 20 depends from claim 1, such that it incorporate all of the terms and limitations of claim 1 in addition to other limitations, which together further patentably distinguish this claim over the art of record. Accordingly, the Applicant respectfully requests that the § 103(a) rejection of claim 20 be withdrawn and that this claim be allowed.

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**Concluding remarks**

In view of the foregoing amendments and remarks, the Applicant earnestly solicits a timely issuance of a Notice of Allowance for claims 1–14 and 16–20. If there are any remaining issues that can be addressed over the telephone, the Examiner is cordially invited to call the Applicant's attorney at the number listed below.

Respectfully submitted,
CHRISTIE, PARKER & HALE, LLP

By Bruce A. Wagar
Bruce A. Wagar, Ph.D.
Reg. No. 72,186
626/795-9900

BAW/cmj

MAC PAS1328905.3-*-02/2/15 5:12 PM



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BOE et al. v. Samsung, IPR2023-00988

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 21378114 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Bruce A. Wagar/Marti Carrillo |
| **Filer Authorized By:** | Bruce A. Wagar |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 02-FEB-2015 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 21:15:46 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Transmittal Letter | 69657_Transmittal.PDF | 34898<br>c2aea8c4650dc88c6902e8cf49242eb0aca65389 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 2 | | 69657_Amendment.PDF | 261314<br>3897da425353d030ddd113afd6cade62c198c990 | yes | 10 |

| Multipart Description/PDF files in .zip description | | |
|---|---|---|
| **Document Description** | **Start** | **End** |
| Amendment/Req. Reconsideration-After Non-Final Reject | 1 | 1 |
| Claims | 2 | 5 |
| Applicant Arguments/Remarks Made in an Amendment | 6 | 10 |

| | |
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| **Warnings:** | |
| **Information:** | |
| **Total Files Size (in bytes):** | 296212 |

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**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

# IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
# AMENDMENT TRANSMITTAL LETTER

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on February 2, 2015 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Marti Carrillo

Inventor : Sang-Shin Lee — Confirmation No. 4264
Application No. : 13/614,197
Filed : September 13, 2012
Title : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

Grp./Div. : 2691
Examiner : Kwang-Su Yang

Docket No. : 69657/S1437

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
February 2, 2015

Commissioner:

Enclosed is an amendment to the above-identified application.

| CLAIMS AS AMENDED | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Claims Remaining After Amendment | Highest Number Previously Paid For | Number Extra Claims | Large Entity Rate | Small Entity Rate | Micro Entity Rate | FEE |
| Total Claims | 19 - | * 20 | = 0 | 0 x $80.00 | $40.00 | $20.00 | $0.00 |
| Independent Claims | 1 - | ** 3 | = 0 | 0 x $420.00 | $210.00 | $105.00 | $0.00 |
| Multiple Dependent Claims*** | | | | $780.00 | $390.00 | $195.00 | $0.00 |
| | | | | | | Total Additional Fee | $0.00 |
| List Independent Claims: 1 | | | | | | | |
| * If the "Highest Number of Total Claims Previously Paid For" is less than 20, enter "20" in this space<br>** If the "Highest Number of Independent Claims Previously Paid For" is less than 3, enter "3" in this space<br>*** Pay this fee only when "Multiple Dependent Claims" are added for the first time | | | | | | | |

__X__ No additional fee is required.

_____ A Petition for Extension of Time and the required fee are enclosed.

_____ Other enclosures: _____



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The Commissioner is hereby authorized to charge any fees under 37 CFR 1.16 and 1.17 which may be required by or to give effect to this paper to Deposit Account No. 03-1728. Please show our docket number with any charge or credit to our Deposit Account.

Respectfully submitted,

CHRISTIE, PARKER & HALE, LLP

By Bruce A. Wagar

Bruce A. Wagar, Ph.D.
Reg. No. 72,186
626/795-9900

BAW/mac

MAC PAS1339549.1-*-02/2/15 5:20 PM



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BOE et al. v. Samsung, IPR2023-00988

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

| PATENT APPLICATION FEE DETERMINATION RECORD<br>Substitute for Form PTO-875 | Application or Docket Number<br>13/614,197 | Filing Date<br>09/13/2012 | ☐ To be Mailed |
|---|---|---|---|

**ENTITY**: ☒ LARGE ☐ SMALL ☐ MICRO

## APPLICATION AS FILED – PART I

| FOR | (Column 1) NUMBER FILED | (Column 2) NUMBER EXTRA | RATE ($) | FEE ($) |
|---|---|---|---|---|
| ☐ BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | |
| ☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | |
| ☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | minus 20 = | * | X $ = | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | minus 3 = | * | X $ = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | |

## APPLICATION AS AMENDED – PART II

AMENDMENT **02/02/2015**

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * 19 | Minus | ** 20 | = 0 | X $80 = | 0 |
| Independent (37 CFR 1.16(h)) | * 1 | Minus | ***3 | = 0 | X $420 = | 0 |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | TOTAL ADD'L FEE | 0 |

AMENDMENT

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * | Minus | ** | = | X $ = | |
| Independent (37 CFR 1.16(h)) | * | Minus | *** | = | X $ = | |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/THERESA LINDSAY/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

| FORM PTO/SB/08A/B (10-01)<br>Substitute for PTO-1449A/B<br><br>**INFORMATION DISCLOSURE**<br><br>**STATEMENT BY APPLICANT**<br><br>(use as many sheets as necessary) | **Attorney Docket Number** | 69657/S1437 |
|---|---|---|
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang -Su Yang |

| U.S. PATENT DOCUMENTS | | | | |
|---|---|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER<br>Number - Kind Code[2] (If Known) | PUBLICATION DATE<br>MM-DD-YYYY | NAME OF PATENTEE |
| | | 2012/0086330 A1 | 04-12-2012 | Umeda et al. |
| | | 2013/0037827 A1 | 02-14-2013 | Levermore et al. |
| | | | | |
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| FOREIGN PATENT DOCUMENTS | | | | | |
|---|---|---|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document<br>Country Code[3] - Number[4] - Kind Code[5]<br>(If Known) | Publication Date<br>MM-DD-YYYY | Name of Patentee or<br>Applicant of Cited Document | T[6]<br>(✓) |
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| OTHER DOCUMENTS | | |
|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
| | | U.S. Office action dated August 29, 2014, for cross reference U.S. Patent application 14/059,356, (18 pages) |
| | | |
| | | |
| | | |

DLG PAS1327990.1-*-11/18/14 10:20 AM

| EXAMINER SIGNATURE | | DATE CONSIDERED | |
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EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

JEJ/dg



Petitioner Ex 1015, p. 593
BOE et al. v. Samsung, IPR2023-00988

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 13614197 |
| **Filing Date:** | 13-Sep-2012 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Filer:** | Jun-Youg E. Jeon/Diane Goss |
| **Attorney Docket Number:** | 69657/S1437 |

Filed as Large Entity

## Utility under 35 USC 111(a) Filing Fees

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| Submission- Information Disclosure Stmt | 1806 | 1 | 180 | 180 |
| | | **Total in USD ($)** | | **180** |

# Electronic Acknowledgement Receipt

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|---|---|
| **EFS ID:** | 20732953 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Youg E. Jeon/Diane Goss |
| **Filer Authorized By:** | Jun-Youg E. Jeon |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 18-NOV-2014 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 17:09:13 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

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|---|---|
| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | $180 |
| RAM confirmation Number | 3757 |
| Deposit Account | |
| Authorized User | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
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| | **Document Description** | | **Start** | **End** | |
| | Transmittal Letter | | 1 | 2 | |
| | Information Disclosure Statement (IDS) Form (SB08) | | 3 | 3 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Non Patent Literature | USOA9356-29AUG2014.pdf | 792911<br>981d3967a86b2dd2d6d725dca67c987cdfb4ba2f | no | 18 |
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| **Information:** | | | | | |
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| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 931149 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on November 18, 2014 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Diane L. Goss

| | | |
|---|---|---|
| Inventor | : Sang-Shin Lee | Confirmation No. 4264 |
| Application No. | : 13/614,197 | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| Grp./Div. | : 2691 | |
| Examiner | : Kwang-Su Yang | |
| Docket No. | : 69657/S1437 | |

**INFORMATION DISCLOSURE STATEMENT WITH FEE UNDER 37 CFR §§ 1.97(c) AND 1.17(p)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
November 18, 2014

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is FORM PTO/SB/08A/B listing the references that are known to applicant. Copies of each of the listed Foreign Patent Documents and Other Documents references are enclosed.

It is respectfully requested that the listed references be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of FORM PTO/SB/08A/B be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

The processing fee of $180.00 as required by 37 CFR § 1.17(p) is submitted herewith. The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
CHRISTIE, PARKER & HALE, LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/dg
Enclosures: Form PTO/SB/08A/B, w/references

DLG PAS1327997.1-*-11/18/14 10:23 AM



Petitioner Ex 1015, p. 599
BOE et al. v. Samsung, IPR2023-00988

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

23363 7590 11/07/2014

CHRISTIE, PARKER & HALE, LLP
PO BOX 29001
Glendale, CA 91209-9001

| EXAMINER | |
|---|---|
| YANG, KWANG-SU | |
| ART UNIT | PAPER NUMBER |
| 2691 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 11/07/2014 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pto@cph.com
pair_cph@firsttofile.com



Petitioner Ex 1015, p. 600
BOE et al. v. Samsung, IPR2023-00988

| Office Action Summary | Application No. 13/614,197 | Applicant(s) LEE, SANG-SHIN | |
|---|---|---|---|
| | Examiner KWANG-SU YANG | Art Unit 2691 | AIA (First Inventor to File) Status No |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *10/16/2014*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims***

5)☒ Claim(s) *1-20* is/are pending in the application.

5a) Of the above claim(s) *6-15* is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-5,16,19 and 20* is/are rejected.

8)☒ Claim(s) *17 and 18* is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

**Application Papers**

10)☒ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *09/13/2012* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a)☐ All b)☒ Some** c)☐ None of the:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.



**Petitioner Ex 1015, p. 601**
**BOE et al. v. Samsung, IPR2023-00988**

**DETAILED ACTION**

1. The present application is being examined under the pre-AIA first to invent provisions.

***Election/Restrictions***

2. Applicant's election with traverse of Species E (Fig. 5) in the supplemental response filed on 10/16/2014 is acknowledged. The traversal is on the grounds that, although the five species are patentably distinct species, the differences between the five species do not appear to unduly burden the Examiner to search for embodiments of these five species. This is not found persuasive because the application contains a number of species, i.e., five species, that would require new separate searches, which places an undue burden on the Examiner. The Examiner considers that the claims 1-5 and 19-20 are generic. The requirement is still deemed proper and is therefore made FINAL.

***Priority***

3. Receipt is acknowledged of certified copies of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file. However, since the certified copies of papers do not include Fig. 5 of an instant application, the claims directed to Fig. 5 of the instant application do not obtain a foreign priority filing date.

***Claim Objections***

4. Claims 16-18 are objected to because of the following informalities:

- In line 2 of claim 16: "… a octagonal shape..." should be changed to --... an octagonal shape ...--.
- In line 5 of claim 17: "… is ..." should be changed to --... are ...--.
- In line 3 and line 5 of claim 18: "… neighboring ones ..." should be changed to --... neighboring pixels ...--.

### *Claim Rejections - 35 USC § 112*

5. The following is a quotation of 35 U.S.C. 112(b):

> (b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 2-5 and 16-18 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

- In claim 2, the limitations "the second pixel" and "a pair of second pixels" are indefinite since second pixel and second pixel(s) are not differentiated explicitly.
- In claim 3: the limitations "the third pixel" and "a pair of third pixels" are indefinite since third pixel and third pixel(s) are not differentiated explicitly.

### *Claim Rejections - 35 USC § 102*

7. The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

8. Claims 1-5 and 19 are rejected under pre-AIA 35 U.S.C. 102(a) as being anticipated by Smith (U.S. Pub. No. US 2009/03302331 A1).

**As to claim 1,** Smith (Fig. 2) teaches **a pixel arrangement structure** (sub-pixel arrangement; Fig. 2) **of an organic light emitting diode display** (a light-emissive display; [0005], lines 1-3)**, comprising:**

- **a first pixel** (a central blue sub-pixel 8) **having a center coinciding with a center of a virtual square** (a virtual square is formed by using different weights of the four vertices for respective green sub-pixel 6 and respective red sub-pixel 4 so that a center of the central blue sub-pixel can coincide with the center of the virtual square; Fig. 2)**;**
- **a second pixel** (a green sub-pixel 6) **separated from the first pixel (**the blue sub-pixel 8) **and having a center at a first vertex of the virtual square** (the weighted center of the green sub-pixel 6 at the first vertex of the virtual square; Fig. 2)**; and**
- **a third pixel** (a red sub-pixel 4) **separated from the first pixel** (the blue sub-pixel 8) **and the second pixel** (the green sub-pixel 6) (Fig. 2)**, and having a center at a second vertex neighboring the first vertex of the virtual square** (a center of the red sub-pixel 4 at the second vertex neighboring the first vertex of the virtual square; Fig. 2)**.**

**As to claim 2,** Smith teaches **the pixel arrangement structure of claim 1, where**

- **the second pixel comprises a pair of second pixels** (a pair of the green sub-pixels 6) (Fig. 2)**, and**
- **the second pixels** (the pair of the green sub-pixels 6) **are separated from each other by the first pixel** (the central blue sub-pixel 8) (Fig. 2)**.**

**As to claim 3,** Smith teaches **the pixel arrangement structure of claim 2, where**

- **the third pixel comprises a pair of third pixels** (a pair of the red sub-pixel 4) (Fig. 2)**, and**
- **the third pixels** (the pair of the red sub-pixels 4) **are separated from each other by the first pixel** (the central blue sub-pixel 8) (Fig. 2)**.**

**As to claim 4,** Smith teaches **the pixel arrangement structure of claim 3,**

- **wherein the second pixels** (the pair of the green sub-pixels 6) **and the third pixels** (the pair of the red sub-pixels 4) **enclose the first pixel** (the central blue sub-pixel 8) **in the virtual square** (Fig. 2)**.**

**As to claim 5,** Smith teaches **the pixel arrangement structure of claim 4, wherein**

- **the first pixel, the second pixels, and the third pixels have polygonal shapes** (rhombus, quadrilateral, and quadrilateral; Fig. 2)**, and**
- **the second pixels** (the pair of the green sub-pixels 6) **and the third**

**pixels** (the pair of the red sub-pixels 4) **have a larger area than the first pixel** (the central blue sub-pixel 8) (Fig. 2)**.**

**As to claim 19,** Smith teaches **the pixel arrangement structure of claim 1,**

- **wherein the first pixel, the second pixel, and the third pixel are configured to emit different color lights** (blue, green, and red; Fig. 2)**.**

***Claim Rejections - 35 USC § 103***

9. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claim 16 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Smith in view of Ko (U.S Patent No. US 8,350,468 B2).

**As to claim 16,** Smith teaches **the pixel arrangement structure of claim 5, wherein**

- **the second pixels** (the pair of the green sub-pixels 6) **and the third pixels** (the pair of the red sub-pixels 4) **have quadrilateral shapes** (Fig. 2)**.**

Smith does not teach **the first pixel has a octagonal shape.**

Ko (Fig. 2B) teaches

- **the first pixel has a octagonal shape** (other shapes of pixels may be implemented, such as octagon-shaped pixels; col. 4, lines 40-42; Fig. 2B)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have replaced an octagon-shaped pixel as taught by Ko for a central pixel of Smith because the octagon-shaped pixel provides a user with a visually smoothing feature for a display device.

11. Claim 20 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Smith in view of Kim (U.S Pub. No. US 2011/0012820 A1).

**As to claim 20,** Smith teaches **the pixel arrangement structure of claim 19.**

Smith also teaches **wherein the third pixel is configured to emit red light** (the red sub-pixel 4; Fig. 2)**.**

Smith does not teach **wherein the first pixel and the second pixel are configured to emit green light and blue light, respectively.**

Kim (Figs. 1, 2 and 4) teaches

- **wherein the first pixel and the second pixel are configured to emit green light and blue light, respectively** (first sub-pixels G 12 and a second sub-pixels B 14; Figs. 1, 2 and 4)**.**

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have exchange blue pixels and green pixels as taught by Kim in a pixel arrangement of Smith because the exchange of pixels may be changed based on the factors, for example, the life of materials respectively utilized in each color sub-pixel for balancing the lives of sub-pixels.

***Allowable Subject Matter***

12, Claims 17-18 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), 2nd paragraph, set forth in this Office action.

As allowable subject matter has been indicated, applicant's reply must either comply with all formal requirements or specifically traverse each requirement not complied with. See 37 CFR 1.111(b) and MPEP § 707.07(a).

***Conclusion***

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Osada (U.S. Pub. No. US 2002/0113195 A1) is cited to teach an image signal processing method applicable to a digital camera, image inputting unit or similar image apparatus of the type interpolating pixel data in virtual pixels by using the pixel data of real pixels.
- Satou (U.S. Pub. No. US 2010/0171440 A1) is cited to teach an illuminating device comprising integrated luminance sources having a light-emitting element and a phosphor, emitting a composite light of primary lights from the luminescence sources.

***Inquiry***

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kwang-Su Yang whose telephone

number is 571-270-7307. The examiner can normally be reached on Mon-Fri during 9:00am-6:00pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chanh Nguyen can be reached on 571-272-7772. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/KWANG-SU YANG/
Primary Examiner, Art Unit 2691

| Notice of References Cited | Application/Control No. 13/614,197 | Applicant(s)/Patent Under Reexamination LEE, SANG-SHIN | |
|---|---|---|---|
| | Examiner KWANG-SU YANG | Art Unit 2691 | Page 1 of 1 |

**U.S. PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Name | Classification |
|---|---|---|---|---|---|
| * | A | US-2009/0302331 A1 | 12-2009 | Smith et al. | 257/88 |
| * | B | US-8,350,468 B2 | 01-2013 | Ko et al. | 313/506 |
| * | C | US-2011/0012820 A1 | 01-2011 | Kim et al. | 345/82 |
| * | D | US-2002/0113195 A1 | 08-2002 | Osada, Masaru | 250/208.1 |
| * | E | US-2010/0171440 A1 | 07-2010 | Satou et al. | 315/294 |
| | F | US- | | | |
| | G | US- | | | |
| | H | US- | | | |
| | I | US- | | | |
| | J | US- | | | |
| | K | US- | | | |
| | L | US- | | | |
| | M | US- | | | |

**FOREIGN PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Country | Name | Classification |
|---|---|---|---|---|---|---|
| | N | | | | | |
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| | T | | | | | |

**NON-PATENT DOCUMENTS**

| * | | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|---|---|
| | U | |
| | V | |
| | W | |
| | X | |

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.



**Petitioner Ex 1015, p. 610**
**BOE et al. v. Samsung, IPR2023-00988**

| FORM PTO/SB/08A/B (10-01)<br>Substitute for PTO-1449A/B<br><br>**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**<br><br>(use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 69657/S1437 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Amr A. Awad |

| U.S. PATENT DOCUMENTS | | | | |
|---|---|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER<br>Number - Kind Code[2] (If Known) | PUBLICATION DATE<br>MM-DD-YYYY | NAME OF PATENTEE |
| | | 2002/0015110 A1 | 02-07-2002 | Brown Elliott |
| | | 2002/0070909 A1 | 06-13-2002 | Asano et al. |
| | | 2004/0108818 A1 | 06-10-2004 | Cok et al. |
| | | 2005/0001542 A1 | 01-06-2005 | Kiguchi |

| FOREIGN PATENT DOCUMENTS | | | | | |
|---|---|---|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document<br>Country Code[3] - Number[4] - Kind Code[5]<br>(If Known) | Publication Date<br>MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6]<br>(✓) |
| | | GB 2 437 110 A | 10-17-2007 | Smith et al. | Patent Abstracts of Japan |
| | | JP 2000-235891 | 08-29-2000 | Fujimori et al. | Patent Abstracts of Japan |
| | | JP 2006-309182 | 11-09-2006 | Koyama et al. | Patent Abstracts of Japan |
| | | JP 2008-015521 | 01-24-2008 | Chao et al. | Patent Abstracts of Japan |

| OTHER DOCUMENTS | | |
|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
| | | EPO Search Report dated July 8, 2013, for corresponding European Patent application 13157562.3, (6 pages) |
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| EXAMINER SIGNATURE | /Kwang-Su Yang/ | DATE CONSIDERED | 10/24/2014 |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KY/

Sheet 1 of 1

| FORM PTO/SB/08A/B (10-01)<br>Substitute for PTO-1449A/B<br><br>**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**<br><br>(use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 69657/P849 |
| | **Application Number** | To Be Determined |
| | **Filing Date** | September 12, 2012 |
| | **Applicant(s)** | Sang-Shin Lee |
| | **Group Art Unit** | To Be Determined |
| | **Examiner Name** | To Be Determined |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
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**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
| | | KR 10-0807524 | 02-26-2008 | Choo et al. | Korean Patent Abstracts |
| | | KR 10-2009-0017910 | 02-19-2009 | Park et al. | Korean Patent Abstracts |
| | | KR 10-2011-0023996 | 03-09-2011 | Kim et al. | Korean Patent Abstracts |
| | | KR 10-2011-0106565 | 09-29-2011 | Kim et al. | Korean Patent Abstracts |
| | | | | | |

**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | Korean Patent Abstracts, Publication Number 1020030031207A, dated April 21, 2003 for corresponding Korean Patent 10-0807524 listed above. |
| | | |
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SMM PAS1193589.1-*-09/12/12 10:53 AM

| EXAMINER SIGNATURE | /Kwang-Su Yang/ | DATE CONSIDERED | 10/24/2014 |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KY/

Sheet 1 of 1

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | Examiner | Art Unit |
| | KWANG-SU YANG | 2691 |

| CPC- SEARCHED | | |
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| Symbol | Date | Examiner |
| | | |

| CPC COMBINATION SETS - SEARCHED | | |
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| Symbol | Date | Examiner |
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| US CLASSIFICATION SEARCHED | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
| 345 | 82 419 | 10/24/2014 | KY |

| SEARCH NOTES | | |
|---|---|---|
| Search Notes | Date | Examiner |
| EAST: Inventor Search | 10/24/2014 | KY |
| EAST: Text Search | 10/24/2014; 10/27/2014 | KY |

| INTERFERENCE SEARCH | | | |
|---|---|---|---|
| US Class/ CPC Symbol | US Subclass / CPC Group | Date | Examiner |
| | | | |

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| | /KWANG-SU YANG/<br>Primary Examiner.Art Unit 2691 |

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13614197 | LEE, SANG-SHIN |
| | Examiner | Art Unit |
| | KWANG-SU YANG | 2691 |

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|---|---|---|---|---|---|---|---|
| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 10/27/2014 | | | | | | | | |
| | 1 | ✓ | | | | | | | | |
| | 2 | ✓ | | | | | | | | |
| | 3 | ✓ | | | | | | | | |
| | 4 | ✓ | | | | | | | | |
| | 5 | ✓ | | | | | | | | |
| | 6 | N | | | | | | | | |
| | 7 | N | | | | | | | | |
| | 8 | N | | | | | | | | |
| | 9 | N | | | | | | | | |
| | 10 | N | | | | | | | | |
| | 11 | N | | | | | | | | |
| | 12 | N | | | | | | | | |
| | 13 | N | | | | | | | | |
| | 14 | N | | | | | | | | |
| | 15 | N | | | | | | | | |
| | 16 | ✓ | | | | | | | | |
| | 17 | O | | | | | | | | |
| | 18 | O | | | | | | | | |
| | 19 | ✓ | | | | | | | | |
| | 20 | ✓ | | | | | | | | |



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**EAST Search History**

**EAST Search History (Prior Art)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| S1 | 22 | ("20130234917" "20120313844" "20080001525" "8350468" "20020015110" "20020070909" "20040108818" "20050001542").pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/24 17:11 |
| S2 | 470186 | sang-shin.in. near lee.in. samsung.as. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/24 19:50 |
| S3 | 0 | S2 and ((OLED organic) with (pixel sub$1pixel) with (vertex corner) with square).clm. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/24 19:54 |
| S4 | 125 | sang-shin.in. near lee.in. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/24 19:55 |
| S5 | 4 | S4 and (OLED organic) same (pixel sub$1pixel) same (vertex corner) same square | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/24 19:55 |
| S6 | 170867 | organic adj light adj emitting OLED OELD | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/24 20:03 |
| S7 | 40776 | (pixel sub$1pixel) near3 (arrangement layout) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/24 20:09 |
| S8 | 3802 | (center central) same (vertex node) | US-PGPUB; | OR | ON | 2014/10/24 |



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|---|---|---|---|---|---|---|
| | | same square | USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | 20:10 |
| S9 | 17 | S6 and S7 and S8 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/24 20:10 |
| S10 | 4693 | S6 and S7 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/24 20:12 |
| S11 | 55 | S7 and S8 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/24 20:13 |
| S12 | 22 | S6 and S8 and (pixel sub$1pixel) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/24 20:17 |
| S13 | 449 | S6 and (pixel sub$1pixel) and honeycomb | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/24 20:20 |
| S14 | 59 | S6 and (pixel sub$1pixel) same honeycomb | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/24 20:20 |
| S15 | 138 | S6 and (pixel sub$1pixel) same hexagon$2 with (arrangement structure) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/24 20:28 |
| S16 | 8 | ("2008/0001525").URPN. | USPAT | OR | ON | 2014/10/24 20:41 |
| S19 | 25 | ("20020070909" \| "20020140831" \| "20020140833" \| "20040239837" \| "20060061531" \| "20070229422" \| "20080001525" \| "5006840" \| "5192945" | US-PGPUB; USPAT; USOCR | OR | ON | 2014/10/24 20:47 |



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BOE et al. v. Samsung, IPR2023-00988

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|---|---|---|---|---|---|---|
| | | \| "5485293" \| "5767837" \| "6008868" \| "6243055" \| "6326981" \| "6327008" \| "6486923" \| "7471274" \| "7522132" \| "7570255" \| "7595782" \| "7737931" \| "7787001" \| "7880698" \| "8026669" \| "8063852").PN. OR ("8477160").URPN. | | | | |
| S20 | 38 | ("20020000576" \| "20020021293" \| "20020118150" \| "20030062524" \| "20030094612" \| "20030117348" \| "20030132896" \| "20040100427" \| "20040113922" \| "20040183758" \| "20040217694" \| "20040263499" \| "20050024305" \| "20050052365" \| "20050068271" \| "20050083271" \| "20050093791" \| "20050190126" \| "20060038752" \| "20060076550" \| "5822026" \| "5952789" \| "6404410" \| "6421033" \| "6583775" \| "6618031" \| "6768482" \| "6771028" \| "6933756" \| "7336251" \| "7535447").PN. OR ("7880698").URPN. | US-PGPUB; USPAT; USOCR | OR | ON | 2014/10/24 20:51 |
| S21 | 1 | "20120019529".pn. | US-PGPUB; USPAT; USOCR | OR | ON | 2014/10/24 21:02 |
| S22 | 12100 | 345/82,419.ccls. | US-PGPUB; USPAT; USOCR | OR | ON | 2014/10/24 21:04 |
| S23 | 261 | S22 and (hexagon$2 honeycomb) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/24 21:05 |
| S24 | 31 | S22 and (hexagon$2 honeycomb) and S6 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/24 21:05 |
| S25 | 3 | "11940593" | US-PGPUB; USPAT; USOCR | OR | ON | 2014/10/24 21:09 |
| S26 | 52 | ("20010024178" \| "20010041489" \| "20020000983" \| "20020047568" \| "20020105579" \| "20020154076" \| "20040047023" \| "20040164939" \| "20040174320" \| "20040207386" \| "20050162737" \| "20050169551" \| "20050248520" \| "20050248524" \| "20050276448" \| "20060066547" \| "20060109231" \| "20060158729" \| "20060164407" \| "20060167670" \| "20060176935" \| "20060238464" \| "20060262147" \| "20070109327" \| "20070126657" \| "20070230818" \| "20070257866" \| "5208689" \| "5225919" \| "5289174" \| "5359342" \| "5432461" \| "5504504" \| "5708451" \| "5982946" \| "6089739" \| "6111424" \| "6115092" \| "6154561" \| "6359662" \| "6618115" \| | US-PGPUB; USPAT; USOCR | OR | ON | 2014/10/24 21:10 |



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|---|---|---|---|---|---|---|
| | | "6704008" \| "6806870" \| "6891672" \| "6985127" \| "6985272" \| "7053976" \| "7061226" \| "7061533" \| "7295233").PN. OR ("8164598").URPN. | | | | |
| S27 | 1631 | red same green same blue same (hexagon$2 honeycomb) | US-PGPUB; USPAT; USOCR | OR | ON | 2014/10/24 21:15 |
| S28 | 39 | (pixel sub$1pixel) and red same green same blue same (hexagon$2 honeycomb) near arrangement | US-PGPUB; USPAT; USOCR | OR | ON | 2014/10/24 21:15 |
| S29 | 12 | ("20020118291" \| "4558365" \| "5306906" \| "5319451" \| "5485204" \| "5555464" \| "5581357" \| "5591660" \| "5686742" \| "5689283" \| "5894143" \| "6452634").PN. OR ("7236196").URPN. | US-PGPUB; USPAT; USOCR | OR | ON | 2014/10/24 21:24 |
| S30 | 2 | "20030117423".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/24 21:37 |
| S31 | 0 | (pixel sub$1pixel) and green with cent$3 same (hexagon$2 honeycomb) near arrangement | US-PGPUB; USPAT; USOCR | OR | ON | 2014/10/24 22:01 |
| S32 | 27 | (pixel sub$1pixel) and green with cent$3 same (hexagon$2 honeycomb) | US-PGPUB; USPAT; USOCR | OR | ON | 2014/10/24 22:01 |
| S33 | 154 | ("4686519" \| "4798448").PN. OR ("5161042").URPN. | US-PGPUB; USPAT; USOCR | OR | ON | 2014/10/24 22:11 |
| S34 | 2 | "20020113195".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/27 12:36 |
| S35 | 2 | "20030117423".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/27 13:33 |
| S36 | 11 | blue with (sub-pixel pixel) with octagon$2 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/27 15:37 |
| S37 | 12 | ("20020186309" \| "20050084150" \| "20070058050" \| "20070071362" \| "20080012953" \| "6392699" \| "6832009" \| "7071978" \| "7072508" \| "7194129").PN. OR ("8165394").URPN. | US-PGPUB; USPAT; USOCR | OR | ON | 2014/10/27 15:40 |
| S38 | 4 | ("20040196393" \| "5283451" \| "6541805").PN. OR ("7710484").URPN. | US-PGPUB; USPAT; USOCR | OR | ON | 2014/10/27 15:42 |



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BOE et al. v. Samsung, IPR2023-00988

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|---|---|---|---|---|---|---|
| S39 | 11 | ("5446493" \| "6388278").PN. OR ("6541805").URPN. | US-PGPUB; USPAT; USOCR | OR | ON | 2014/10/27 15:43 |
| S40 | 549 | (sub-pixel pixel) with octagon$2 | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/27 15:45 |
| S41 | 9 | (sub-pixel pixel) with octagon$2 same (OLED organic) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/27 15:46 |
| S42 | 186 | (sub-pixel pixel) with octagon$2 and (OLED organic) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/27 15:47 |
| S43 | 186 | S42 and (OLED organic) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/27 15:57 |
| S44 | 43 | S42 and OLED | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/27 15:58 |
| S45 | 88 | green with compensat$3 same (OLED organic adj light) | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/27 17:31 |
| S46 | 2 | "6882364".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/27 17:40 |
| S47 | 5 | "8421820".pn. | US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | OR | ON | 2014/10/27 17:51 |
| S48 | 5 | "8421820".pn. | US-PGPUB; | OR | ON | 2014/10/27 |



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BOE et al. v. Samsung, IPR2023-00988

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| | | | USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB | | | 17:51 |

**EAST Search History (Interference)**

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**C:\Users\kyang\Documents\EAST\Workspaces\13614197.wsp**



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BOE et al. v. Samsung, IPR2023-00988

| FORM PTO/SB/08A/B (10-01)<br>Substitute for PTO-1449A/B<br><br>**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**<br><br>(use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 69657/S1437 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

| U.S. PATENT DOCUMENTS | | | | |
|---|---|---|---|---|
| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER<br>Number - Kind Code[2] (If Known) | PUBLICATION DATE<br>MM-DD-YYYY | NAME OF PATENTEE |
| | | 2012/0313844 A1 | 12-13-2012 | Im et al. |
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| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document<br>Country Code[3] - Number[4] - Kind Code[5]<br>(If Known) | Publication Date<br>MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6]<br>(✓) |
| | | JP 2004-192813 | 07-08-2004 | Yamashita | Patent Abstracts of Japan |
| | | JP 2011-076760 | 04-14-2011 | Enkai et al. | Patent Abstracts of Japan |
| | | WO 2005/067352 A1 | 07-21-2005 | Chung et al. | |
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| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
| | | EPO Search Report dated July 9, 2014, for European Patent application 14155124.2, (8 pages) |
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| EXAMINER SIGNATURE | /Kwang-Su Yang/ | DATE CONSIDERED | 10/24/2014 |
|---|---|---|---|

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KY/



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BOE et al. v. Samsung, IPR2023-00988

| FORM PTO/SB/08A/B (10-01)<br>Substitute for PTO-1449A/B<br><br>**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**<br><br>(use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 69657/S1437 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER Number - Kind Code[2] (If Known) | PUBLICATION DATE MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
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| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
| | | KR 10-0742370 B1 | 07-24-2007 | Kang et al. | *Korean Patent Abstracts |
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**OTHER DOCUMENTS**

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|---|---|---|
| | | *Korean Patent Abstracts for Korean Publication 1020070055908 dated May 31, 2007, to Korean Patent 10-0742370 dated July 24, 2007, listed above. |
| | | EPO Search Report dated December 20, 2013 for European Patent application 13178648.5, (9 pages) |
| | | |
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DLG PAS1297076.1-*-05/9/14 11:51 AM

| EXAMINER SIGNATURE | /Kwang-Su Yang/ | DATE CONSIDERED | 10/24/2014 |
|---|---|---|---|

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Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KY/

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# BIB DATA SHEET

**CONFIRMATION NO. 4264**

| SERIAL NUMBER | FILING or 371(c) DATE<br>RULE | CLASS | GROUP ART UNIT | ATTORNEY DOCKET NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | 345 | 2691 | 69657/S1437 |

**APPLICANTS**

**INVENTORS**
Sang-Shin Lee, Yongin-si, KOREA, REPUBLIC OF;

**** CONTINUING DATA ***************************

**** FOREIGN APPLICATIONS ***************************
REPUBLIC OF KOREA 10-2012-0022967 03/06/2012

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****
09/25/2012

| Foreign Priority claimed ☑ Yes ☐ No<br>35 USC 119(a-d) conditions met ☐ Yes ☑ No<br>Verified and Acknowledged /KWANG-SU YANG/ Examiner's Signature | ☐ Met after Allowance<br>Initials | STATE OR COUNTRY | SHEETS DRAWINGS | TOTAL CLAIMS | INDEPENDENT CLAIMS |
|---|---|---|---|---|---|
| | | KOREA, REPUBLIC OF | 5 | 20 | 1 |

**ADDRESS**

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PO BOX 29001
Glendale, CA 91209-9001
UNITED STATES

**TITLE**

PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

| FILING FEE RECEIVED | | |
|---|---|---|
| 1250 | FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following: | ☐ All Fees<br>☐ 1.16 Fees (Filing)<br>☐ 1.17 Fees (Processing Ext. of time)<br>☐ 1.18 Fees (Issue)<br>☐ Other _____<br>☐ Credit |

| FORM PTO/SB/08A/B (10-01)<br>Substitute for PTO-1449A/B<br><br>**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**<br><br>(use as many sheets as necessary) | | |
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| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2696 |
| | **Examiner Name** | Bipin H. Shalwala |

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|---|---|---|---|---|---|
| | | KR 10-2012-0022967 | 03-12-2012 | Nakano et al. | Korean Patent Abstracts |
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**OTHER DOCUMENTS**

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| EXAMINER SIGNATURE | /Kwang-Su Yang/ | DATE CONSIDERED | 10/24/2014 |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

JEJ/dg

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KY/

Sheet 1 of 6

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on October 16, 2014 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Christina M. Jauregui

Inventor : Sang-Shin Lee
Application No. : 13/614,197
Filed : September 13, 2012
Title : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

Confirmation No. 4264

Grp./Div. : 2691
Examiner : YANG, KWANG-SU

Docket No. : 69657/S1437

**SUPPLEMENTAL RESPONSE TO RESTRICTION REQUIREMENT**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
October 16, 2014

Commissioner:

In response to the Restriction Requirement of August 18, 2014 (hereinafter "the Restriction Requirement") and the Applicant's election of October 15, 2014 (hereinafter "the Election"), please consider the following:

**Remarks/Arguments** begin on page 2 of this paper.



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BOE et al. v. Samsung, IPR2023-00988

## REMARKS/ARGUMENTS

The Applicant thanks the Examiner for his time, courtesy, and guidance during the October 16, 2014 telephone interview (hereinafter "the Interview") with the Applicant's representative. During the Interview, the Applicant's representative explained that the Applicant has changed their mind and would like to now elect Species E with traverse (instead of Species A with traverse, as submitted in the Election). The Examiner agreed to the request, and asked the Applicant to submit a supplemental election to this effect as soon as possible.

Accordingly, the Applicant would like to withdraw the Election made October 15, 2014 and instead provisionally elect Species E (FIG. 5) with traverse, including claims 1–5 and 16–20. Further, the Applicant does not believe it would be unduly burdensome for the Examiner to also search for embodiments of Species A, B, C, and D (FIGs. 1–4), further including claims 6–15.

For example, comparing FIGs. 1–5, it does not appear that the differences between the pixel arrangements (namely, the different polygon arrangements of the first, second, and third pixels 100, 200, and 300, such as the octagons for the first pixels 100 and the quadrilaterals for the second and third pixels 200 and 300 in FIG. 5 versus the quadrilaterals for the first pixels 100 and the octagons for the second and third pixels 200 and 300 in FIGs. 1–2) would unduly burden the Examiner to search for embodiments of all five Species.

The traversal of the Restriction Requirement and the remarks regarding the traversal are being submitted without prejudice. Neither the traversal of the Restriction Requirement, nor the remarks regarding the traversal shall be interpreted as disputing the Examiner's finding that inventive species are patentably distinct. Nevertheless, patentably distinct species notwithstanding, the differences between the five species do not appear to unduly burden the Examiner to search for embodiments of these five species.

Additionally, the Applicant expects the Examiner to use a consistent test with respect to what matters are obvious and what matters are unobvious throughout the prosecution of this application. Because the Examiner is adopting a particular standard for patentability in this case, in terms of the Restriction Requirement, the Applicant will expect that the same test be used



Petitioner Ex 1015, p. 626
BOE et al. v. Samsung, IPR2023-00988

throughout the prosecution of this application if the Examiner does not withdraw the Restriction Requirement.

In summary, the Applicant hereby provisionally elects Species E (FIG. 5) with traverse, including claims 1–5 and 16–20, for the reasons stated above. In addition, the Applicant reserves the right to file a divisional application with any claims that are withdrawn from the present application. If there are any remaining issues that can be addressed over the telephone, the Examiner is cordially invited to call the Applicant's attorney at the number listed below.

Respectfully submitted,
CHRISTIE, PARKER & HALE, LLP

By Bruce A. Wagar
Bruce A. Wagar, Ph.D.
Reg. No. 72,186
626/795-9900

BAW/cmj

CMJ PAS1323038.1-*-10/16/14 1:09 PM



Petitioner Ex 1015, p. 627
BOE et al. v. Samsung, IPR2023-00988

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 20438705 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Bruce A. Wagar/Christina Jauregui |
| **Filer Authorized By:** | Bruce A. Wagar |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 16-OCT-2014 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 17:38:54 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 69657_SupplementalResponse toRestrictionRequirement.pdf | 76523<br>1c5adfc8192d2aa7b74a31a80f1a1d605531764e | yes | 3 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Supplemental Response or Supplemental Amendment | 1 | 1 |
| | Applicant Arguments/Remarks Made in an Amendment | 2 | 3 |
| **Warnings:** | | | |
| **Information:** | | | |
| | **Total Files Size (in bytes):** | 76523 | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on October 15, 2014 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Marti Carrillo

| | | |
|---|---|---|
| Inventor | : Sang-Shin Lee | Confirmation No. 4264 |
| Application No. | : 13/614,197 | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| Grp./Div. | : 2691 | |
| Examiner | : YANG, KWANG-SU | |
| Docket No. | : 69657/S1437 | |

**RESPONSE TO RESTRICTION REQUIREMENT**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
October 15, 2014

Commissioner:

In response to the Restriction Requirement of August 18, 2014 (hereinafter "the Restriction Requirement"), the Applicant hereby provisionally elects Species A (FIG. 1) with traverse, including claims 1–9, 13, and 19–20. The Applicant does not believe it would be unduly burdensome for the Examiner to also search for embodiments of Species B, C, and D (FIGs. 2–4), further including claims 10–12 and 14–15 (and withdrawing only claims 16–18).

For example, comparing FIGs. 1–4, it does not appear that the only differences between the pixel arrangements (namely, the relative sizes and truncations of the second and third pixels 200 and 300, and their corresponding effects on the orientations and truncations of the first pixels 100) would unduly burden the Examiner to search for embodiments of these four Species.

The traversal of the Restriction Requirement and the remarks regarding the traversal are being submitted without prejudice. Neither the traversal of the Restriction Requirement, nor the remarks regarding the traversal shall be interpreted as disputing the Examiner's finding that



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inventive species are patentably distinct. Nevertheless, patentably distinct species notwithstanding, the differences between the four species do not appear to unduly burden the Examiner to search for embodiments of these four species.

Additionally, the Applicant expects the Examiner to use a consistent test with respect to what matters are obvious and what matters are unobvious throughout the prosecution of this application. Because the Examiner is adopting a particular standard for patentability in this case, in terms of the Restriction Requirement, the Applicant will expect that the same test be used throughout the prosecution of this application if the Examiner does not withdraw the Restriction Requirement.

In summary, the Applicant hereby provisionally elects Species A (FIG. 1) with traverse, including claims 1–9, 13, and 19–20, for the reasons stated above. In addition, the Applicant reserves the right to file a divisional application with any claims that are withdrawn from the present application. If there are any remaining issues that can be addressed over the telephone, the Examiner is cordially invited to call the Applicant's attorney at the number listed below.

Respectfully submitted,
CHRISTIE, PARKER & HALE, LLP

By Bruce A. Wagar
Bruce A. Wagar, Ph.D.
Reg. No. 72,186
626/795-9900

BAW/cmj

MAC PAS1322836.2-*-10/15/14 4:24 PM



Petitioner Ex 1015, p. 631
BOE et al. v. Samsung, IPR2023-00988

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 20428231 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Bruce A. Wagar/Marti Carrillo |
| **Filer Authorized By:** | Bruce A. Wagar |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 15-OCT-2014 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 19:54:01 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Response to Election / Restriction Filed | 69657_Response_RR.PDF | 54758<br>fe7c8db25c84e289562ea2b2649e332e2aff54ef | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |

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|---|---|
| **Total Files Size (in bytes):** | 54758 |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | Sang-Shin Lee | 69657/S1437 | 4264 |

23363 7590 08/18/2014
CHRISTIE, PARKER & HALE, LLP
PO BOX 29001
Glendale, CA 91209-9001

| EXAMINER | |
|---|---|
| YANG, KWANG-SU | |
| ART UNIT | PAPER NUMBER |
| 2691 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 08/18/2014 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pto@cph.com
pair_cph@firsttofile.com



Petitioner Ex 1015, p. 634
BOE et al. v. Samsung, IPR2023-00988

| Office Action Summary | Application No. 13/614,197 | Applicant(s) LEE, SANG-SHIN | |
|---|---|---|---|
| | Examiner KWANG-SU YANG | Art Unit 2691 | AIA (First Inventor to File) Status No |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 2 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *09/13/2012*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims***

5)☒ Claim(s) *1-20* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☐ Claim(s) _____ is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☒ Claim(s) *1-20* are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

**Application Papers**

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.



**Petitioner Ex 1015, p. 635**
**BOE et al. v. Samsung, IPR2023-00988**

## *DETAILED ACTION*

1. The present application is being examined under the pre-AIA first to invent provisions.

### *Election/Restrictions*

2. This application contains claims directed to the following patentably distinct species of the claimed invention:

A. Species of Fig. 1;

B. Species of Fig. 2;

C. Species of Fig. 3;

D. Species of Fig. 4; and

E. Species of Fig. 5.

The species are independent or distinct because claims to the different species recite the mutually exclusive characteristics of each species or grouping of species. Species A (Fig. 1) teaches a pixel arrangement structure of the OLED display in which there are a plurality of first pixels, a plurality of second pixels, and a plurality of third pixels, each of the first pixels having the same quadrilateral shape (e.g., a square or rhombus), the second pixels being arranged diagonally with respect to the first pixels and having the same octagonal shape, and the third pixels being arranged diagonally with respect to the first pixels and having the same octagonal shape. Species B (Fig. 2) teaches a pixel arrangement structure of the OLED display in which there are a plurality of first pixels, a plurality of second pixels, and a plurality of third pixels, each of the first pixels having the same quadrilateral shape (e.g., a parallelogram), and in which the

second pixels have a larger area than the third pixels. Species C (Fig. 3) teaches a pixel arrangement structure of the OLED display in which there are a plurality of first pixels, a plurality of second pixels, and a plurality of third pixels, each of the first pixels having the same quadrilateral shape (e.g., a parallelogram), and in which the second pixels have a larger area than the third pixels and the second pixels and the third pixels may have polygon shapes (e.g., hexagonal or octagonal). Species D (Fig. 4) teaches a pixel arrangement structure of the OLED display in which there are a plurality of first pixels, a plurality of second pixels, and a plurality of third pixels, each of the first pixels having the same quadrilateral shape (e.g., a parallelogram) and being symmetrical to each other, and in which the third pixels have a larger area than the second pixels. Species E (Fig. 5) teaches a pixel arrangement structure of the OLED display in which there are a plurality of first pixels, a plurality of second pixels, and a plurality of third pixels, each of the first pixels having the same octagonal shape and being symmetrical to each other, and in which the second pixels have a larger area than the third pixels and the second pixels and the third pixels may have quadrilateral shapes (e.g., rhombus).

Applicant is required under 35 U.S.C. 121 to elect a single disclosed species, or a single grouping of patentably indistinct species, for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable. Currently, there is no generic.

There is a search and/or examination burden for the patentably distinct species as set forth above. The species require a different field of search (e.g., searching

different classes/subclasses or electronic resources, or employing different search queries); and/or the prior art applicable to one species would not likely be applicable to another species; and/or the species are likely to raise different non-prior art issues under 35 U.S.C. 101 and/or 35 U.S.C. 112, first paragraph.

**Applicant is advised that the reply to this requirement to be complete must include (i) an election of a species or a grouping of patentably indistinct species to be examined** even though the requirement may be traversed (37 CFR 1.143) **and (ii) identification of the claims encompassing the elected species or grouping of patentably indistinct species**, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

The election may be made with or without traverse. To preserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the election of species requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable on the elected species or grouping of patentably indistinct species.

Should applicant traverse on the ground that the species, or groupings of patentably indistinct species from which election is required, are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing them

to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the species unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other species.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which depend from or otherwise require all the limitations of an allowable generic claim as provided by 37 CFR 1.141.

3. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

***Inquiry***

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kwang-Su Yang whose telephone number is 571-270-7307. The examiner can normally be reached on Mon-Fri during 9:00am-6:00pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chanh Nguyen can be reached on 571-272-7772. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/KWANG-SU YANG/
Primary Examiner, Art Unit 2691

| FORM PTO/SB/08A/B (10-01)<br>Substitute for PTO-1449A/B<br><br>**INFORMATION DISCLOSURE**<br><br>**STATEMENT BY APPLICANT**<br><br>(use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 69657/S1437 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Kwang-Su Yang |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER<br>Number - Kind Code[2] (If Known) | PUBLICATION DATE<br>MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
| | | 2012/0313844 A1 | 12-13-2012 | Im et al. |
| | | | | |
| | | | | |
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| | | | | |

**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document<br>Country Code[3] - Number[4] - Kind Code[5]<br>(If Known) | Publication Date<br>MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6]<br>(✓) |
|---|---|---|---|---|---|
| | | JP 2004-192813 | 07-08-2004 | Yamashita | Patent Abstracts of Japan |
| | | JP 2011-076760 | 04-14-2011 | Enkai et al. | Patent Abstracts of Japan |
| | | WO 2005/067352 A1 | 07-21-2005 | Chung et al. | |
| | | | | | |
| | | | | | |

**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | EPO Search Report dated July 9, 2014, for European Patent application 14155124.2, (8 pages) |
| | | |
| | | |
| | | |

DLG PAS1313569.1-*-08/18/14 8:40 AM

| EXAMINER SIGNATURE | | DATE CONSIDERED | |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

JEJ/dg



Petitioner Ex 1015, p. 641
BOE et al. v. Samsung, IPR2023-00988

# PATENT ABSTRACTS OF JAPAN

(11)Publication number : **2004-192813**
(43)Date of publication of application : **08.07.2004**

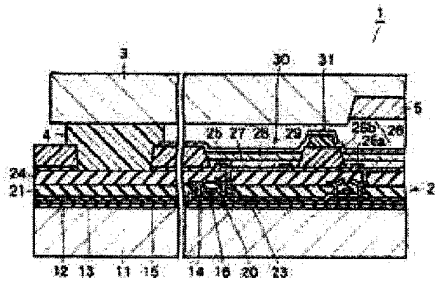
(51)Int.Cl. **H05B 33/22**
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## (54) ORGANIC ELECTROLUMINESCENT DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an organic EL display device capable of realizing high life characteristics.
SOLUTION: The organic EL display device 1 is provided with a first substrate 11, a plurality of first electrodes 25 arranged separate from each other on one main face of the first substrate 11, a partition insulating layer 26 fitted on the main face of the first substrate 11 and equipped with a plurality of through-holes at positions corresponding to the plurality of the first electrodes 25, organic matter layers containing a luminous layer 28 fitted on the plurality of the first electrodes respectively, a second electrode 29 fitted on the plurality of the organic matter layers, and a plurality of columnar members 31 fitted separate from each other on the partition insulating layer 26.






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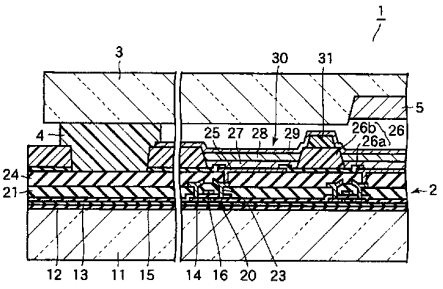
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(54)【発明の名称】有機ＥＬ表示装置

(57)【要約】
【課題】高い寿命特性を実現可能な有機ＥＬ表示装置を提供すること。
【解決手段】本発明の有機ＥＬ表示装置１は、第１基板１１と、前記第１基板１１の一方の主面上で互いに離間して配列した複数の第１電極２５と、前記第１基板１１の前記主面上に設けられるとともに前記複数の第１電極２５に対応した位置に複数の貫通孔をそれぞれ有する隔壁絶縁層２６と、前記複数の第１電極２５上にそれぞれ設けられるとともにそれぞれ発光層２８を含んだ複数の有機物層と、前記複数の有機物層上に設けられた第２電極２９と、前記隔壁絶縁層２６上に互いに離間して設けられた複数の柱状部材３１とを具備したことを特徴とする。
【選択図】　図１




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【特許請求の範囲】
【請求項１】
第１基板と、
前記第１基板の一方の主面上で互いに離間して配列した複数の第１電極と、
前記第１基板の前記主面上に設けられるとともに前記複数の第１電極に対応した位置に複数の貫通孔をそれぞれ有する隔壁絶縁層と、
前記複数の第１電極上にそれぞれ設けられるとともにそれぞれ発光層を含んだ複数の有機物層と、
前記複数の有機物層上に設けられた第２電極と、
前記隔壁絶縁層上に互いに離間して設けられた複数の柱状部材とを具備したことを特徴とする有機ＥＬ表示装置。
【請求項２】
前記第２電極は前記隔壁絶縁層と前記複数の柱状部材とを被覆していることを特徴とする請求項１に記載の有機ＥＬ表示装置。
【請求項３】
前記第１基板の前記主面と対向した第２基板と、
前記第１基板と前記第２基板との間に介在してそれらの間に密閉された空間を形成する枠状のシール層とをさらに具備したことを特徴とする請求項１に記載の有機ＥＬ表示装置。
【請求項４】
前記第２基板は前記第１基板との対向面に互いに離間した複数の凹部を有し、前記複数の柱状部材は前記複数の凹部間の凸部に対応した位置に設けられていることを特徴とする請求項３に記載の有機ＥＬ表示装置。
【請求項５】
前記複数の柱状部材は前記第２基板に接触していることを特徴とする請求項３または請求項４に記載の有機ＥＬ表示装置。
【請求項６】
前記複数の柱状部材は弾性体であることを特徴とする請求項３乃至請求項５の何れか１項に記載の有機ＥＬ表示装置。
【請求項７】
前記複数の柱状部材はそれぞれ逆テーパ状の断面形状を有していることを特徴とする請求項３乃至請求項６の何れか１項に記載の有機ＥＬ表示装置。
【請求項８】
前記複数の柱状部材の側面及び前記第２基板との対向面のうち前記第２基板との対向面に前記第２電極と同一の材料からなる導電層が選択的に設けられていることを特徴とする請求項７に記載の有機ＥＬ表示装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】
本発明は、表示装置に係り、特には有機ＥＬ（エレクトロルミネッセンス）表示装置に関する。
【０００２】
【従来の技術】
有機ＥＬ表示装置は自己発光表示装置であるため、視野角が広く、応答速度が速い。また、バックライトが不要であるため、薄型軽量化が可能である。これらの理由から、近年、有機ＥＬ表示装置は、液晶表示装置に代わる平面表示装置として注目されている。
【０００３】
ところで、有機ＥＬ素子の寿命特性は使用温度の上昇に対して指数関数的に低下する。そのため、有機ＥＬ表示装置は可能な限り低い温度で使用することが望まれる。しかしながら、有機ＥＬ素子に電力を供給すると、その一部は発光に利用されるものの、多くは熱へと変換される。そのため、特に大面積の有機ＥＬ表示装置では、有機ＥＬ素子の発熱に起

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因して高い寿命特性を実現し難いという問題がある。

【０００４】

【発明が解決しようとする課題】

本発明は、上記問題点に鑑みてなされたものであり、高い寿命特性を実現可能な有機ＥＬ表示装置を提供することを目的とする。

【０００５】

【課題を解決するための手段】

上記課題を解決するため、本発明は、第１基板と、前記第１基板の一方の主面上で互いに離間して配列した複数の第１電極と、前記第１基板の前記主面上に設けられるとともに前記複数の第１電極に対応した位置に複数の貫通孔をそれぞれ有する隔壁絶縁層と、前記複数の第１電極上にそれぞれ設けられるとともにそれぞれ発光層を含んだ複数の有機物層と、前記複数の有機物層上に設けられた第２電極と、前記隔壁絶縁層上に互いに離間して設けられた複数の柱状部材とを具備したことを特徴とする有機ＥＬ表示装置を提供する。

【０００６】

本発明において、第２電極は隔壁絶縁層と複数の柱状部材とを被覆していてもよい。

本発明に係る有機ＥＬ表示装置は、第１基板の上記主面と対向した第２基板と、第１基板と第２基板との間に介在してそれらの間に密閉された空間を形成する枠状のシール層とをさらに具備していてもよい。

【０００７】

第２基板は第１基板との対向面に互いに離間した複数の凹部を有していてもよい。この場合、複数の柱状部材はそれら凹部間の凸部に対応した位置に設けられていてもよい。

【０００８】

柱状部材は第２基板に接触していてもよい。或いは、柱状部材は第２基板から離間していてもよい。また、柱状部材は弾性体であってもよい。

柱状部材はそれぞれ逆テーパ状の断面形状を有していてもよい。この場合、柱状部材の側面及び第２基板との対向面のうち第２基板との対向面に第２電極と同一の材料からなる導電層が選択的に設けられていてもよい。

【０００９】

【発明の実施の形態】

以下、本発明の実施形態について、図面を参照しながら詳細に説明する。なお、各図において、同様または類似する構成要素には同一の参照符号を付し、重複する説明は省略する。

【００１０】

図１は、本発明の第１の実施形態に係る有機ＥＬ表示装置を概略的に示す断面図である。

図２は、図１に示す有機ＥＬ表示装置のアレイ基板の一部を概略的に示す斜視図である。

図３は、図１に示す有機ＥＬ表示装置の封止基板を概略的に示す平面図である。なお、図２では、陰極を省略している。

【００１１】

図１に示す有機ＥＬ表示装置１は、アレイ基板２と封止基板３とを備えている。アレイ基板２と封止基板３とは互いに接触しておらず、シール層４を介して対向している。シール層４は封止基板３の周縁に沿って設けられており、それにより、アレイ基板２と封止基板３との間に密閉された空間を形成している。この空間は、Ａｒガスなどの希ガスや$N_2$ガスのような不活性ガスで満たされている。また、封止基板３のアレイ基板２との対向面には凹部３ａと凸部３ｂとが設けられており、凹部３ａにはシート状の乾燥剤５が貼り付けられている。

【００１２】

アレイ基板２は、基板１１を有している。基板１１上には、アンダーコート層として、例えば、$SiN_x$層１２と$SiO_2$層１３とが順次積層されている。アンダーコート層１３上には、チャネル及びソース・ドレインが形成されたポリシリコン層のような半導体層１４、ゲート絶縁膜１５、及びゲート電極１６が順次積層されており、それらはトップゲー

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ト型の薄膜トランジスタ（以下、ＴＦＴという）２０を構成している。

【００１３】

ゲート絶縁膜１５及びゲート電極１６上には、$SiO_2$などからなる層間絶縁膜２１が設けられている。層間絶縁膜２１上には電極配線（図示せず）及びソース・ドレイン電極２３が設けられており、それらは、$SiN_x$などからなるパッシベーション膜２４で埋め込まれている。なお、ソース・ドレイン電極２３は、層間絶縁膜２１に設けられたコンタクトホールを介してＴＦＴ２０のソース・ドレインに電気的に接続されている。

【００１４】

パッシベーション膜２４上には、透明電極（陽極）２５が互いに離間して並置されている。陽極２５は、パッシベーション膜２４に設けられたビアホールを介してドレイン電極２３に電気的に接続されている。

【００１５】

パッシベーション膜２４上には、さらに、絶縁層２６ａが設けられている。絶縁層２６ａは、陽極２５の中央部に対応した位置に貫通孔を有しており、パッシベーション膜２４の陽極２５から露出した部分と陽極２５の周縁部とを被覆している。絶縁層２６ａは、例えば、親水性の無機絶縁層である。

【００１６】

絶縁層２６ａ上には、絶縁層２６ｂが設けられている。絶縁層２６ｂは、陽極２５に対応した位置に陽極２５よりも大きな径の貫通孔を有している。これら貫通孔は陽極２５を取り囲むように設けられている。絶縁層２６ｂは、例えば、撥水性の有機絶縁層である。なお、絶縁層２６ａと絶縁層２６ｂとの積層体は、陽極２５に対応した位置に貫通孔を有する隔壁絶縁層２６を構成している。

【００１７】

隔壁絶縁層２６の貫通孔内で露出した画素電極２５上には、バッファ層２７及び発光層２８が順次積層されている。バッファ層２７は、陽極２５から発光層２８への正孔の注入を媒介する役割を果たす。また、発光層２８は、例えば、発光色が赤色、緑色、または青色のルミネセンス性有機化合物を含んだ薄膜である。

【００１８】

隔壁絶縁層２６上には、隔壁絶縁層２６に接して柱状部材３１が設けられている。柱状部材３１の材料に特に制限はない。例えば、柱状部材３１の材料は、導電体であってもよく、或いは、絶縁体であってもよい。

【００１９】

隔壁絶縁層２６、柱状部材３１、及び発光層２８上には共通電極（陰極）２９が設けられている。陰極２９は、パッシベーション膜２４及び隔壁絶縁層２６に設けられたコンタクトホール（図示せず）を介して電極配線に電気的に接続されている。それぞれの有機ＥＬ素子３０は、これら陽極２５、バッファ層２７、発光層２８、及び陰極２９で構成されている。

【００２０】

さて、本実施形態に係る有機ＥＬ表示装置１では、隔壁絶縁層２６は主要な発熱源の１つである有機ＥＬ素子３０に隣接している。また、熱伝導率の高い陰極２９は、発光層２８だけでなく隔壁絶縁層２６も被覆するとともに、外部空間，ここではアレイ基板２と封止基板３とシール層４とに囲まれた空間，と隣接している。さらに、隔壁絶縁層２６上に柱状部材３１を設けているため、アレイ基板２の上記外部空間との接触面積を極めて大きくすることができる。

【００２１】

したがって、本実施形態によると、有機ＥＬ素子３０などで生じた熱を有機ＥＬ素子３０から速やかに外部空間へと放熱させることができる。これにより、高い寿命特性を実現することが可能となる。

【００２２】

また、有機ＥＬ表示装置１が大面積であると、表示装置１の表示面に外光反射防止用の偏

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光板を貼り付ける際や表示装置を運搬する際などに、アレイ基板２や封止基板３が撓むことがある。この場合、柱状部材３１が設けられていない構造では、封止基板３と陰極２９とが広い面積にわたって接触し易い。そのため、比較的広い面積にわたって陰極２９などの剥離や亀裂を生じ、多くの有機ＥＬ素子３０が破壊されることがある。

【００２３】

これに対し、本実施形態に係る有機ＥＬ表示装置１では、隔壁絶縁層２６上に柱状部材３１を設けているため、アレイ基板２や封止基板３が撓んだとしても、封止基板３の凸部３ｂと接触するのは陰極２９の柱状部材３１上に位置した部分のみである。すなわち、封止基板３と陰極２９とが広い面積にわたって接触することはない。したがって、有機ＥＬ素子３０が破壊されるに至るほどの剥離や亀裂が発生するのを抑制することができる。

【００２４】

本実施形態において、柱状部材３１の数に特に制限はないが、数が多いほど、放熱性や有機ＥＬ素子３０の破壊防止の観点で有利である。例えば、発光色が赤、緑、青色の３つの画素３０に対して１個または２個程度の割合で柱状部材３１を設ければ、極めて高い放熱性を実現できるとともに、有機ＥＬ素子３０の破壊を十分に防止することができる。

【００２５】

本実施形態において、柱状部材３１は、均一な密度で設けてもよく、或いは、アレイ基板２の周縁部よりも中央部でより高い密度となるように設けてもよい。有機ＥＬ素子３０などの発熱による温度上昇は、基板中央部で最も大きい。また、アレイ基板２及び／または封止基板３が撓んだ場合、通常、その変形量は基板中央部で最も大きくなる。したがって、柱状部材３１をアレイ基板２の周縁部よりも中央部でより高い密度となるように設ければ、上述した効果の大きさを基板周縁部と基板中央部とでほぼ等しくすることができる。

【００２６】

本実施形態において、柱状部材３１の隔壁絶縁層２６側の径に対する封止基板側の径の比は、１よりも大きいことが好ましい。放熱性の観点では、陰極２９は柱状部材３１の上面だけでなく側面も被覆していることが有利である。上記比が先の範囲内にあれば、そのような構造を比較的容易に得ることができる。また、柱状部材３１の隔壁絶縁層２６側の径に対する封止基板側の径の比は、約２以下であることが好ましい。この場合、アレイ基板２の上記外部空間との接触面積を大きくするうえで有利である。

【００２７】

本実施形態において、柱状部材３１の高さは、約５μｍ以上であることが好ましい。この場合、アレイ基板２の上記外部空間との接触面積を大きくするうえで有利である。また、柱状部材３１の高さは、約１０μｍ以下であることが好ましい。過剰に高い柱状部材３１は、多くの場合、高い精度で形状や寸法を制御することが難しく、また、それ自体の破損を生じ易い。

【００２８】

次に、本発明の第２の実施形態について説明する。

図４は、本発明の第２の実施形態に係る有機ＥＬ表示装置を概略的に示す断面図である。

図４に示す有機ＥＬ表示装置１は、陰極２９の柱状部材３１上に位置した部分が封止基板３の凸部３ｂと接触していること以外は図１に示す有機ＥＬ表示装置１と同様の構造を有している。

【００２９】

このような構造を採用すると、有機ＥＬ素子３０などで生じた熱を有機ＥＬ素子３０から基板２，３とシール層４とに囲まれた空間を介することなく封止基板３に伝導させることができる。そのため、第１の実施形態で説明したのと同様の効果が得られるのに加え、より高い放熱性を実現することができる。

【００３０】

次に、本発明の第３の実施形態について説明する。

図５は、本発明の第３の実施形態に係る有機ＥＬ表示装置を概略的に示す断面図である。

図５に示す有機ＥＬ表示装置１は、柱状部材３１が逆テーパ状の断面形状を有しているこ

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と以外は図４に示す有機ＥＬ表示装置１と同様の構造を有している。

【００３１】

図４に示す構造では、柱状部材３１と封止基板３とが陰極２９を介して接触しているため、アレイ基板２及び／または封止基板３が撓むと、図１に示す構造に比べ、隔壁絶縁層２６と柱状部材３１と陰極２９との積層体により大きな応力が加わる。この応力から有機ＥＬ素子３０を保護するためには、柱状部材３１は隔壁絶縁層２６に比べて剛性が低い弾性体であること，すなわち、変形することにより上記応力を吸収可能であること，が望まれる。しかしながら、図４に示す構造で柱状部材３１が変形すると、その近傍で陰極２９の剥離や亀裂が生じることがある。

【００３２】

これに対し、図５に示すように柱状部材３１の断面形状を逆テーパ状とすると、陰極２９の成膜過程で柱状部材３１の側面に陰極材料が堆積するのを防止することができる。したがって、上記応力により柱状部材３１が変形したとしても、その近傍で陰極２９の剥離や亀裂が生じるのを防止することができる。

【００３３】

なお、陰極２９を形成した後に柱状部材３１を形成しても同様の効果を得ることができ、この場合、柱状部材３１の断面形状を逆テーパ状とする必要はない。但し、柱状部材３１と隔壁絶縁層２６との間に陰極２９が介在していると、柱状部材３１と下地との間の密着性が不十分となることがある。したがって、陰極２９を形成した後に柱状部材３１を形成する場合、柱状部材３１と隔壁絶縁層２６とが直接接触できるように陰極２９に開口を設けることが好ましい。

【００３４】

次に、第１乃至第３の実施形態に係る有機ＥＬ表示装置１の主要な構成要素に使用可能な材料などについて説明する。

基板１１としては、その上に形成される構造を保持可能なものであれば、どのようなものを用いてもよい。基板１１としては、ガラス基板のように硬質な基板が一般的であるが、有機ＥＬ表示装置１の用途によっては、プラスチックシートなどのようにフレキシブルな基板を使用してもよい。

【００３５】

有機ＥＬ表示装置１が基板１１側から光を発する下面発光型の場合、陽極２５としては光透過性を有する透明電極を使用する。透明電極の材料としては、ＩＴＯ（インジウム・スズ酸化物）等の透明導電材料を使用することができる。透明電極の膜厚は、通常、１０ｎｍ乃至１５０ｎｍ程度である。透明電極は、ＩＴＯ等の透明導電材料を蒸着法やスパッタリング等により堆積し、それにより得られる薄膜をフォトリソグラフィ技術を用いてパターニングすることにより得ることができる。

【００３６】

絶縁層２６ａの材料としては、例えば、シリコン窒化物やシリコン酸化物のような無機絶縁材料を使用することができる。これら無機絶縁材料からなる絶縁層２６ａは比較的高い親水性を示す。

【００３７】

絶縁層２６ｂの材料としては、例えば、有機絶縁材料を使用することができる。絶縁層２６ｂに使用可能な有機絶縁材料に特に制限はないが、感光性樹脂を使用した場合、貫通孔が設けられた絶縁層２６ｂを容易に形成可能である。絶縁層２６ｂを形成するのに使用可能な感光性樹脂としては、例えば、フェノール樹脂、ポリアクリル、ポリアミド樹脂、ポリアミック酸などのアルカリ可溶性の高分子誘導体にナフトキノンジアジドなどの感光性化合物を添加してなり、露光及びアルカリ現像によりポジパターンを与える材料を挙げることができる。また、ネガパターンを与える感光性樹脂としては、化学線の照射により現像液への溶解速度が遅くなる感光性組成物，例えばエポキシ基のように化学線照射により架橋する官能基を有する感光性組成物を挙げることができる。絶縁層２６ｂは、例えば、これら感光性樹脂を基板１１の陽極２５などが形成された面にスピンコート法などにより

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塗布し、それにより得られた塗膜をフォトリソグラフィ技術を用いてパターニングすることにより得られる。

【００３８】

隔壁絶縁層２６の膜厚は、バッファ層２７の膜厚と発光層２８の膜厚との和以上であることが望ましい。なお、バッファ層２７や発光層２８を形成する際には、インクジェット法による溶液塗布時の位置精度向上のため、絶縁層２６ｂの表面を予め$CF_4$・$O_2$などのプラズマガスで撥水処理しておくことが望ましい。

【００３９】

バッファ層２７の材料としては、例えば、ドナー性の高分子有機化合物とアクセプタ性の高分子有機化合物との混合物を使用することができる。ドナー性の高分子有機化合物としては、例えば、ポリエチレンジオキシチオフェン（以下、ＰＥＤＯＴという）のようなポリチオフェン誘導体及び／またはポリアニリンのようなポリアニリン誘導体などを使用することができる。また、アクセプタ性の有機化合物としては、例えば、ポリスチレンスルホン酸（以下、ＰＳＳという）などを使用することができる。

【００４０】

バッファ層２７は、隔壁絶縁層２６が形成する液溜めを、溶液塗布法により、ドナー性の高分子有機化合物とアクセプタ性の高分子有機化合物との混合物を有機溶媒中に溶解してなる溶液で満たし、液溜め内の液膜を乾燥することにより、それら液膜から溶媒を除去することにより得られる。バッファ層２７を形成するのに利用可能な溶液塗布法としては、例えば、ディッピング、インクジェット、及びスピンコート法などを挙げることができるが、なかでも、インクジェット法を利用することが好ましい。また、上記液膜の乾燥は、熱及び／または減圧のもとで行ってもよく、或いは、自然乾燥により行ってもよい。

【００４１】

発光層２８の材料としては、有機ＥＬ表示装置で一般に使用されているルミネセンス性有機化合物を用いることができる。そのような有機化合物のうち赤色のルミネセンスを発するものとしては、例えば、ポリビニレンスチレン誘導体のベンゼン環にアルキルまたはアルコキシ置換基を有する高分子化合物や、ポリビニレンスチレン誘導体のビニレン基にシアノ基を有する高分子化合物などを挙げることができる。緑色のルミネセンスを発する有機化合物としては、例えば、アルキルまたはアルコキシまたはアリール誘導体置換基をベンゼン環に導入したポリビニレンスチレン誘導体などを挙げることができる。青色のルミネセンスを発する有機化合物としては、例えば、ジアルキルフルオレンとアントラセンの共重合体のようなポリフルオレン誘導体などを挙げることができる。また、発光層２８には、これらの高分子のルミネセンス性有機化合物に低分子のルミネセンス性有機化合物などをさらに添加してもよい。

【００４２】

発光層２８は、上記の通り、隔壁絶縁層２６が形成する液溜めを、溶液塗布法により、ルミネセンス性有機化合物を溶媒中に溶解してなる溶液で満たし、液溜め内の液膜を乾燥することにより、それら液膜から溶媒を除去することにより得られる。発光層２８を形成するのに利用可能な溶液塗布法としては、例えば、ディッピング、インクジェット、及びスピンコート法などを挙げることができるが、なかでも、インクジェット法を利用することが好ましい。また、上記液膜の乾燥は、熱及び／または減圧のもとで行ってもよく、或いは、自然乾燥により行ってもよい。

【００４３】

発光層２８の膜厚は、使用する材料に応じて適宜設定する。通常、発光層２８全体の膜厚は５０ｎｍ乃至２００ｎｍの範囲内である。

【００４４】

陰極２９は、単層構造を有していてもよく、或いは、多層構造を有していてもよい。陰極２９を多層構造とする場合、例えば、発光層２８上にバリウムやカルシウムなどを含有した主導体層と銀やアルミニウムなどを含有した保護導体層とを順次積層してなる二層構造としてもよい。また、発光層２８上にフッ化バリウムなどを含有した非導体層と銀やアル

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ミニウムなどを含有した導体層とを順次積層してなる二層構造としてもよい。さらに、発光層２８上にフッ化バリウムなどを含有した非導体層とバリウムやカルシウムなどを含有した主導体層と銀やアルミニウムなどを含有した保護導体層とを順次積層してなる三層構造としてもよい。

【００４５】

柱状部材３１の材料は、先に述べたように、導電体であってもよく、或いは、絶縁体であってもよい。但し、柱状部材３１の材料としては、有機材料を使用することが望ましく、特に感光性樹脂を使用することが望ましい。柱状部材３１の材料として利用可能な感光性樹脂としては、例えば、絶縁層２６ｂの材料として例示したものなどを挙げることができる。

【００４６】

第１乃至第３の実施形態では、封止基板３に乾燥剤５を貼り付けたが、乾燥剤５は必ずしも設ける必要はない。また、第１乃至第３の実施形態では、封止基板３とシール層４とを用いて有機ＥＬ素子３０を封止したが、封止基板３やシール層４は必ずしも設ける必要はない。

【００４７】

さらに、第１乃至第３の実施形態では、陽極２５をパッシベーション膜２４上に設けたが、陽極２５は層間絶縁膜２１上に、つまり信号線と陽極２５とを同一平面上に設けてもよい。また、第１乃至第３の実施形態では有機ＥＬ表示装置１を下面発光型としたが、上面発光型とすることもできる。

【００４８】

【実施例】

以下、本発明の実施例について説明する。

（実施例１）

本実施例では、図１に示す有機ＥＬ表示装置１を以下の方法により作製した。

【００４９】

すなわち、まず、ガラス基板１１のアンダーコート層１２，１３が形成された面に対し、通常のＴＦＴ形成プロセスと同様に成膜とパターニングとを繰り返し、ＴＦＴ２０、層間絶縁膜２１、電極配線（図示せず）、ソース・ドレイン電極２３、及びパッシベーション膜２４を形成した。

【００５０】

次に、パッシベーション膜２４上に、スパッタリング法を用いてＩＴＯ膜を形成した。続いて、このＩＴＯ膜を、フォトリソグラフィ技術を用いてパターニングすることにより陽極２５を得た。なお、陽極２５は、マスクスパッタリング法により形成してもよい。

【００５１】

次いで、基板１１の陽極２５を形成した面に、各画素の発光部に対応して開口を有する親水性の無機絶縁層２６ａを形成した。続いて、基板１１の陽極２５を形成した面に、ポジ型の感光性樹脂を塗布し、得られた塗膜をパターン露光及び現像することにより、各画素の発光部に対応して開口を有する撥水性の有機絶縁層２６ｂを形成した。以上のようにして、絶縁層２６ａと絶縁層２６ｂとを積層してなる隔壁絶縁層２６を得た。

【００５２】

その後、基板１１の隔壁絶縁層２６を形成した面に、ポジ型の感光性樹脂を塗布し、得られた塗膜をパターン露光及び現像することにより、断面形状が順テーパ形状の柱状部材３１を形成した。ここでは、柱状部材３１の底部の直径は６０μｍとし、頂部の直径は６４μｍとし、高さは１０μｍとした。

【００５３】

次に、基板１１の隔壁絶縁層２６などを形成した面に対して、反応性イオンエッチング装置により反応性フッ素含有ガスを用いた表面処理を施し、隔壁絶縁層２６及び陽極２５の表面を改質した。次いで、隔壁絶縁層２６が形成するそれぞれの液溜めに、インクジェット法によりバッファ層形成用インクを吐出して液膜を形成した。続いて、これら液膜を加

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熱することによりバッファ層２７を得た。

【００５４】

その後、赤、緑、青色の画素に対応したバッファ層２７上に、それぞれ、赤、緑、青色の発光層形成用インクをインクジェット法により吐出して液膜を形成した。続いて、これら液膜を加熱することにより発光層２８を得た。

【００５５】

次いで、基板１１の発光層２８を形成した面にバリウムを真空蒸着し、続いてアルミニウムを蒸着することにより陰極２９を形成した。これにより、ＴＦＴアレイ基板２を完成した。

【００５６】

その後、封止基板３の一方の主面の周縁部に紫外線硬化型樹脂を塗布してシール層４を形成した。ここでは、封止基板３として、図３に示すように一方の主面に凹部３ａと凸部３ｂとが設けられたガラス基板を使用し、凹部３ａにはシート状の乾燥剤５を貼り付けた。次いで、封止基板３とアレイ基板２とを、封止基板３のシール層４を設けた面とアレイ基板２の陰極２９を設けた面とが対向するように$N_2$ガス中で貼り合せた。さらに、紫外線照射によりしてシール層を硬化させることにより、図１に示す有機ＥＬ表示装置１を完成した。

【００５７】

（実施例２）

本実施例では、図４に示す有機ＥＬ表示装置１を上記実施例１で説明したのと同様の方法により作製した。なお、本例では、柱状部材３１の底部の直径は６０μｍとし、頂部の直径は５４μｍとし、高さは７μｍとした。また、本例では、柱状部材３１と封止基板３とを陰極２９を介して接触させた。

【００５８】

（実施例３）

本実施例では、図５に示す有機ＥＬ表示装置１を上記実施例１で説明したのとほぼ同様の方法により作製した。なお、本例では、柱状部材３１の形成条件を変更することにより、その断面形状を逆テーパ状とした。また、本例では、柱状部材３１の底部の直径は６０μｍとし、頂部の直径は６４μｍとし、高さは７μｍとした。さらに、本例では、柱状部材３１と封止基板３１とを陰極２９を介して接触させた。

【００５９】

（比較例）

柱状部材３１を設けなかったこと以外は上記実施例１で説明したのと同様の方法により有機ＥＬ表示装置を作製した。

【００６０】

次に、上記実施例１乃至実施例３及び比較例に係る有機ＥＬ表示装置１について、同一条件で連続点灯を行い、その温度変化について調べた。その結果、実施例１乃至実施例３に係る有機ＥＬ表示装置１では、比較例に係る有機ＥＬ表示装置ほど高い温度になることはなかった。特に、実施例２に係る有機ＥＬ表示装置１では、温度上昇が最も少なかった。

【００６１】

また、上記実施例１乃至実施例３及び比較例に係る有機ＥＬ表示装置１について、基板面に垂直な方向に応力を加え、陰極２９や有機ＥＬ素子３０などの破損状況を調べた。その結果、比較例に係る有機ＥＬ表示装置では、広い面積にわたり陰極２９などの剥離や亀裂を生じ、多くの有機ＥＬ素子３０が破壊された。これに対し、実施例１乃至実施例３に係る有機ＥＬ表示装置１では陰極２９などの剥離や亀裂は殆ど生じず、特に、実施例３に係る有機ＥＬ表示装置１では陰極２９などの剥離や亀裂は全く生じなかった。

【００６２】

【発明の効果】

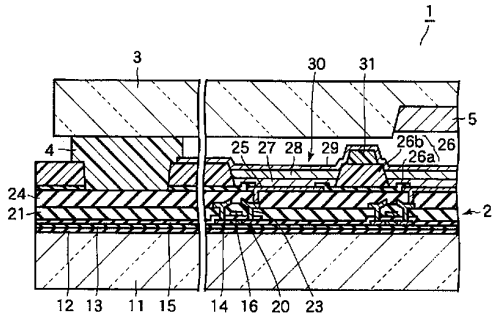
以上説明したように、本発明では、隔壁絶縁層上に複数の柱状部材を互いに離間して設ける。そのため、高い放熱性を実現することができ、したがって、優れた寿命特性を実現す

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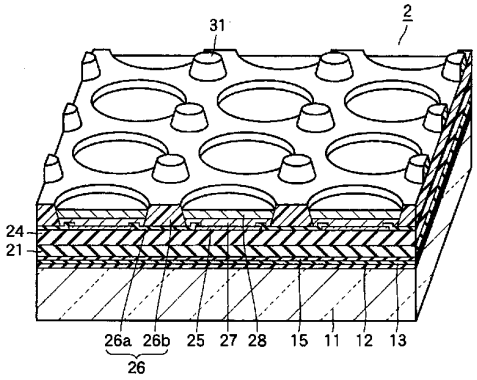
ることが可能となる。
すなわち、本発明によると、高い寿命特性を実現可能な有機ＥＬ表示装置が提供される。
【図面の簡単な説明】
【図１】本発明の第１の実施形態に係る有機ＥＬ表示装置を概略的に示す断面図。
【図２】図１に示す有機ＥＬ表示装置のアレイ基板の一部を概略的に示す斜視図。
【図３】図１に示す有機ＥＬ表示装置の封止基板を概略的に示す平面図。
【図４】本発明の第２の実施形態に係る有機ＥＬ表示装置を概略的に示す断面図。
【図５】本発明の第３の実施形態に係る有機ＥＬ表示装置を概略的に示す断面図。
【符号の説明】
１…有機ＥＬ表示装置
２…アレイ基板
３…封止基板
４…シール層
１１…基板
１２…アンダーコート層
１３…アンダーコート層
１４…半導体層
１５…ゲート絶縁膜
１６…ゲート電極
２０…ＴＦＴ
２１…層間絶縁膜
２３…ソース・ドレイン電極
２４…パッシベーション膜
２５…陽極
２６…隔壁絶縁層
２６ａ，２６ｂ…絶縁層
２７…バッファ層
２８…有機発光層
２９…陰極
３０…有機ＥＬ素子
３１…柱状部材

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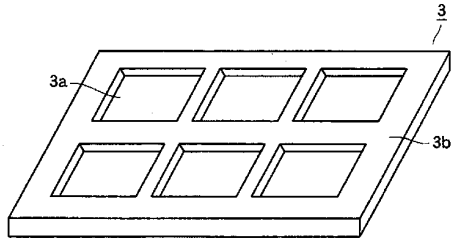
【図１】



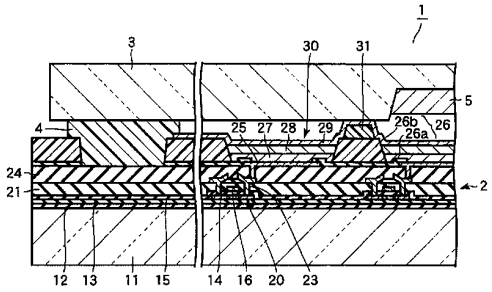

【図２】



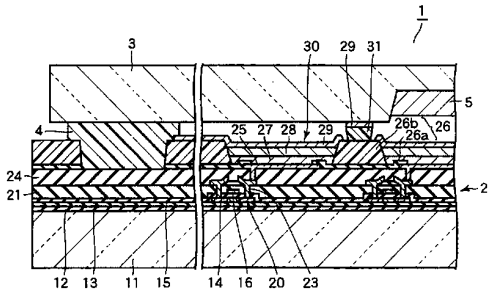

【図３】




【図４】




【図５】




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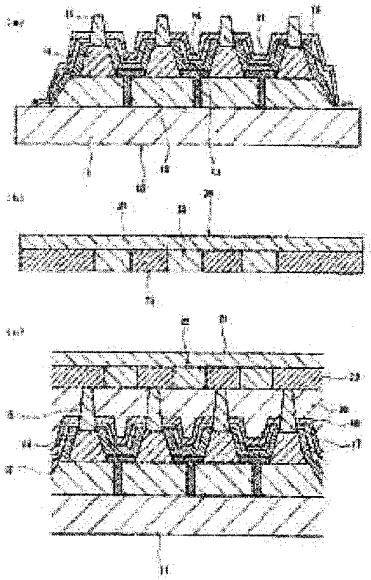
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(71)Applicant : **TOPPAN PRINTING CO LTD**
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## (54) ORGANIC EL DEVICE AND METHOD OF MANUFACTURING THE SAME

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an organic EL device capable of preventing moisture, air, or the like, in the atmosphere from entering an adhesive portion between a substrate having a plurality of light emission pixel regions and columnar barrier ribs formed on one surface and a sealing base material, and to provide a method of manufacturing the organic EL device.
SOLUTION: When the organic EL device is manufactured by sticking an organic EL element substrate 10 and a sealing substrate 21 together by an adhesive, a plurality of projections 15 are arranged and installed on intersection portions of the columnar ribs 14 to demarcate a first electrode 13 of the organic EL substrate 10; and the organic EL element substrate 10 and the sealing substrate 21 are stuck together, while the tips of these projections 15 are abutted against the sealing substrate 21.





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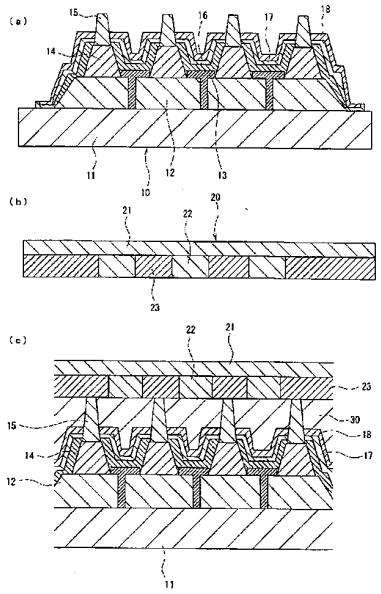
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最終頁に続く

(54)【発明の名称】有機ＥＬ装置およびその製造方法

(57)【要約】
【課題】一表面上に複数の発光画素領域と格子状隔壁が形成された基板と封止基材との接着部に大気中の水分や空気等が入り込むことを抑制することのできる有機ＥＬ装置及びその製造方法を提供する。
【解決手段】有機ＥＬ素子基板１０と封止基板２１とを接着剤により貼り合わせて有機ＥＬ装置を製造するに際して、有機ＥＬ素子基板１０の第一電極１３を区画する格子状隔壁１４の交差部上に複数の突起物１５を配設し、これら突起物１５の先端を封止基板２１に当接させた状態で有機ＥＬ素子基板１０と封止基板２１とを貼り合わせる。
【選択図】図１



【特許請求の範囲】
【請求項１】
第一電極、有機発光媒体層及び第二電極を積層して形成される複数の発光画素領域と該発光画素領域を囲う格子状隔壁とを一表面上に有する基板と、該基板と前記発光画素領域及び前記格子状隔壁を介して貼り合わされた封止基材とを備え、前記格子状隔壁が互いに平行な複数の第一隔壁ラインと、該第一隔壁ラインと直交する複数の第二隔壁ラインとで形成される有機ＥＬ装置の製造方法であって、
前記第一隔壁ライン上のみに複数の突起物を配設した後、前記有機発光媒体層を形成する複数の層のうち少なくとも１つの層を凸版印刷法により前記第一隔壁ラインに沿ってパターン形成し、次いで前記有機発光媒体層上に前記第二電極を形成した後、前記突起物の先端を前記封止基材に当接させた状態で前記基板と前記封止基材とを貼り合わせることを特徴とする有機ＥＬ装置の製造方法。
【請求項２】
請求項１記載の有機ＥＬ装置の製造方法において、前記複数の突起物を前記第一隔壁ラインと前記第二隔壁ラインとの交差部上に配設した後、前記有機発光媒体層を形成する複数の層のうち少なくとも１つの層を凸版印刷法により前記第一隔壁ラインまたは前記第二隔壁ラインに沿ってパターン形成し、次いで前記有機発光媒体層上に前記第二電極を形成した後、前記突起物の先端を前記封止基材に当接させた状態で前記基板と前記封止基材とを貼り合わせることを特徴とする有機ＥＬ装置の製造方法。
【請求項３】
請求項１又は２記載の有機ＥＬ装置の製造方法において、前記有機発光媒体層を形成する複数の層のうち少なくとも１つの層を前記凸版印刷法によりパターン形成するに際して、表面に複数の凸部がストライプ状に形成された凸版印刷版を用いて前記有機発光媒体層を形成する複数の層のうち少なくとも１つの層をパターン形成することを特徴とする有機ＥＬ装置の製造方法。
【請求項４】
請求項３記載の有機ＥＬ装置の製造方法において、前記凸部の短辺方向の幅が前記有機発光媒体層の一辺の長さより小さい凸版印刷版を用いて前記有機発光媒体層を形成する複数の層のうち少なくとも１つの層をパターン形成することを特徴とする有機ＥＬ装置の製造方法。
【請求項５】
請求項３又は４記載の有機ＥＬ装置の製造方法において、前記凸部の短辺方向の幅が前記複数の突起物のうち隣り合う二つの突起物の間隔より小さい凸版印刷版を用いて前記有機発光媒体層を形成する複数の層のうち少なくとも１つの層をパターン形成することを特徴とする有機ＥＬ装置の製造方法。
【請求項６】
請求項３～５のいずれか一項記載の有機ＥＬ装置の製造方法において、前記凸部の高さが前記突起物の高さより低い凸版印刷版を用いて前記有機発光媒体層を形成する複数の層のうち少なくとも１つの層をパターン形成することを特徴とする有機ＥＬ装置の製造方法。
【請求項７】
第一電極、有機発光媒体層及び第二電極を積層して形成される複数の発光画素領域と該発光画素領域を囲う格子状隔壁とを一表面上に有する基板と、該基板と前記発光画素領域及び前記格子状隔壁を介して貼り合わされた封止基材とを備え、前記格子状隔壁が互いに平行な複数の第一隔壁ラインと、該第一隔壁ラインと直交する複数の第二隔壁ラインとで形成される有機ＥＬ装置であって、
前記基板と前記封止基材との間隔を規定する複数の突起物が前記格子状隔壁の第一隔壁ライン上に配設されていることを特徴とする有機ＥＬ装置。
【請求項８】
請求項７記載の有機ＥＬ装置において、前記複数の突起物が前記格子状隔壁の第一隔壁

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ラインと第二隔壁ラインとの交差部上に配設されていることを特徴とする有機ＥＬ装置。
【請求項９】
請求項７又は８記載の有機ＥＬ装置において、前記封止基材が前記発光画素領域からの光をカラー化するカラーフィルタ層と、該カラーフィルタ層を格子状に区画するブラックマトリクス層とを有することを特徴とする有機ＥＬ装置。
【請求項１０】
請求項９記載の有機ＥＬ装置において、前記突起物が前記ブラックマトリクス層と対向する位置に形成されていることを特徴とする有機ＥＬ装置。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、有機エレクトロルミネッセンス（以下「有機ＥＬ」という。）現象を利用した有機ＥＬ装置とその製造方法に関するものである。
【背景技術】
【０００２】
基板上に薄膜トランジスタ（ＴＦＴ）を備えると共に、該ＴＦＴと接続するように電極（陽極、陰極）を設け、これらの陽極と陰極との間に、少なくともＥＬ発光現象を呈する有機発光層を積層させた複数の有機ＥＬ素子を備える有機ＥＬ装置においては、これら有機ＥＬ素子の発光画素領域を囲うために、絶縁性を有する隔壁が前記基板の一表面上に格子状に形成されている。さらに、発光効率を高めることを目的として、陽極と有機発光層との間に正孔輸送層、正孔注入層、および有機発光層と陰極との間に電子輸送層、電子注入層が配置される場合もある。これらの積層構造を有機発光媒体層と呼ぶ。
【０００３】
しかし、このような陰極や電子注入層は高活性であるため、大気中の水分と反応しやすく変質しやすい。かかる変質により、電子注入効果が損なわれ、ダークスポットと呼ばれる非発光部分が画素内に発生する。そこで、従来は有機ＥＬ素子が形成された基板（以下「有機ＥＬ素子基板」という。）とガラスなどからなる封止基材とを、有機ＥＬ素子を覆うように樹脂等により貼り合わせた構造が知られている。
【０００４】
このように樹脂等を塗布させた状態で封止を行う場合、有機ＥＬ素子基板と封止基材とのギャップ（間隔）を精密に制御し、基板全体の高さを一定にする必要がある。この高さが不均一の場合、大気中の水分が有機ＥＬ素子基板と封止基材との接着部に混入することによる変質が発生する。この変質が有機ＥＬ装置の劣化へとつながる。よって、基板間のギャップを管理することにより変質を防ぐ必要がある。このようなギャップを管理する簡便な方法として、貼りあわせを実施する基板の少なくとも一つの基板上にスペーサ（ギャップ材）を形成させる方法が知られている（特許文献１参照）。
【先行技術文献】
【特許文献】
【０００５】
【特許文献１】特開２００５－２９４０５７号公報
【発明の概要】
【発明が解決しようとする課題】
【０００６】
しかし、特許文献１に開示された技術のように、カラーフィルタ層を有する基板（以下「カラーフィルタ基板」という。）上にスペーサを形成して封止基材としてのカラーフィルタ基板と有機ＥＬ素子基板とを貼り合わせると、カラーフィルタ層がブラックマトリクス層に乗り上げることによるオーバーラップ現象やツノ段差などが発生し、有機ＥＬ素子基板とカラーフィルタ基板とのギャップを精密に調整することが困難になるという課題があった。ゆえに、カラーフィルタ上にスペーサを設けた基板では、これらの影響により基板内高さを均一にすることが出来ず、対向基板とのセルギャップにバラつきが生じるとい

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う課題があった。

【０００７】

このような現象は有機ＥＬ装置の場合でも見られる。カラーフィルタ上にスペーサが形成された基板と、有機ＥＬ素子が形成された基板とを樹脂等を用いて貼り合わせた場合、カラーフィルタ上にスペーサが形成された基板のツノ段差により、該基板と有機ＥＬ素子基板とを均一に貼り合わせることが出来ないという課題があった。かかる現象により、有機ＥＬ装置内に大気中の水分や酸素が混入する。有機ＥＬ素子基板上の陰極や電子注入層は高活性材料にて構成されているため、該水分や酸素による変質が生じる。ゆえに、有機ＥＬ素子基板上にスペーサを形成し、カラーフィルタとの均一な貼り合わせを可能とする有機ＥＬ装置が必要となる。

また、有機ＥＬ素子基板上に突起物を形成した場合、凸版印刷法を用いて有機発光媒体層を印刷すると、突起物が凸版印刷法の印刷版と接触し、印刷不良が生じるという問題があった。その為、突起物を印刷版と接触しない位置に配置させる必要がある。

【０００８】

凸版印刷法とは印刷法における手法の一つである。ここで、凸版印刷法により用いられる印刷版は、ストライプ状の凸部を複数有しており、該凸部に有機発光材料インキを塗布し、該インキを基板上に塗布させる。この方法を用いて有機発光媒体層を形成した場合、真空蒸着法などの他の手法を用いた場合より精細なパターン形成を可能とし、かつ均一な薄膜となる有機発光媒体層の形成を可能とする。

本発明は上述した課題に鑑みてなされたもので、一表面上に複数の発光画素領域と格子状隔壁が形成された基板と封止基材との接着部に大気中の水分や空気等が入り込むことを抑制することのできる有機ＥＬ装置及びその製造方法を提供することを目的とする。

【課題を解決するための手段】

【０００９】

上記課題を解決するために、本発明の請求項１に係る発明は、第一電極、有機発光媒体層及び第二電極を積層して形成される複数の発光画素領域と該発光画素領域を囲う格子状隔壁とを一表面上に有する基板と、該基板と前記発光画素領域及び前記格子状隔壁を介して貼り合わされた封止基材とを備え、前記格子状隔壁が互いに平行な複数の第一隔壁ラインと、該第一隔壁ラインと直交する複数の第二隔壁ラインとで形成される有機ＥＬ装置の製造方法であって、前記第一隔壁ライン上のみに複数の突起物を配設した後、前記有機発光媒体層を形成する複数の層のうち少なくとも１つの層を凸版印刷法により前記第一隔壁ラインに沿ってパターン形成し、次いで前記有機発光媒体層上に前記第二電極を形成した後、前記突起物の先端を前記封止基材に当接させた状態で前記基板と前記封止基材とを貼り合わせることを特徴とする。

【００１０】

本発明の請求項２に係る発明は、請求項１記載の有機ＥＬ装置の製造方法において、前記複数の突起物を前記第一隔壁ラインと前記第二隔壁ラインとの交差部上に配設した後、前記有機発光媒体層を形成する複数の層のうち少なくとも１つの層を凸版印刷法により前記第一隔壁ラインまたは前記第二隔壁ラインに沿ってパターン形成し、次いで前記有機発光媒体層上に前記第二電極を形成した後、前記突起物の先端を前記封止基材に当接させた状態で前記基板と前記封止基材とを貼り合わせることを特徴とする。

【００１１】

本発明の請求項３に係る発明は、請求項１又は２記載の有機ＥＬ装置の製造方法において、前記有機発光媒体層を形成する複数の層のうち少なくとも１つの層を前記凸版印刷法によりパターン形成するに際して、表面に複数の凸部がストライプ状に形成された凸版印刷版を用いて前記有機発光媒体層を形成する複数の層のうち少なくとも１つの層をパターン形成することを特徴とする。

【００１２】

本発明の請求項４に係る発明は、請求項３記載の有機ＥＬ装置の製造方法において、前記凸部の短辺方向の幅が前記有機発光媒体層の一辺の長さより小さい凸版印刷版を用いて

Petitioner Ex 1015, p. 659
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前記有機発光媒体層を形成する複数の層のうち少なくとも１つの層をパターン形成することを特徴とする。

本発明の請求項５に係る発明は、請求項３又は４記載の有機ＥＬ装置の製造方法において、前記凸部の短辺方向の幅が前記複数の突起物のうち隣り合う二つの突起物の間隔より小さい凸版印刷版を用いて前記有機発光媒体層を形成する複数の層のうち少なくとも１つの層をパターン形成することを特徴とする。

【００１３】

本発明の請求項６に係る発明は、請求項３～５のいずれか一項記載の有機ＥＬ装置の製造方法において、前記凸部の高さが前記突起物の高さより低い凸版印刷版を用いて前記有機発光媒体層を形成する複数の層のうち少なくとも１つの層をパターン形成することを特徴とする。

本発明の請求項７に係る発明は、第一電極、有機発光媒体層及び第二電極を積層して形成される複数の発光画素領域と該発光画素領域を囲う格子状隔壁とを一表面上に有する基板と、該基板と前記発光画素領域及び前記格子状隔壁を介して貼り合わされた封止基材とを備え、前記格子状隔壁が互いに平行な複数の第一隔壁ラインと、該第一隔壁ラインと直交する複数の第二隔壁ラインとで形成される有機ＥＬ装置であって、前記基板と前記封止基材との間隔を規定する複数の突起物が前記格子状隔壁の第一隔壁ライン上に配設されていることを特徴とする。

【００１４】

本発明の請求項８に係る発明は、請求項７記載の有機ＥＬ装置において、前記複数の突起物が前記格子状隔壁の第一隔壁ラインと第二隔壁ラインとの交差部上に配設されていることを特徴とする。

本発明の請求項９に係る発明は、請求項７又は８記載の有機ＥＬ装置において、前記封止基材が前記発光画素領域からの光をカラー化するカラーフィルタ層と、該カラーフィルタ層を格子状に区画するブラックマトリクス層とを有することを特徴とする。

本発明の請求項１０に係る発明は、請求項９記載の有機ＥＬ装置において、前記突起物が前記ブラックマトリクス層と対向する位置に形成されていることを特徴とする。

【発明の効果】

【００１５】

本発明の請求項１に係る発明によれば、基板と封止基材との間隔（ギャップ）を格子状隔壁の第一隔壁ライン上に配設された複数の突起物により基板の全面にわたって一定に保つことが可能となるので、基板と封止基材との接着部に大気中の水分や空気等が入り込むことを抑制することができる。したがって、基板と封止基材との接着部に入り込んだ水分によって発光画素領域が変質したり、あるいは基板と封止基材との接着部に入り込んだ空気によって発光画素領域に気泡が発生したりすることを抑制することができる。また、例えば有機発光層を凸版印刷法によりパターン形成するに際して、有機発光層を第一隔壁ラインに沿ってパターン形成することで、凸版印刷版の凸部が突起物と干渉することを防止することができる。

【００１６】

本発明の請求項２に係る発明によれば、凸版印刷による印刷方向を格子状隔壁の横方向または縦方向のどちらに選択しても凸版印刷版の凸部が突起物と干渉し合うことがないので、格子状隔壁の横方向と縦方向のいずれの方向からでも有機発光媒体層を形成することができる。

本発明の請求項３に係る発明によれば、凸版印刷版の凸部を格子状隔壁で囲まれた領域に合せるだけで有機発光媒体層を第一電極上に形成することが可能となるので、第一電極上に有機発光媒体層を精密に形成することができる。

【００１７】

本発明の請求項４に係る発明によれば、凸版印刷版の凸部が格子状隔壁の側面と干渉することを防止することが可能となり、これにより、第一電極上に有機発光媒体層を精密に形成することができる。

Petitioner Ex 1015, p. 660
BOE et al. v. Samsung, IPR2023-00988

本発明の請求項５に係る発明によれば、凸版印刷版の凸部が突起物と干渉することを防止することが可能となり、これにより、第一電極上に有機発光媒体層を精密に形成することができる。

【００１８】

本発明の請求項６に係る発明によれば、凸版印刷版の凸部が突起物と干渉することを防止することが可能となり、これにより、第一電極上に有機発光媒体層を精密に形成することができる。

本発明の請求項７に係る発明によれば、基板と封止基材との間隔（ギャップ）を格子状隔壁の第一隔壁ライン上に配設された複数の突起物により基板の全面にわたって一定に保つことが可能となるので、基板と封止基材との接着部に大気中の水分や空気等が入り込むことを抑制することができる。したがって、基板と封止基材との接着部に入り込んだ水分によって発光画素領域が変質したり、あるいは基板と封止基材との接着部に入り込んだ空気によって発光画素領域に気泡が発生したりすることを抑制することができる。

【００１９】

本発明の請求項８及び９に係る発明によれば、凸版印刷による印刷方向を格子状隔壁の横方向または縦方向のどちらに選択しても凸版印刷版の凸部が突起物と干渉し合うことがないので、格子状隔壁の横方向と縦方向のいずれの方向からでも有機発光媒体層を形成することができる。

本発明の請求項１０に係る発明によれば、格子状隔壁上に配設された複数の突起物をブラックマトリクス層の交点に当接させた状態で基板と封止基材とを貼り合わせることができる。

【図面の簡単な説明】

【００２０】

【図１】本発明の一実施形態に係るトップエミッション型有機ＥＬ装置の構造を模式的に示す断面図である。

【図２】本発明の一実施形態に係るトップエミッション型有機ＥＬ装置の格子状隔壁上に配設された突起物を模式的に示す図である。

【図３】有機ＥＬ装置の有機発光媒体層を形成するときに用いられる凸版印刷版の凸部と発光画素領域を模式的に示す断面図である。

【発明を実施するための形態】

【００２１】

以下、本発明の実施の形態について図面を参照して説明する。なお、以下の説明で参照する図面は本発明の構成を説明するためのものであり、図示される各部の大きさや厚さ、寸法等は実際のものとは異なる。また、本発明はこれらに限定されるものではない。

図１～図３は本発明の一実施形態を説明するための図で、図１（ａ）は本発明の一実施形態に係るトップエミッション型有機ＥＬ装置の有機ＥＬ素子基板の構造を模式的に示す断面図、図１（ｂ）は本発明の一実施形態に係るトップエミッション型有機ＥＬ装置のカラーフィルタ基板の構造を模式的に示す断面図である。また、図１（ｃ）は本発明の一実施形態に係るトップエミッション型有機ＥＬ装置の構造を模式的に示す断面図で、本発明の一実施形態に係るトップエミッション型有機ＥＬ装置は、図１（ａ）に示す構造の有機ＥＬ素子基板１０と図１（ｂ）に示す構造のカラーフィルタ基板２０とを接着層３０により貼り合わせて形成されている。

【００２２】

ここで、有機ＥＬ素子基板１０は基板１１、平坦化膜１２、第一電極１３、格子状隔壁１４、突起物１５、有機発光媒体層１６、第二電極１７、保護膜１８及び薄膜トランジスタ層（図示せず）を含んで構成され、カラーフィルタ基板２０は封止基板２１、カラーフィルタ層２２及びブラックマトリクス層２３を含んで構成されている。

以下、有機ＥＬ素子基板１０を構成する各部について説明する。

基板１１の素材としては、絶縁性を有する材料または表面に絶縁性を有する薄膜を形成した基板であればよく、基板の色も特に限定されるものではない。この基板１１の表面に

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は、後述する第一電極１３への電力供給を制御する目的で薄膜トランジスタ（ＴＦＴ）が形成される。この薄膜トランジスタは、公知の技術により作成することが可能である。たとえば、ソース領域、ドレイン領域およびチャネル領域をそれぞれ有し、多結晶シリコンやアモルファスシリコン等からなる半導体膜を基板１１上に形成し、半導体膜を覆う透明なゲート絶縁膜上にゲート電極を形成することでＴＦＴを基板１１上に形成することができる。この場合、ゲート電極はＡｌ、Ｍｏ、Ｔｉ、Ｔａ等から形成され、かつ半導体膜のチャネル領域に対応する位置に形成されることが好ましい。

【００２３】

平坦化膜１２は、基板１１上にＴＦＴを形成することにより生じた基板表面の凹凸を吸収し、基板表面を平坦化させる目的で基板１１上のＴＦＴと第一電極１３との間に形成されるものである。従って、平坦化膜１２の素材としては、絶縁性を有すると共に平坦性に優れた材料を用いる必要があり、例えばポリイミド系やアクリル系などの樹脂材料を挙げることができる。

【００２４】

第一電極１３は平坦化膜１２の表面に形成されるものであり、ＴＦＴを機能させるために、平坦化膜１２に形成されたスルーホール内の金属配線を介してＴＦＴのゲート電極と電気的に接続される。なお、ＴＦＴのソース電極と接続される場合は陽極として機能し、ＴＦＴのドレイン電極と接続される場合は陰極として機能する。

第一電極１３の素材としては、導電性を有する材料であれば特に制約を受けないが、仕事関数の大きい材料（例えば、スズドープ酸化インジウム（ＩＴＯ）、亜鉛ドープ酸化インジウム（ＩＺＯ）等の導電性金属酸化物）を用いることが好ましい。また、第一電極１３の厚さも特に制約はないが、例えば０．０２μｍ以上０．５μｍ以下の厚さで平坦化膜１２上に形成することで格子状隔壁１４の厚みより薄くなるので好ましい。

【００２５】

第一電極１３をＩＴＯ、ＩＺＯ等の導電性金属酸化物で形成する場合は、効率のよい発光を得るために、反射率の高いメタル電極を第一電極１３と平坦化膜１２との間に形成してもよい。このようなメタル電極は導電性金属酸化物より抵抗率が低いため、メタル電極が補助電極として機能すると同時に、光を対向基板側へ反射させることによる光の有効利用を図ることが可能である。メタル電極としては反射率の高い金属であればよく、例えばＡｇ、Ａｌ、Ｍｏ、Ｔａなどの高反射率金属が挙げられる。

【００２６】

格子状隔壁１４は第一電極１３、有機発光媒体層１６及び第二電極１７からなる発光画素領域を格子状に区画するためのもので、第一電極１３の端部を覆いながら平坦化膜１２上に格子状に形成される。格子状隔壁１４の素材としては絶縁性を有するものであれば特に制約はないが、具体的にはポリイミド系、アクリル樹脂系、ノボラック樹脂系などの材料が挙げられる。

【００２７】

また、格子状隔壁１４は互いに平行な複数の第一隔壁ライン１４１（図２参照）と、これらの第一隔壁ライン１４１と直交する複数の第二隔壁ライン１４２（図２参照）とで形成されている。

平坦化膜１２の表面に格子状隔壁１４を形成するときには格子状隔壁１４の高さを有機ＥＬ素子全体の厚みに応じて設定すればよいが、格子状隔壁１４の高さが０．１μｍ未満の場合は有機発光媒体層１６の形成時における各発光色の塗り分けが不十分となったり、格子状隔壁１４が第一電極１３の端部を覆いきることが出来ずにショートしたりするなどの現象が生じ、１０μｍを超える場合は有機発光媒体層１６の形成に支障が生じるという理由から、格子状隔壁１４の高さを０．１μｍ以上１０μｍ以下、望ましくは０．５μｍ以上２μｍ以下とすることが好ましい。

【００２８】

突起物１５は有機ＥＬ素子が形成された基板１１とカラーフィルタ層２２等が形成された封止基板２１とのギャップ（間隔）を一定に保持して有機ＥＬ装置全体の高さを一定に

Petitioner Ex 1015, p. 662
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するためのもので、保護膜１８の表面から先端を突出させて格子状隔壁１４上に設けられている。

図２は格子状隔壁上に配設された突起物を模式的に示す図で、図２に示すように、突起物１５は格子状隔壁１４の第一隔壁ライン１４１上に、好ましくは第一隔壁ライン１４１と第二隔壁ライン１４２との交差部１４３上に配設されている。

【００２９】

突起物１５の形成方法としては公知の技術を用いることが可能であり、例えばフォトリソグラフィー法、印刷法などが挙げられる。また、パターン形成法としてロールコート法やスピンコート法などを用い、フォトリソグラフィー法と組み合わせることにより形成される方法もある。

突起物１５の素材としては、突起物１５が封止基板２１からの応力に対して変形や変質が生じない材料であることが望ましく、この条件を満たす材料であればよい。例えば、エポキシモノマー、エポキシオリゴマーといった熱硬化性エポキシ樹脂などの熱硬化性樹脂、ポリエステル樹脂、アクリル樹脂などの熱可塑性樹脂、光硬化性エポキシ樹脂などの光硬化性樹脂などが挙げられ、これらの材料を単独もしくは複数組み合わせてもよい。

【００３０】

ただし、突起物１５が有機ＥＬ素子基板１０の高さを一定にさせ、突起物１５の先端が封止基板２１および接着層３０と接することにより均一な貼り合わせを実現する。そのため、突起物１５は加工が容易な材質であることが好ましい。このような条件を満たす材料として、硬化後の加工が容易であるアクリル樹脂が突起物１５の材料として好ましい。

上述した突起物１５を格子状隔壁１４の第一隔壁ライン１４１上に、好ましくは第一隔壁ライン１４１と第二隔壁ライン１４２との交差部１４３上に配設する場合は、突起物１５の高さを０．５μｍ以上、望ましくは格子状隔壁１４の高さと合計した高さが１０μｍ以下となる高さとすることが好ましい。これは、突起物１５の高さが０．５μｍ未満の場合、貼り合わせ後の封止基板２１から発生する応力に突起物１５が耐えることができずに損傷してしまい、有機ＥＬ装置内のセルギャップを均一に出来ず、大気中の水分や酸素の混入による劣化につながるという理由からである。

【００３１】

有機発光媒体層１６は、第一電極１３と第二電極１７との間に形成され、少なくとも有機発光層を含み、かつ低電圧で高効率の発光を目的として正孔注入層と、正孔輸送層と、電子輸送層と、電子注入層とを適宜選択し、各層を積層させた構造体である。なお、有機発光媒体層１６の各層は単層構造または積層構造のどちらでもよい。また、有機発光層の発光色も問わないが、望ましくは赤色、緑色、青色の三色であることが好ましい。

【００３２】

有機発光媒体層１６の正孔輸送層に用いられる正孔輸送材料としては、銅フタロシアニンやその誘導体、１，１－ビス（４－ジ－ｐ－トリアミノフェニル）シクロヘキサン、Ｎ，Ｎ´－ジフェニル－Ｎ，Ｎ‘－ビス（３－メチルフェニル）－１，１´－ビフェニル－４，４’－ジアミンなどの芳香族アミンなどの低分子材料、ポリアニリン誘導体、ポリチオフェン誘導体、ポリビニルカルバゾール誘導体、ポリ（３，４－エチレンジオキシチオフェン）（以下、ＰＥＤＯＴ）や、ＰＥＤＯＴとポリスチレンスルホン酸（以下、ＰＳＳ）との混合物（ＰＥＤＯＴ／ＰＳＳ）などの高分子材料、ポリチオフェンオリゴマー材料、$CU_2O$、$Mn_2O_3$、ＮｉＯ、$Ag_2O$、$MoO_2$、ＺｎＯ、ＴｉＯ、$Ta_2O_5$．$MoO_3$、$WO_3$、$MoO_3$どの無機材料化合物などが挙げられる。これらの材料から正孔輸送層を形成する手法としては公知の技術を用いることができ、例えば真空蒸着法、スパッタリング法、あるいは正孔輸送材料を溶媒に溶解および分散させることによりインキ化させた正孔輸送材料インキを塗布する方法などが挙げられる。また、正孔輸送材料インキを塗布する方法も公知の技術を用いることができ、例えばスピンコート法、フォトリソグラフィー法、インクジェット法、印刷法などが挙げられる。

【００３３】

また、正孔輸送材料が高分子材料の場合、正孔の輸送性を高める目的で、有機発光媒体

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層１６内にインターレイヤ層を形成してもよい。このインターレイヤ層は正孔輸送層と有機発光層との間に形成されることが好ましい。このようなインターレイヤ層の材料としては、ポリアリーレン系、ポリアリーレンビニレン系、ポリフルオレン系等の高分子材料や、芳香族アミンなどの低分子を混合させたものが挙げられる。

【００３４】

有機発光媒体層１６の有機発光層に用いられる有機発光材料としては、クマリン系、ペリレン系、ピラン系、アンスロン系、ポルフィレン系、キナクドリン系、Ｎ，Ｎ´－ジアルキル置換キナクドリン系、ナフタルイミド系、イリジウム錯体系、白金錯体系などの低分子発光性色素を、ポリスチレン、ポリメチルメタクリレート、ポリビニルカルバゾールなどの高分子材料中に溶解、もしくは重合させたものや、ポリアリーレン系、ポリアリーレンビニレン系、ポリフルオレン系などの高分子材料が挙げられる。

【００３５】

これらの有機発光材料を用いて有機発光層を形成する場合は、有機発光材料を溶媒に溶解および分散させることによりインキ化させた有機発光インキを塗布する方法を用いることができ、この場合に用いられる溶媒としては、トルエン、キシレン、アニソール、メチルエチルケトン、メチルイソブチルケトン、シクロヘキサノンなどの単独、またはこれらの混合溶媒が挙げられる。特に、トルエン、キシレン、アニソールといった芳香族有機溶媒が好ましい。

【００３６】

また、有機発光材料をインキ化して塗布する方法も公知の技術を用いることができ、例えばスピンコート法、フォトリソグラフィー法、インクジェット法、印刷法などが挙げられる。

有機発光媒体層１６の電子輸送層に用いられる電子輸送材料としては、２－（４－ビフェニルイル）－５－（４－ｔ－ブチルフェニル）－１，３，４－オキサジアゾール、２，５－ビス（１－ナフチル）－１，３，４－オキサジアゾールなどが挙げられる。また、これらの電子輸送材料にナトリウム、バリウム、リチウムといった仕事関数が低いアルカリ金属を少量ドープさせてもよい。

【００３７】

次に、有機発光媒体層１６の形成方法について説明する。なお、以下の説明では本発明を有機発光層の形成に適用した場合を例として説明するが、正孔輸送層、電子輸送層などについても適用可能である。

有機発光媒体層１６の有機発光層を形成する場合、本実施形態では、凸版印刷法を用いて有機発光層を形成する。凸版印刷法とは、印刷版の基材表面に複数の凸部が合成樹脂材料等により形成された印刷版（以下「凸版」という。）を用いた印刷法のことであり、このような印刷法を用いることで基板上に精細なパターンを形成することが可能となる。特に、凸版印刷法による方法は、精細なパターン形成、および膜厚均一性などに優れた層形成を可能とするとともに、有機発光材料として高分子材料を用いることを可能とする。したがって、格子状隔壁１４に囲まれた発光画素領域に高精細で平坦性の高い有機発光層を形成することが可能となる。特に、有機発光層を複数の発光色に塗り分ける場合に好適である。

【００３８】

凸版印刷法を用いて有機発光層等をパターン形成する場合、凸版基材表面の凸部がストライプ状に形成された凸版を用いることで、一方向のみの位置合わせを厳密に行うだけで良いという利点がある。すなわち、凸版の凸部を格子状隔壁１４で囲まれた発光画素領域に合わせるだけで有機発光層を凸版印刷法によりパターン形成することが可能となるので、印刷ずれのない有機発光層を第一電極１３上にパターン形成することが可能となる。

【００３９】

凸版の基材としては、印刷に対する機械的強度を有し且つ有機発光材料に添加される有機溶剤に対する耐性が高い材料であればよく、例えば鉄、銅、アルミニウムなどの金属材料、鉄とニッケルなどの合金材料などが挙げられる。凸版基材表面の凸部は、公知の技術

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により形成することができ、材料は問わない。好ましくは、ポリエチレン、ポリスチレン、ポリブタジエン、ポリ塩化ビニル、ポリアミド、ポリエチレンテレフタレート、ポリビリニアルコールなどの合成樹脂、鉄、銅、アルミニウムなどの金属材料、およびそれらの単層体や積層体などを凸部の材料として使用できる。

【００４０】

基材表面に複数の凸部がストライプ状に形成された凸版を用いて有機発光層を形成する場合、突起物１５が例えば図２（ｂ）に示すような配置で格子状隔壁１４上に配設される場合には、突起物１５との干渉を避けるために、図２（ｂ）に矢印Ｘ１で示す方向（第一隔壁ライン１４１と平行な方向）に沿って有機発光層を凸版印刷法により形成する必要がある。

【００４１】

これに対し、図２（ａ）に示すように、突起物１５が格子状隔壁１４の第一隔壁ライン１４１と第二隔壁ライン１４２との交差部１４３上に配設されている場合には、凸版による印刷方向を格子状隔壁１４の横方向（図２（ａ）に矢印Ｘ１で示す方向）または縦方向（図２（ａ）に矢印Ｙ１で示す方向）のどちらに選択しても凸版の凸部と突起物１５とが干渉し合うことがないので、格子状隔壁１４の横方向と縦方向のいずれの方向からでも有機発光層を形成することができる。

【００４２】

したがって、突起物１５が図２（ａ）に示す配置で格子状隔壁１４上に配設されている場合は、有機発光層を図２（ａ）に矢印Ｘ１で示す方向に沿って凸版印刷法により形成した後、有機発光層上に形成される次の層（例えば第一電極１３が陽極の場合は電子輸送層、第一電極１３が陰極の場合は正孔輸送層）を有機発光層の印刷方向と直角に交差する方向（図２（ａ）に矢印Ｙ１で示す方向）に沿って凸版印刷法により形成することが可能となる。

【００４３】

図３は、有機発光媒体層を形成するときに用いられる印刷版の凸部と発光画素領域を模式的に示す断面図である。なお、図３では３箇所の格子状隔壁１４と発光画素領域を示しているが、実際の有機ＥＬ装置では、図３に示すような格子状隔壁１４と発光画素領域が有機ＥＬ素子基板１０上に複数形成されている。

図３に示すように、発光画素領域の一画素の長さをａ、前記した凸版のストライプ状凸部３１の短辺方向の長さをｂ、格子状隔壁１４上に設けられた複数の突起物１５のうち隣り合う二つの突起物１５の間隔をｘとした場合、本実施形態では、印刷版の凸部３１と突起物１５とが干渉し合うのを防止するために、ａ＜ｂ＜ｘの関係を満たしている。

【００４４】

このようにして形成される有機発光媒体層１６の厚さは、基板１１と封止基板２１との貼り合わせ時における不具合を解消するために、有機発光媒体層１６の構造を単層構造または複数の層からなる積層構造とする場合でも、格子状隔壁１４との高さの差が１μｍ以下、望ましくは０．０５～０．２μｍであることが好ましい。

第二電極１７は、第一電極１３が陽極の場合は陰極として機能し、第一電極１３が陰極の場合は陽極として機能するように、有機発光媒体層１６上に形成される。第二電極１７を陰極として用いる場合、電子注入効果を高める目的で仕事関数の小さい材料を用いることが好ましく、例えばＬｉ、Ｎａ等のアルカリ金属、Ｍｇ、Ａｌ、Ｂａ、Ｃａ、Ｓｒ等のアルカリ土類金属、ＬｉＦ等のフッ化アルカリ金属などが仕事関数の小さい材料として挙げられる。また、第二電極１７の構造として、これら金属の単層構造でもよく、積層構造でもよいものとし、複数の金属を組み合わせた構造でもよい。

【００４５】

第二電極１７の素材としては、有機発光媒体層１６からの発光を通過させるために、透光性を有する材料を用いる必要がある。しかし、このような仕事関数の小さい材料は透光性が低いため、金属同士や金属と化合物の積層構造、および合金系を用いることにより低透光性を補う構造が用いられることもある。また、仕事関数の小さい金属単体を極薄膜化

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とすることにより、透光性の低下を最小限とする手法が取られる。このような構造体の場合、効率を高める目的で、ＩＴＯ等の透明導電性材料との積層構造にすることが好ましい。

【００４６】

保護膜１８は、第二電極１７をはじめとして有機ＥＬ素子基板上の格子状隔壁１４などを覆うように形成され、電気的絶縁性を有する薄膜である。また、保護膜１８は酸素や水分の透過を防止し、有機ＥＬ素子基板上に形成された積層各部の劣化を防ぐ目的で形成される。保護膜１８の形成方法には特に制約はなく、保護膜は単層構造または複数の層からなる積層構造のどちらでもよい。

【００４７】

保護膜１８の膜厚としては、封止基材としての封止基板２１からの応力に耐えられる膜厚であれば特に制約はないが、有機発光媒体層１６からの発光が保護膜１８を通過するため、例えば０．５μｍ以上１０μｍ以下、望ましくは０．５μｍ以上１０μｍ以下であることが好ましい。

保護膜１８の素材としては、封止基材としての封止基板２１からの応力に耐えられる材料であれば特に制約はないが、有機発光媒体層１６からの発光が通過するため、例えば$Al_2O_3$、ＴｉＯ、ＺｎＯ等の無機酸化物、$Si_3N_4$等の無機窒化物を用いることが好ましい。

【００４８】

次に有機ＥＬ装置の封止基板２１について説明する。

封止基板２１は、有機発光媒体層１６からの発光が通過するため、透光性を有する必要がある。このような封止基材として、カラーフィルタ基板を用いる場合もある。カラーフィルタ基板とは特定の波長を選択するもの、および発光波長を変換させ透過させるものなどを可能とする基板を指しており、有機ＥＬ装置においては有機発光媒体層１６からの発光に対して機能する。また、このようなカラーフィルタ基板とは、少なくとも透光性のある基板上の一面に、カラーフィルタ層２２およびブラックマトリクス層２３が形成された基板を指す。

【００４９】

封止基材としては、該封止基材を有機ＥＬ素子基板１０と貼り合わせた後に、基板の変形や応力により有機ＥＬ素子基板１０に対して損傷を与えない材料が用いられる。また、有機発光媒体層１６からの発光波長およびカラーフィルタ層２２によって変換された光の波長に対して透光性を有する材料で封止基材が形成されており、このような封止基材の材質としては、カラーフィルタ層２２やブラックマトリクス層２３の形成条件（温度、溶媒、応力など）に耐えられる材質、例えばガラス、ポリエチレンテレフタレート、ポリメチルメタクリレート等の樹脂を含んだ材質、特に無アルカリガラスが好ましい。

【００５０】

カラーフィルタ層２２は、封止基板２１上に形成され、ブラックマトリクス層２３により区画された画素領域内に、少なくとも２色以上の薄膜が形成された構造を指しており、その画素領域の配置形状、配列、単位画素領域面積、薄膜の大きさは問わない。また、２色以上の薄膜は単層構造または複積構造のどちらでもよく、有機ＥＬ素子基板１０の有機発光媒体層１６と同構成である赤色、緑色、青色の薄膜が形成されたものが好ましい。このようなカラーフィルタ層２２は公知の技術により形成することができ、材質や形成方法は特に限られるものではない。

【００５１】

ブラックマトリクス層２３は、カラーフィルタ層２２が形成される領域の周囲に形成される。このため、ブラックマトリクス層２３により区画された領域がカラーフィルタ基板における画素領域となる。このようなブラックマトリクス層２３は、カラーフィルタ層２２を形成するときの混色や層間の光漏れを防止したり、あるいはフロントパネル側から見た際に有機ＥＬ素子基板１０上のＴＦＴ配線や端子部を覆うことによる写りこみを防止する目的で封止基板２１の表面に形成される。このような条件を満たすブラックマトリクス

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層であれば、その形状や配列、面積、大きさは特に制約されるものでない。また、ブラックマトリクス層２３の構造は単層構造または複数の層からなる積層構造のどちらでもよい。

【００５２】

ただし、カラーフィルタ層２２及びブラックマトリクス層２３が形成された封止基板２１と有機ＥＬ素子基板１０とを接着剤により貼り合わせる場合、有機発光媒体層１６からの発光が遮蔽されないように封止基板２１を配置して貼り合わせを行う必要があり、そのためにはブラックマトリクス層２３を有機ＥＬ素子基板１０上の格子状隔壁１４と配置させた状態で貼り合わせることが好ましい。よって、本発明では、ブラックマトリクス層２３は格子状隔壁１４と同形状である格子形状を有している。

【００５３】

次に、有機ＥＬ装置の封止構造について説明する。

接着層３０は、外部環境の酸素や水分の透過による有機ＥＬ装置の劣化を防ぐために、有機ＥＬ素子基板１０とカラーフィルタ基板２０との間に形成される。そのため、接着層３０は低透湿性を有する材質であることが好ましく、周囲の環境により変質しない材質であること、経時的に変形、収縮、膨張などの現象がほぼ発生しない材質であることなどが望まれる。

【００５４】

このような接着層３０は公知の技術により形成することが可能であり、例えばスピンコート法、ディスペンス法、フォトリソグラフィー法、印刷法、ラミネート法などの方法により接着層３０を形成することができる。また、接着層３０の材質も公知のものを使用でき、好ましくは液状接着剤を用いることができる。この場合、接着層３０は有機発光媒体層１６からの発光波長に対して透光性を有する必要がある。また、有機発光媒体層１６からの発光を効率よく透過させるために、接着層３０の屈折率が保護膜１８の屈折率より低い材料を接着層３０の素材として用いることが好ましい。

【００５５】

接着層３０の屈折率が保護膜１８の屈折率より低い材料としては、例えば熱硬化型エポキシ樹脂などの熱硬化型接着性樹脂、ポリエチレン樹脂やアクリル樹脂などの熱可塑型接着性樹脂、光硬化型エポキシ樹脂などの光硬化型接着性樹脂などが挙げられる。

接着層３０の形成方法としては、一例として、一方の基板上の画素領域に沿って周辺シール剤を塗布した後、接着剤を塗布した基板と他方の基板と貼り合わせを実施する手法が挙げられる。この場合、接着剤や周辺シール剤の塗布方法は特に限られるものではなく、公知の方法を用いることができる。また、接着剤や周辺シール剤が塗布される基板は有機ＥＬ素子基板１０またはカラーフィルタ基板２０のどちらでもよいが、接着剤や周辺シール剤を塗布した後は、カラーフィルタ層２２と有機発光媒体層１６とを対向させると共にブラックマトリクス層２３と格子状隔壁１４とを対向させて両基板の貼り合わせを行う。

【００５６】

本実施形態において、接着層３０の形成方法は、接着性樹脂からなる周辺シール剤を基板上に塗布した後、周辺シール剤よりも粘度が低い樹脂材料からなる接着剤を周辺シール剤の内部全体に塗布する。この手法により、硬化した周辺シール剤により接着剤の流出を防ぐことが可能となる。

周辺シール剤や接着剤の材料としては公知の材料を選択することが可能であるが、熱硬化型エポキシ樹脂などの熱硬化型接着性樹脂、ポリエチレン樹脂やアクリル樹脂などの熱可塑型接着性樹脂、光硬化型エポキシ樹脂などの光硬化型接着性樹脂を用いることが好ましい。なお、周辺シール剤はカラーフィルタの画素領域外となる位置に塗布され、画素領域上には接着剤のみが塗布される。

【００５７】

有機ＥＬ素子基板１０とカラーフィルタ基板２０とを接着層３０により貼り合わせる際には、接着層３０が低透湿性材料であり、内部残留の水分や酸素により有機ＥＬ素子が変質するなどの理由から、外部環境のみならず、有機ＥＬ装置内に酸素や水分がほぼ存在し

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ない状況にする必要がある。そこで、有機ＥＬ素子基板１０とカラーフィルタ基板２０とを貼り合わせを真空中、窒素雰囲気下、不活性ガス雰囲気下などの大気中の水分や酸素がほぼ存在しない環境下にて行う。ただし、上記の条件を満たす場合は公知の技術を用いることが可能である。

【００５８】

本実施形態では、ブラックマトリクス層２３がカラーフィルタ層２２を区画するように格子状に形成されているとともに、突起物１５が格子状隔壁１４の交差部１４３上に配設されているため、格子状隔壁１４とブラックマトリクス層２３とを対向させた状態で有機ＥＬ素子基板１０とカラーフィルタ基板２０とを貼り合わせると、図１（ｃ）に示すように、突起物１５の先端をブラックマトリクス層２３の交点に当接させた状態で基板１１と封止基板２１とを貼り合わせることができる。これにより、有機ＥＬ素子が形成された基板１１とカラーフィルタ層２２及びブラックマトリクス層２３が形成された封止基板２１との間隔（ギャップ）を基板の全面にわたって一定に保つことが可能となり、有機ＥＬ素子基板１０とカラーフィルタ基板２０との接着部に大気中の水分や空気が入り込みにくくなるので、有機ＥＬ素子の変質等が生じにくい有機ＥＬ装置を製造することができる。

なお、上述した本実施形態では、トップエミッション構造の有機ＥＬ装置について記述したが、ボトムエミッション構造の有機ＥＬ装置についても同様の手法を用いることが可能である。

【００５９】

［実施例１］

有機ＥＬ素子基板１０の基板１１として、基板の一面にＴＦＴが形成された厚さ０．７ｍｍの無アルカリガラスを用い、基板１１上に平坦化膜１２として厚さ０．１μｍのポリイミド膜をフォトリソグラフィー法により形成した後、第一電極１３として厚さ０．１５μｍのＩＴＯ膜を平坦化膜１２の上にスパッタリング法にて形成した。なお、平坦化膜１２にはスルーホールが形成されており、ＴＦＴと第一電極１３は電気的に接続されている。

【００６０】

次に、第一電極１３上に、ポリイミド樹脂からなる格子状隔壁１４を２μｍの厚さでフォトグラフィー法により形成し、この格子状隔壁１４の交差部１４３上に、アクリル樹脂からなる突起物１５を５μｍの高さでフォトグラフィー法により形成した。このとき、格子状隔壁１４に囲われた発光画素領域の数は９６０×５４０であった。また、突起物１５は柱状体となるように形成し、その先端部は正方形となるように形成した。さらに、突起物１５を格子状隔壁１４の全ての交差部１４３上に設け、２つの突起物の間隔が７６μｍとなるように突起物１５を形成した。

【００６１】

次に、有機発光媒体層１６として、正孔輸送層にＰＥＤＯＴ（０．０２μｍ）、有機発光材料にポリ［２－メトキシ－５－（２´エチルーヘキシロキシ）－１，４－フェニレンビニレン］をアニソールにて溶解させた溶液（０．１μｍ）を、それぞれ凸版印刷法より形成した。その後、有機発光媒体層１６上に第二電極１７として、ＩＴＯ膜（０．１μｍ）を形成し、ＩＴＯ膜の上に保護膜１８として、ＳｉＮｘ膜（１μｍ）を形成した。これにより、図１（ａ）に示すような有機ＥＬ素子基板１０を得た。

【００６２】

次に、封止基板２１として無アルカリガラスを用い、基板２１上にブラックマトリクス層２３として、フォトグラフィー工程にてカラーモザイクＣＫ－７８００（フジフイルムエレクトロニクスマテリアルズ（株）製）を用いた格子状の黒色薄膜（厚さ：１．５μｍ）と、画素領域の周囲に同黒色薄膜（厚さ：１．５μｍ）を形成した。その後、カラーフィルタ層２２として、フォトグラフィー工程にてカラーモザイクＣＲ－７００１を用いた赤色薄膜、カラーモザイクＣＧ－７００１を用いた緑色薄膜、カラーモザイクＣＢ－７００１を用いた青色の薄膜（それぞれフジフイルムエレクトロニクスマテリアルズ（株）製、厚み１．５μｍ）を形成して、図１（ｂ）に示すようなカラーフィルタ基板２０を得た

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。

【００６３】

次に、窒素雰囲気下装置内に有機ＥＬ素子基板１０を置き、周辺シール剤として光硬化型接着性エポキシ樹脂を、接着剤として熱硬化型接着性エポキシ樹脂をそれぞれ用いて、周辺シール剤と接着剤をそれぞれディスペンス法にて有機ＥＬ素子基板１０上に塗布した。このとき、接着剤は有機発光媒体層１６からの発光に対して透光性を有する材質を用いた。その後、真空下装置内にカラーフィルタ基板２０と有機ＥＬ素子基板１０を置き、接着剤塗布後、カラーフィルタ基板２０と有機ＥＬ素子基板１０とを対向させて配置した。このとき、カラーフィルタ基板２０のカラーフィルタ層２２と有機ＥＬ素子基板１０の有機発光媒体層１６とがそれぞれ対向すると共にブラックマトリクス層２３と格子状隔壁１４とがそれぞれ対向する位置になるようにカラーフィルタ基板２０と有機ＥＬ素子基板１０とを配置した。その後、突起物１５の先端が接着層３０を介してブラックマトリクス層２３の交点と接するように基板同士を加圧した後、常圧下にて８０℃のオーブンにて接着剤を硬化させることにより、図１（ｃ）に示すような有機ＥＬ装置を得た。

この有機ＥＬ装置を６０℃９０％ＲＨの条件に保たれた恒温恒湿槽内に１５００時間放置したが、有機ＥＬ装置内に気泡や画素欠陥の発生は見られなかった。

【００６４】

［比較例１］

突起物１５を有機ＥＬ素子基板上に形成せず、カラーフィルタ基板２０上のブラックマトリクス層２３上に突起物が形成された基板を用いて、実施例１に記載した接着方法と同様の方法で有機ＥＬ素子基板とカラーフィルタ基板とを貼り合わせて有機ＥＬ装置を得た。そして、貼り合わせ後の状態を確認したところ、接着層内に複数の気泡が見られた。さらに、比較例１で得られた有機ＥＬ装置を６０℃９０％ＲＨの条件に保たれた恒温恒湿内に１５００時間放置したところ、不均一な貼り合わせによる外部環境（水分や酸素）のガス混入により、全発光画素領域の約２０％程度において非発光となっていた。

【００６５】

［比較例２］

突起物１５を格子状隔壁１４の交差部１４３上以外の箇所に設けた有機ＥＬ素子基板を用いて、実施例１に記載した接着方法と同様の手段で有機ＥＬ素子基板とカラーフィルタ基板とを貼り合わせて有機ＥＬ装置を得た。

この有機ＥＬ装置において、正孔輸送層印刷時に、凸版のストライプ状凸部３１と突起物１５が接触した。この有機ＥＬ装置において貼り合わせ後の状態を確認したところ、印刷に起因した発光表示ムラが見られた。

【符号の説明】

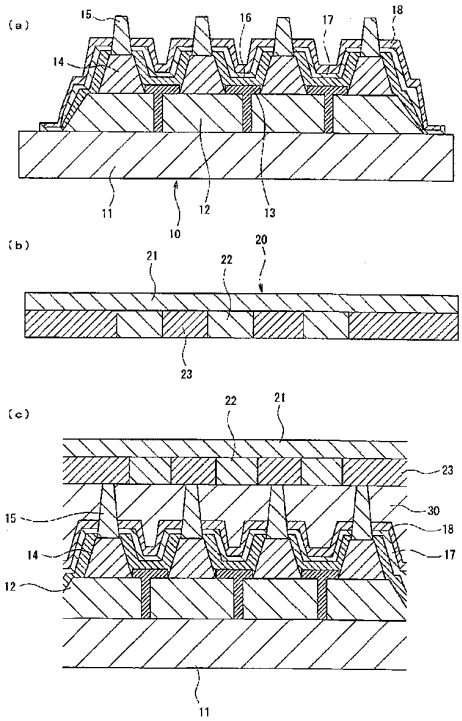
【００６６】

１０…有機ＥＬ素子基板
１１…基板
１２…平坦化膜
１３…第一電極
１４…格子状隔壁
１４１…第一隔壁ライン
１４２…第二隔壁ライン
１４３…交差部
１５…突起物
１６…有機発光媒体層
１７…第二電極
１８…保護膜
２０…カラーフィルタ基板
２１…封止基板
２２…カラーフィルタ層

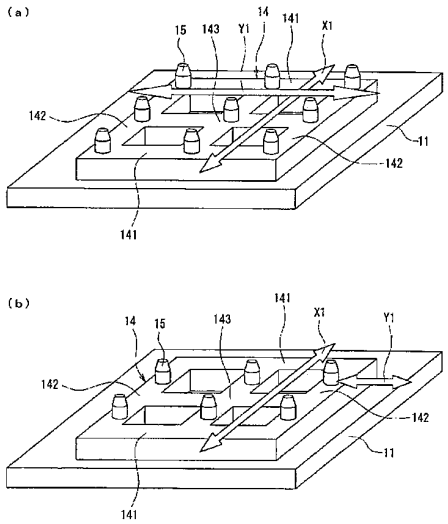
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２３…ブラックマトリクス層
３０…接着層
３１…凸版印刷版の凸部

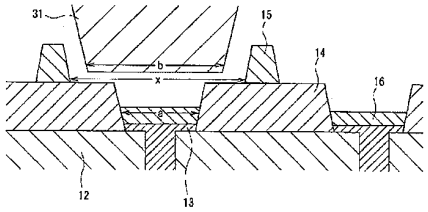
【図１】




【図２】



【図３】




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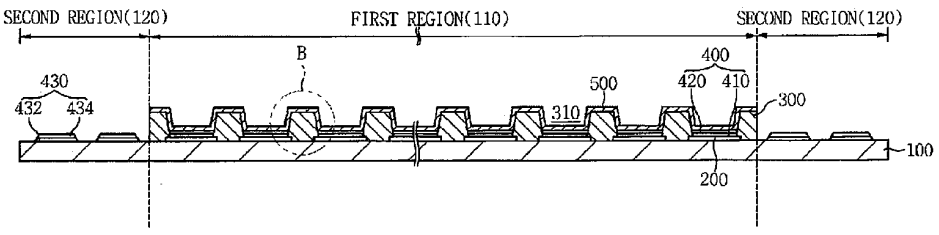
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(54) Title: DISPLAY DEVICE, AND METHOD OF MANUFACTURING THE DISPLAY DEVICE




(57) Abstract: In a display device and a method of manufacturing the display device, the display device has a substrate (100) having a first region (110) and a second region (120) disposed at a peripheral portion of the first region (110). The substrate (100) includes a plurality of first electrodes (200) disposed on the first region (110) and an insulation member (300) selectively disposed in the first region (110). The insulating member (300) has a plurality of openings (310) that expose a portion corresponding to the first electrodes (200). The substrate (100) includes light emitting patterns (400) being disposed on the first electrodes (200) through the openings (310) and the substrate (100) has a second electrode (500) disposed on the light emitting patterns (400). Accordingly, the thickness of the light emitting patterns (400) is uniformity so that the quality of an image generated from the light emitting patterns (400) is improved

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# Description

# DISPLAY DEVICE, AND METHOD OF MANUFACTURING THE DISPLAY DEVICE

## Technical Field

[1] The present invention relates to a display device and a method of manufacturing the display device. More particularly, the present invention relates to a display device with enhanced display quality and a method of manufacturing the display device.

## Background Art

[2] Generally, a display device operates as an interface device that converts data generated by an information-processing device into an image.

[3] The display device includes a cathode ray tube (CRT) display device, a liquid crystal display (LCD) device, an organic electro luminescent (EL) device, a plasma display panel (PDP) device etc. The CRT display device displays an image by controlling electron beams irradiated onto the fluorescent layer of the CRT screen. The LCD device displays an image using liquid crystal. The EL device displays an image through an organic light emitting layer that emits by a current supplied to the organic light emitting layer. The PDP displays an image by plasma.

[4] The organic EL device has merits such as a lightweight, a small thickness, a high brightness, an excellent color-reappearance, a fast response speed, a capability of displaying a full color image, a low power consumption, a wide range of operational temperature, a low manufacturing cost in comparison with other display devices such as the LCD device.

[5] The organic EL device includes anode electrodes, an organic layer, organic light emitting patterns, and a cathode electrode. The anode electrodes are disposed on a substrate in a matrix configuration, the organic layer is disposed on the substrate, and the organic layer has an opening that exposes the anode electrodes. The organic light-emitting patterns are disposed on the anode electrodes and emit light. The cathode electrode is disposed on the organic light-emitting patterns.

[6] Conventional organic light-emitting patterns of the organic EL device have a multiple-layered structure. For example, the organic light-emitting patterns have a hole injection layer (HIL), an emission material layer (EML) formed on the HIL, and an electron injection layer (EIL) formed on the EIL.

[7] The organic light-emitting patterns may be formed by various apparatus such as a slit mask processing apparatus, a spin coating processing apparatus, a vacuum

deposition processing apparatus etc. Recently, the organic light-emitting patterns are formed by an ink-jet type drop filling device.

[8] In forming the organic light-emitting patterns on the substrate, a speed of drying an organic light-emitting material of the organic light-emitting patterns is very important.

[9] Generally, the organic light-emitting material includes a volatile solvent. When the light-emitting patterns is formed on the substrate by the ink-jet type drop filling device, the thickness of the organic light emitting-patterns are affected by the speed of drying the organic light emitting material. When the speed of drying the organic light emitting materials is locally different, the thickness of the organic light emitting-patterns may not be uniformly controlled so that a brightness uniformity of lights generated from the organic light emitting-patterns may not be uniformly controlled

[10] In order to overcome this problem, the droplet including organic material is formed on a non-effective display region disposed on an organic layer of the substrate as well as an effective display region, thereby forming dummy organic light-emitting patterns on the non-effective display region. The dummy organic light-emitting patterns adjust the speed of drying the organic light-emitting patterns formed on the effective display region.

[11] However, the dummy organic light-emitting patterns disposed in the non-display region of the organic layer have a position higher than that of the organic light-emitting patterns in the display region by a thickness difference between the anode electrode and the organic layer. Therefore, a dummy organic material for forming the dummy organic light-emitting patters flows into the opening of the display region.

[12] When the dummy organic material flows into the opening, the thickness of the organic light-emitting patters may not be controlled, so that the display quality of the image may be deteriorated

## Disclosure of Invention

## Technical Problem

[13] the present invention is provided to substantially obviate one or more problems due to limitations and disadvantages of the related art.

[14] It is a feature of the present invention to provide a display device improving a display quality of an image.

[15] It is another feature of the present invention to provide a method of manufacturing of the display device.

## Technical Solution

[16] In accordance with one aspect of the present invention, a display device includes a substrate, a plurality of first electrodes, an insulation member, a light emitting patterns and second electrodes. The substrate has a first region and a second region disposed at a peripheral portion of the first region. The plurality of first electrodes is disposed on the first region. The insulation member is selectively disposed in the first region and the insulation member has a plurality of openings that expose a portion corresponding to the first electrodes, respectively. The light emitting patterns is disposed on the first electrodes through the openings, respectively. The second electrode is disposed on the light emitting patterns.

[17] In accordance with another aspect of the present invention, there is provided a method of manufacturing a display device. In the method, a plurality of first electrodes is formed on a first region formed on the substrate. An insulating layer formed on the first region and the insulating layer has openings so as to expose to the first electrodes. A plurality of light emitting patterns is formed on the first electrodes, respectively, and a second electrode formed on the first region to cover the light emitting patterns.

[18] According to the present invention, a display device includes a first electrodes formed on the first region of a substrate in a matrix configuration. An organic insulating layer formed on the second region formed around the first region and the organic insulating layer has an openings corresponding to the first electrodes. A plurality of organic light emitting patterns is formed on the first electrodes for emitting a light. A second electrode is formed on the organic light emitting patterns. Thus, the lights generated from the organic light emitting patterns have uniformity brightness so that the quality of the image is improved

## Brief Description of the Drawings

[19] The above and other features and advantage points of the present invention will become more apparent by describing in detailed exemplary embodiments thereof with reference to the accompanying drawings, in which:

[20] FIG. 1 is a plan view illustrating a display device in accordance with one embodiment of the present invention.

[21] FIG. 2 is a cross-sectional view taken along a line I-I' in FIG. 1.

[22] FIG. 3 is an enlarged view illustrating a portion "B" in FIG. 2.

[23] FIG. 4 is an enlarged view illustrating a portion "C" in FIG. 1.

[24] FIG. 5 is partially cut plan view illustrating another embodiment of the present invention.

[25] FIG. 6 is a plan view illustrating a display device in accordance with another

embodiment of the present invention.

[26] FIG. 7 is a cross-sectional view taken along a line II-II' in FIG. 6.

[27] FIG. 8 is a plan view illustrating a display device in accordance with another embodiment of the present invention.

[28] FIG. 9 is a cross-sectional view taken along a line III-III' in FIG. 8.

[29] FIGS. 10 to 20 are cross-sectional views and plan views illustrating a method of manufacturing a display device in accordance with still another embodiment of the present invention.

## Best Mode for Carrying Out the Invention

[30] The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to similar or identical elements throughout.

[31]

[32] Display Device

[33] FIG. 1 is a plan view illustrating a display device in accordance with one embodiment of the present invention. FIG. 2 is a cross-sectional view taken along a line I-I' in FIG. 1. FIG. 3 is an enlarged view illustrating a portion "B" in FIG. 2. FIG. 4 is an enlarged view illustrating a portion "C" in FIG. 1.

[34] Referring to FIGS. 1 to 4, a display device 700 includes a substrate 100, a plurality of first electrodes 200 disposed on the substrate 100, an insulating layer 300, an organic light emitting pattern 400 and a second electrode 500.

[35] Referring to FIG. 1, the substrate 100 includes a transparent material or an opaque material. When the substrate 100 includes the transparent material, the first electrodes 200 may include a transparent conductive material such as indium thin oxide (ITO) or indium zinc oxide (IZO).

[36] On the contrary, when the substrate 100 includes the opaque material such as an opaque synthetic resin, the first electrode 200 may include an opaque conductive material such as aluminum or aluminum alloy.

[37] In this embodiment, the substrate 100 includes for example the transparent material and the first electrode 200 includes ITO or IZO.

[38] The substrate 100 includes a first region 110 and a second region 120. The first

region 110 is disposed at the central portion of the substrate 100 and displays an image. The second region 120 is disposed at the peripheral portion of the first region 110. An electrical circuit and a signal wire, etc. are formed in the second region 120.

[39] Referring again to FIG. 2 and FIG 4, the first electrodes 200 are disposed in the first region 110 of the substrate 100, and the first electrodes 200 are arranged in a matrix configuration. In this embodiment, the first electrodes 200 include transparent conductive indium tin oxide (ITO) or indium zinc oxide (IZO).

[40] The first electrodes 200 are disposed on the substrate 100. The first electrodes 200 have a rectangular film shape. The first electrodes 200 have a length L on the substrate 100 in a first direction and have a width W on the substrate 100 in a second direction substantially perpendicular to the first direction. The first electrodes 200 are formed such that the first electrodes 200 are spaced apart from each other by an interval G.

[41] Each of the first electrodes 200 receives a first driving signal through a driving circuit that includes two thin film transistors (TFT), a storage capacitance and driving signal wires.

[42] The insulating layer 300 is disposed on the substrate 100. The insulating layer includes a photosensitive organic material that reacts with a light, an organic material such as benzocyclobutene (BCB), and an inorganic material such as SiOC.

[43] In this embodiment, the insulating layer 300 is selectively formed on the first region 110 of the substrate 100. Referring to FIGS 2 and 3, the insulating layer 300 has openings 310. The openings 310 are disposed in the first region 110 in a matrix configuration as the first electrodes 200 are disposed on the first region 110 in a matrix configuration. Thus, the openings 310 are formed at positions corresponding to the first electrodes 200. In this embodiment, the openings 310 may have a rectangular shape, a hexagonal shape, an octagonal shape or a circular shape etc.

[44] Each of the openings 310 may be arranged at the central portions of the first electrodes 200. Alternatively, the openings 310 are formed such that central portions of the openings 310 are deviated from the central portions of the first electrodes 200. In this embodiment, each of the openings 310 is formed on the central portion of the first electrodes 200.The openings 310 have a various function. That is, the openings 310 expose the first electrodes 200 and receive the flowable organic material in the openings 310 to prevent a spread of the organic material etc.

[45] Referring again to FIG. 3, an angle θ formed between the first electrodes 200 and an inner wall 320 of the openings 310 is in a range of about 30° to about 165°. When the angle θ is less than about 30° or is more than about 165°, uniformity of the

thickness of the organic light emitting patterns may be deteriorated so that the brightness of the light generated from the light emitting patterns may not be controlled. In this embodiment, the openings 310 formed at the insulating layer 300 are formed through a photolithography process or a dry etching process.

[46] Referring again to FIGS. 2 and 3, the organic light emitting patterns 400 is formed on the first electrode 200 through the opening 310 formed at the insulating layer 300. The organic light emitting patterns 400 include a hole injection layer (HIL) 410 and an emitting material layer (EML) 420. The hole injection layer 410 is disposed on the first electrodes 200, and the emitting material layer 420 is disposed on the emitting material layer 420.

[47] In order to form the organic light emitting patterns 400 on the first electrodes 200, an organic material including a volatile solvent is dropped into the openings 310 and dried so that the light emitting patterns are formed on the first electrodes 200.

[48] The thickness of the organic light emitting patterns 400 formed thereon is affected by the speeds of drying the organic material. When the speeds of drying the organic material is different from each other, the thickness of the organic light emitting patterns 400 may not be controlled so that a brightness uniformity of lights generated from the organic light emitting patterns 400 may not be controlled. Such a problem may occur at a first electrodes 200 arranged around a boundary between the first and second regions 110 and 120.

[49] To overcome this problem, the second region 120 has dummy light emitting patterns 430 including a dummy organic material that include the volatile solvent, so that the speed of drying the organic material positioned on the first electrodes 200 arranged around the boundary may be uniformly controlled.

[50] Alternatively, the dummy light emitting patterns 430 are directly disposed on a passivation layer (not shown) formed on the second region 120 while the driving circuit is manufactured on the first region 110. The dummy light emitting patterns 430 include a dummy hole injection layer 432 or includes the dummy hole injection layer 432 and a dummy emitting layer 434.

[51] When the insulating layer 300 remains on the second region 120, the dummy organic material for forming the dummy light emitting patterns 430 is positioned on the insulating layer 300 of the second region 120. Accordingly, the organic material may be capable of flowing into the opening 310 formed in the first region 110. When the dummy organic material flows into the opening 310, the display quality of the image may not be controlled.

[52] However, in this embodiment, the dummy organic material may not flow into the opening 310 because the dummy organic material and the organic material have substantially an identical height from the substrate 100.

[53] FIG. 5 is partially cut plan view illustrating another embodiment of the present invention.

[54] Referring to FIG. 5, the insulating layer 300 is extended from the first region 110 to the second region 120. The extended length of the insulating layer 300 is smaller than the length formed between the dummy organic light emitting patterns 430 and the organic light emitting patterns 400.

[55] Alternatively, because the dummy organic light emitting patterns 430 and the organic light emitting patterns 400 are arranged at intervals apart from the width of the openings 310, the extended length of the insulating layer is smaller than the width of the openings 310.

[56] Referring again to FIG. 2, after the organic light emitting patterns are formed on the first electrodes 200, the second electrode 500 is formed on the entire face of the substrate 100. The second electrode 500 includes aluminum or aluminum ally that has a low work function. The second electrode 500 is disposed on the insulating layer 300 and is electrically connected to the organic light emitting patterns 400.

[57] A second driving signal for displaying the image generated from a driving circuit (not shown) formed on a second region 120 is provided with the second electrode 500.

[58] FIG. 6 is a plan view illustrating a display device in accordance with another embodiment of the present invention. FIG. 7 is a cross-sectional view taken along a line $B_1$-$B_2$ in FIG. 6.

[59] Referring to FIGS. 6 and 7, a display device 700 includes a plurality of first electrodes 200, an insulating layer 300, organic light emitting patterns 400 and a second electrode 500.

[60] The substrate 100 includes a transparent substrate or an opaque substrate. When the substrate 100 includes the transparent substrate, the first electrodes 200 include a transparent conductive material, for example, indium thin oxide (ITO) or indium zinc oxide (IZO).

[61] On the contrary, when the substrate 100 includes the opaque substrate that includes an opaque synthetic resin material, the first electrodes 200 include an opaque conductive material. For example, the first electrodes 200 include aluminum or aluminum alloy. In this embodiment, the substrate 100 includes the transparent substrate.

[62] The substrate 100 includes a first region 110 and a second region 120. The first region 110 is disposed at the central portion of the substrate 100 to display an image. The second region 120 is disposed at the peripheral portion of the first region 110 to form an electrical circuit.

[63] The first electrodes 200 are disposed in the first region 110 of the substrate 100 in a matrix configuration. In this embodiment, the first electrodes 200 may have a rectangular shape. The first electrodes 200 have a length L in a first direction and have a width W in a second direction substantially perpendicular to the first direction. The first electrodes 200 are formed at regular intervals spaced apart from each other. In addition, each of the first electrodes 200 has the regular intervals of about G.

[64] A first driving signal for displaying the image generated from a driving circuit (not shown) is provided with the first electrodes 200. The driving circuit includes two thin film transistors (TFT), storage capacitor and driving signal wires.

[65] The insulating layer 300 includes a first insulating layer 360 and a second insulating layer 370. The first insulating layer 360 is positioned on the first region 110 of the substrate 100. A first insulating layer 360 includes a photosensitive organic material that reacts with a light, an organic material such as benzocyclobutene (BCB), an inorganic material such as SiOC.

[66] The first insulating layer 360 has a plurality of openings 310. The openings 310 are formed at positions corresponding to the first electrodes 200. The openings 310 are disposed in the first region 110 in a matrix configuration because the first electrodes 200 are disposed on the first region 110 in a matrix configuration.

[67] In this embodiment, the openings 310 may have a rectangular shape, a hexagonal shape, an octagonal shape or a circular shape in plane.

[68] Each of the openings 310 may be arranged at the central portion of the first electrodes 200. The openings 310 may be eccentrically arranged relative to the central portion of the first electrodes 200. In this embodiment, the openings 310 are eccentrically arranged relative to the central portion of the first electrodes 200. The openings 310 have a various function as the exposing of the first electrodes 200 or a receiving of the flowable organic material in the openings 310.

[69] The second insulating layer 370 is positioned on the second region 120. The second insulating layer 370 is formed at regular intervals spaced apart from the first insulating layer 360 in plane. As a result, a groove 125 is formed between the first and second insulating layers 360 and 370. The width of the groove 125 is broader than the width of the opening 310.

[70] The groove 125 prevents the dummy organic material disposed in the second region 110 from flowing into the opening 310.

[71] The organic light emitting patterns 400 are disposed on the first electrodes 200 through the opening 310 formed at the insulating layer 300. The organic light emitting patterns 400 include a hole injection layer 410 and a light emitting layer 420. The light emitting layer 430 is positioned on the hole injection layer 420.

[72] In order to form the organic light emitting patterns, an organic material having a volatile solvent is dropped and dried into the opening 310 so that the light emitting patterns are formed on the first electrodes 200.

[73] The thickness of the organic light emitting-patterns 400 formed thereon is affected by the speeds of drying the organic light emitting patterns 400. When the speeds of drying the organic light emitting-patterns 400 are different each other, the thickness of the organic light emitting patterns 400 may not be controlled so that a brightness uniformity of lights generated from the organic light emitting patterns 400 may not be controlled. Such a problem may occur at a first electrodes 200 arranged around a boundary between first and second regions 110 and 120.

[74] To overcome this problem, the second region has dummy light emitting patterns 430 including a dummy organic material that has the volatile solvent, so that the speed of drying the organic material positioned on the first electrodes 200 arranged around the boundary may be uniformly controlled.

[75] Alternatively, the dummy light emitting patterns 430 may be directly disposed on a passivation layer (not shown) formed on the second region 120 while the driving circuit is manufactured on the first region 110. The dummy light emitting patterns 430 include a dummy hole injection layer 432 and a dummy emitting layer 434 formed thereon.

[76] When the insulating layer 300 remains on the second region 120, the dummy organic material for forming the dummy light emitting patterns 430 is positioned on the insulating layer 300 of the second region 120. Accordingly, the organic material may be capable of flowing into the opening 310 formed in the first region 110. When the dummy organic material flows into the opening 310, the display quality of the image may not be controlled.

[77] However, in this embodiment, the dummy organic material may not flow into the opening 310 because the groove 125 is formed between the first and second insulting layer 360 and 370. The dummy organic material positioned in the groove 125 and the organic material positioned on the first electrodes 200 have substantially an identical

height from the substrate 100.

[78] After the organic light emitting patterns are formed on the first electrode 200, the second electrode 500 is formed on the entire face of the substrate 100. The second electrode 500 includes aluminum or aluminum ally that has a low work function. The second electrode 500 is disposed on the insulating layer 300 and is electrically connected to the organic light emitting patterns 400.

[79] A second driving signal for displaying the image generated from a driving circuit (not shown) formed on a second region 120 is provided with the second electrode 500.

[80] FIG. 8 is a plan view illustrating a display device in accordance with another embodiment of the present invention. FIG. 9 is a cross-sectional view taken along a line $B_3$-$B_4$ in FIG. 8.

[81] Referring to FIGS. 8 and 9, a display device 700 includes a substrate 100, a plurality of first electrodes 200, an insulating layer 300, an organic light emitting pattern 400 and a second electrode 500.

[82] The substrate 100 includes a transparent substrate or an opaque substrate. When the substrate 100 includes the transparent substrate, the first electrodes 200 include a transparent conductive material, for example, indium thin oxide (ITO) or indium zinc oxide (IZO).

[83] On the contrary, when the substrate 100 includes the opaque substrate that has an opaque synthetic resin material, the first electrode 200 includes an opaque conductive material, for example, aluminum or aluminum alloy. In this embodiment, the substrate 100 includes the transparent substrate.

[84] The substrate 100 includes a first region 110 and a second region 120. The first region 110 is disposed at the central portion of the substrate 100 to display an image. The second region 120 is disposed at the peripheral portion of the first region 110 to form an electrical circuit.

[85] The first electrodes 200 are disposed in the first region 110 of the substrate 100 in a matrix configuration. In this embodiment, the first electrodes 200 may have a rectangular shape. The first electrodes 200 have a length L in a first direction and have a width W in a second direction substantially perpendicular to the first direction. The first electrodes 200 are formed at regular intervals spaced apart from each other. In addition, each of the first electrodes 200 has the regular intervals of about G.

[86] A first driving signal for displaying the image generated from a driving circuit (not shown) is provided with the first electrodes 200. The driving circuit includes two thin film transistors (TFT), storage capacitor and driving signal wires.

[87] The insulating layer 300 is positioned on the substrate 100. The insulating layer 300 includes a photosensitive organic material that reacts with a light, an organic material such as benzocyclobutene (BCB), an inorganic material such as SiOC.

[88] In this embodiment, the insulating layer 300 is selectively formed on the first region 110 of the substrate 100. In addition, the insulating layer 300 has first openings 310 and second openings 125a.

[89] The first openings 310 are formed at positions corresponding to the first electrodes 200. The first openings 310 are disposed in the first region 110 in a matrix configuration because the first electrodes 200 are disposed on the first region 110 in a matrix configuration. In this embodiment, the first opening 310 may have a rectangular shape, a hexagonal shape, an octagonal shape or a circular shape in plane.

[90] Each of the first openings 310 may be arranged positions at the central portion of the first electrodes 200. The first openings 310 may be eccentrically arranged relative to the central portion of the first electrodes 200. In this embodiment, the first openings 310 are eccentrically arranged relative to the central portion of the first electrodes 200. The first openings 310 have a various function as the exposing of the first electrodes 200, a receiving of the flowable organic material, etc.

[91] The second openings 125a are formed on the second region 120 of the insulating layer 300. The second openings 125a are arranged in a matrix configuration. Intervals between the second openings 125a are substantially identical to the intervals between the first openings 310. The gap formed between the first and second openings 310 and 125a is narrower than the width of the first and second openings 310 and 125a.

[92] The organic light emitting patterns 400 are disposed on the first electrode 200 through the first opening 310 formed on the insulating layer 300. The organic light emitting patterns 400 include a hole injection layer 410 and a light emitting layer 420. The hole injection layer 410 is positioned on the first electrode 200 and the light emitting layer 420 is disposed on the hole injection layer 410.

[93] In order to form the organic light emitting patterns, an organic material having a volatile solvent is dropped and dried into the opening 310 so that the light emitting patterns are formed on the first electrodes 200.

[94] The thickness of the organic light emitting-patterns 400 formed thereon are affected by the speeds drying of the organic light emitting-patterns 400. When the speeds of drying the organic light emitting-patterns 400 is different each other, the thickness of the organic light emitting-patterns 400 may not be controlled so that a brightness uniformity of lights generated from the organic light emitting-patterns 400 may not be

controlled. Such a problem may occur at a first electrodes 200 arranged around a boundary between first and second regions 110 and 120.

[95] To overcome this problem, the second region has dummy light emitting patterns 430 including a dummy organic material that has the volatile solvent, so that the speed of drying the organic material positioned on the first electrodes 200 arranged around the boundary may be uniformly controlled.

[96] Alternatively, the dummy light emitting patterns 430 may be directly disposed on a passivation layer (not shown) formed on the second region 120 while the driving circuit is manufactured on the first region 110. The dummy light emitting patterns 430 includes a dummy hole injection layer 432 or includes the dummy hole injection layer 432 and a dummy emitting layer 434.

[97] When the insulating layer 300 remains on the second region 120, the dummy organic material for forming the dummy light emitting patterns 430 is positioned on the insulating layer 300 of the second region 120. Accordingly, the organic material may be capable of flowing into the openings 310 formed in the first region 110. When the dummy organic material flows into the openings 310, the display quality of the image may not be controlled.

[98] However, in this embodiment, the dummies organic material may not flow into the openings 310 because the dummy organic material and the organic material have substantially an identical height from the substrate 100.

[99] After the organic light emitting patterns 400 forms on the first electrode 200, the second electrode 500 is formed on the entire face of the substrate 100. The second electrode 500 includes aluminum or aluminum ally that has a low work function. The second electrode 500 is disposed on the insulating layer 300 and is electrically connected to the organic light emitting patterns 400.

[100] A second driving signal for displaying the image generated from a driving circuit (not shown) formed on a second region 120 is provided with the second electrode 500.

[101]

[102] Method of manufacturing of a Display Device

[103] FIG. 10 is a cross-sectional view illustrating a substrate in accordance with still another embodiment of the present invention.

[104] Referring to FIG. 10, the substrate 100 includes a first region 110 for displaying an image and a second region 120 disposed at a peripheral portion of the first region 110.

[105] A first conductive layer 200a including ITO or IZO is formed on the entire face of the substrate 100. The first conductive layer 200a is formed by a sputtering process or

a chemical vapor deposition (CVD) process.

[106] Then, a photo resist material is coated on the first conductive layer 200a by a spin coating process or a slit coating process, so that a photoresist film 200b is formed on the first conductive layer 200a.

[107] Next, a mask 201 aligns over the substrate 100. The mask 201 has a transparent body 201a, light absorbing portions 201b and light transmitting portions 201c. The light absorbing portions 201b having a quadrangular shape are formed on the transparent body in a matrix configuration. The light transmitting portions are formed between the light absorbing portions 201b in a lattice configuration.

[108] Then, a light generated from a light source (not shown) travels onto the photoresist film 200b through the light transmitting portion 201c of the mask 201. A photoresist film 200b is exposed to the light so that a photoresist pattern 200c is formed on the first conductive layer 200a by a development process.

[109] FIG. 11 is a cross-sectional view illustrating a first electrode and a photoresist pattern in accordance with still another embodiment of the present invention.

[110] Referring to FIG. 11, a portion of the first conductive layer 200a exposed to the photoresist pattern 200c is etched by a dry etching process or a wet etching process so that a first electrodes 200 are formed on the substrate 100 in a matrix configuration.

[111] In this embodiment, a driving circuit part for providing a driving voltage is formed on the substrate 100 before the first electrode 200 is formed on the substrate 100.

[112] FIG. 12 is a cross-sectional view illustrating the first electrode in FIG. 11.

[113] Referring to FIG. 12, the photoresist pattern 200c for forming the first conductive layer 200a is removed by a photoresist stripper solution so that the first electrodes 200 are disposed on the substrate 100 in a matrix configuration.

[114] FIG. 13 is a plan view illustrating the first electrodes formed on the substrate in FIG. 12.

[115] Referring to FIG. 13, the first electrodes 200 formed on the substrate 100 are formed at portions at regular intervals G spaced apart from each other. The first electrodes 200 having a quadrangular shape have a length L in a first direction and have a width W in a second direction substantially perpendicular to the first direction.

[116] FIG. 14 is a cross-sectional view illustrating an insulating layer formed on the substrate in FIG. 13.

[117] Referring to FIG. 14, an insulating layer is formed on the entire face of the substrate 100 to cover the first electrodes 200. At this time, the insulating layer may include an organic material or an inorganic material. The organic material may include such as a

photoresist material or benzocyclobutene (BCB) and the inorganic material may include such as a SiOC. In this embodiment, the insulating layer includes the photoresist material.

[118] FIG. 15 is a cross-sectional view illustrating the insulating pattern in FIG. 14.

[119] Referring to FIG. 15, a mask 301 aligns over the insulating layer 300b. The mask 301 selectively provides a light generated from a light source (not shown) from the insulating layer 300b. In this embodiment, the insulating layer is selectively exposed to the light passing therethrough.

[120] For this, the mask 301 has a transparent body 301a, light absorbing portions 301b and light transmitting portions 301c. The light transmitting portions 301c are formed on the transparent body 301a corresponding to the first electrode 200 in a lattice configuration. The light absorbing portions 301b are formed between the light transmitting portions 301c.

[121] In state that the mask 301 aligns over the substrate 100, the light generated from the light source travels onto the insulating layer 300a passing through the light transmitting portions 301c of the mask 301, so that the insulating layer 300a is partially exposed to the light.

[122] FIG. 16 is a cross-sectional view illustrating isolation patterns formed on the substrate in FIG. 15.

[123] Referring to FIG. 16, the insulating layer 300a exposed to the light is developed with a developing solution. Accordingly, the insulating layer 300 formed at the second region 120 and the insulating layer 300a corresponding to the first electrode 200 are removed to the insulating layer 300a so that isolation patterns 300 having an opening 310 are formed on the substrate 100.Alternatively, the isolation patterns may be capable of including the photoresist material as well as the BCB or the SiOC. Also, the isolation patterns are formed by a photo process or a dry etching process.

[124] The openings 310 formed at the insulating layer 300a have a circular shape or quadrangular shape in plane.

[125] An angle formed between the first electrodes 200 and the sidewall of the openings 310 has substantially about 30° to about 165°. When the angle has about 30° to about 165°, the thickness of an organic light emitting layer 400 formed on the first electrodes 200 may be precisely controlled

[126] Each of the openings 310 may be arranged positions at the central portion of the first electrodes 200 or may be eccentrically arranged positions relative to the central portion of the first electrodes 200. In this embodiment, the openings 310 are ec-

centrically arranged relative to the central portion of the first electrodes 200.

[127] FIG. 17 is a plan view illustrating isolating patterns in accordance with another embodiment of the present invention. FIG. 18 is a cross-sectional view taken along a line $D_1$-$D_2$ in FIG. 17.

[128] Referring to FIGS, 17 and 18, in this embodiment, isolating patterns 300 are extended from the boundary of the first and second regions 110 and 120 to the second region 120. An extended length of the isolating patterns 300 is narrower than the wid ths of the openings 310.

[129] FIG. 19 is a cross-sectional view illustrating an organic light emitting patterns formed in the first and second regions in FIG. 17.

[130] Referring to FIG. 19, organic light emitting patterns are formed in the openings 310 of the isolation patterns 300 positioned on the first region 110. To form the organic light emitting patterns, a hole injection layer 410 including a hole injection material is formed on the first electrodes 200. The hole injection material having a droplet shape is dropped into the openings 310 of the isolation patterns 300 by a spraying nozzle and the hole injection material is dried.

[131] The hole injection material includes a volatile solvent and the thicknesses of the hole injection layers 410 are difference in accordance with a speed of drying the hole injection material. When the thicknesses of the hole injection layers 410 are difference each other, a display failure may occurs to the display device.

[132] In order to prevent this problem, a dummy hole injection layer 430 is formed on the second region 120 at a regular intervals spaced apart form the hole injection layers 410 to control the speeds of drying the hole injection layers 410.

[133] Next, the light emitting material is dropped in the openings 310 and the light emitting material is dried to form the light emitting layer 420. In addition, a dummy light emitting material is dropped in the second region 120 and the light emitting material is dried to control the speed of drying the dummy light emitting material.

[134] FIG. 20 is a cross-sectional view illustrating a second electrode formed on the substrate in FIG. 19.

[135] Referring to FIG. 20, after the first electrode 200, the isolating patterns 300, the organic light emitting patterns 400 are sequentially formed on the substrate 100, the second electrode 500 is formed on the substrate 100 to electrically connect to the organic light emitting patterns 400. The second electrode 500 includes a metal, for example, aluminum, aluminum ally etc. The second electrode 500 is formed on the entire face of the substrate 100.

[136] Having described the exemplary embodiments of the present invention and its advantages, it is noted that various changes, substitutions and alterations can be made herein without departing from the spirit and scope of the invention as defined by appended claims.

# Claims

[1] A display device comprising:
a substrate having a first region and a second region surrounding the first region;
a plurality of first electrodes disposed in the first region;
an insulation member arranged in the first region and having a plurality of openings that exposes a portion corresponding to each of the first electrodes;
light emitting patterns disposed on the first electrodes, the light emitting patterns filling up the openings, respectively; and
a second electrode disposed on the light emitting patterns.

[2] The display device of the claim 1, further comprising a plurality of dummy light emitting patterns formed in the second region of the substrate.

[3] The display device of the claim 1, wherein the openings have a rectangular shape that has a pair of long sides and a pair of short sides, and the openings are arranged in a matrix shape along a first direction that is substantially parallel with the long sides and a second direction that is substantially parallel with the short sides in the first region.

[4] The display device of the claim 3, wherein a side face of the insulation member is extended from the first region to the second region in the first direction and an extending length of the insulation member is equal to or less than a width formed between the openings.

[5] The display device of the claim 3, wherein a side face of the insulation member is extended from the first region to the second region in the second direction, and an extending length is equal to or less than a width formed between the openings.

[6] The display device of the claim 1, wherein the openings are eccentrically disposed on the center of the first electrodes, respectively.

[7] The display device of the claim 1, wherein each of the light emitting patterns includes a hole injection layer and a light emitting layer, and the light emitting layer is formed on the hole injection layer.

[8] The display device of the claim 1, wherein an inside wall of the openings has an angle about 30° to 165° with respect to the first electrodes formed on the substrate.

[9] The display device of the claim 1, wherein the first electrodes include a transparent conductive material, and the second electrode includes an opaque conductive material.

[10] The display device of the claim 1, wherein the insulation member includes an organic material, an inorganic material or a photoresist material.

[11] A display device comprising:
a substrate having a first region and a second region surrounding the first region;
a plurality of first electrodes disposed in the first region;
an insulation member formed on a whole surface of the substrate to cover the first electrodes, the insulation member having a groove and a plurality of openings, the grooves formed between the first and second regions, and the openings formed on the first electrode;
a light emitting patterns disposed on the first electrodes, the light emitting patterns filling up the openings, respectively; and
a second electrode disposed on the light emitting patterns.

[12] The display device of the claim 11, wherein a width of the groove is equal to or more than a width of the openings.

[13] The display device of the claim 12, wherein the insulation member includes an organic material, an inorganic material or a photoresist material.

[14] The display device of the claim 12, wherein a plurality of dummy light emitting patterns are formed on the substrate corresponding to the groove, and an insulation layer is formed corresponding to the second region of the substrate.

[15] A display device comprising:
a substrate having a first region and a second region surrounding the first region;
a plurality of first electrodes disposed in the first region;
an insulation film, formed on the substrate to cover the first electrodes, having a plurality of first and second openings, the first openings exposing a portion corresponding to each of the first electrodes, the second openings disposed in the second region;
light emitting patterns disposed on the first electrodes, the light emitting patterns filling up the first openings, respectively; and
a second electrode disposed on the light emitting patterns.

[16] The display device of the claim 15, wherein a first width of the first openings is equal to or less than a second width of the second openings.

[17] The display device of the claim 15, wherein a plurality of dummy light emitting patterns are formed on the substrate corresponding to each of the second openings.

[18] A method of manufacturing a display device comprising:

forming a plurality of first electrodes in a first region formed on a substrate;
forming an insulation member on the first region, wherein the insulation member has a plurality of openings each exposing a portion corresponding to each of the first electrodes;
forming light emitting patterns on the first electrodes, respectively; and
forming a second electrode in the first region to cover the light emitting patterns.

[19] The method of the claim 18, wherein a conductive layer including a transparent conductive material is formed on the substrate and the conductive material is patterned to form the first electrodes in the first region.

[20] The method of the claim 19, wherein the first electrodes include an indium tin oxide (ITO) material or an indium zinc oxide (IZO) material.

[21] The method of the claim 19, wherein the openings have a rectangular shape, the openings have a pair of long sides to face each other and a pair of short sides to face each other, and the long sides are disposed in a first direction and the short sides are disposed in a second direction substantially perpendicular to the first direction, and the openings are disposed in a matrix shape.

[22] The method of the claim 18, wherein the insulation member is formed by:
forming an insulation layer on the first and second regions; and
patterning the insulation layer to expose the first electrode in the first region and to remove portions of the insulation layer in the second region.

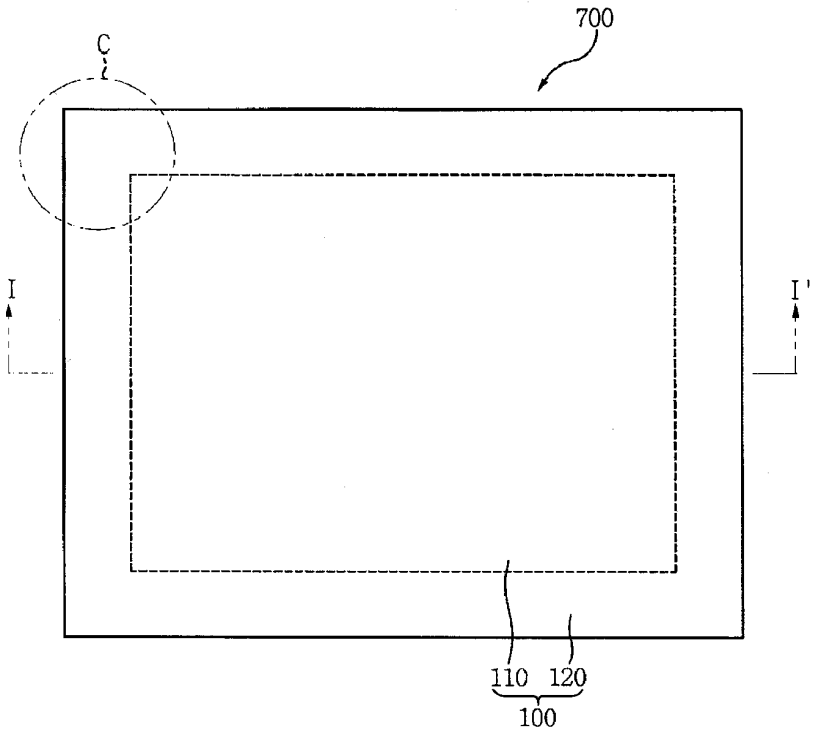
[23] The method of the claim 22, wherein the openings are eccentrically disposed on the center of the first electrodes.

[24] The method of the claim 22, wherein an edge portion of the insulation member is extended from the first region to the second region so as to form a substantially same interval between the openings.

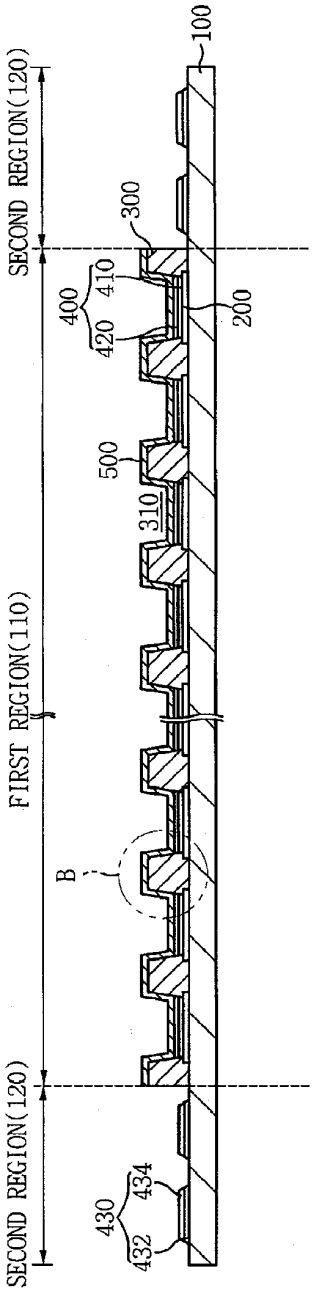
[25] The method of the claim 18, wherein a hole injection material as a droplet shape is dropped on the first electrode so as to form a hole injection layer of the light emitting patterns and a light emitting material as a droplet shape is dropped on the hole injection layer so as to form a light emitting layer of the light emitting patterns.

[26] The method of the claim 18, wherein a plurality of dummy light emitting patterns are disposed in the second region to adjust a speed of drying the light emitting patterns.

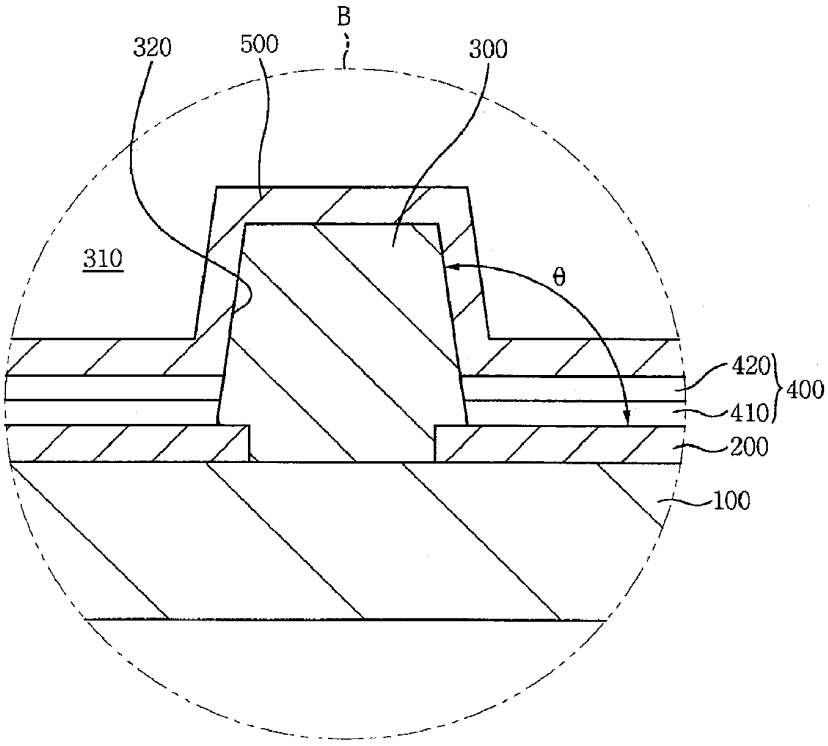
[Fig. 1]



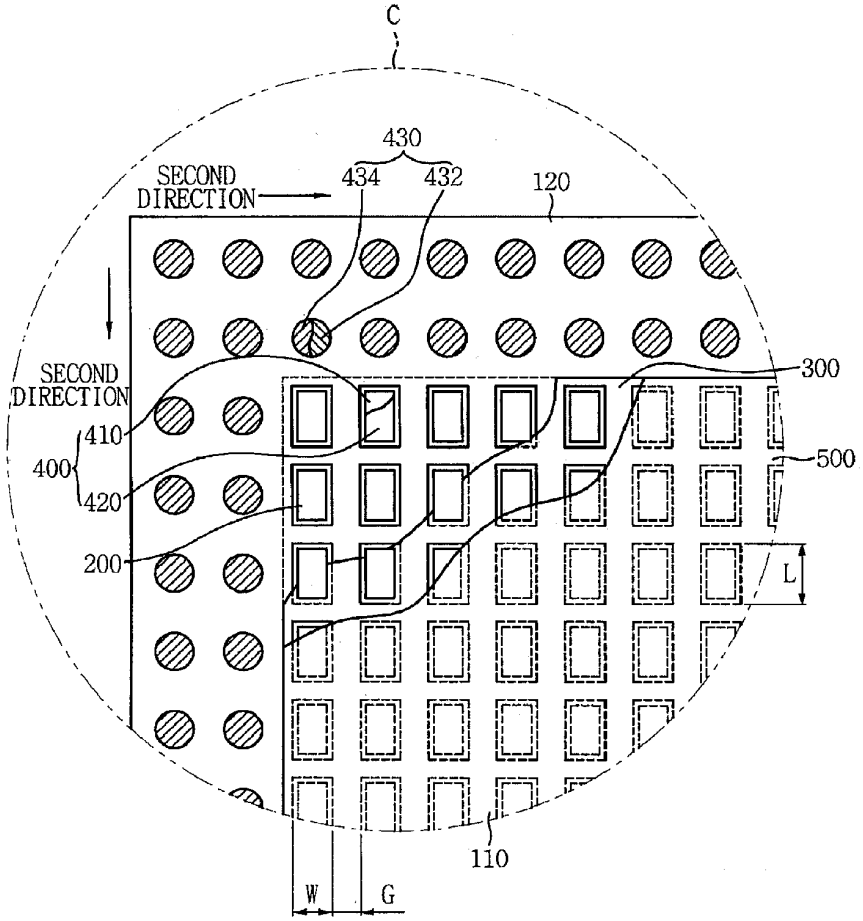
[Fig. 2]


100
SECOND REGION(120)
300
400
410
420
200
500
310
FIRST REGION(110)
B
SECOND REGION(120)
430
434
432

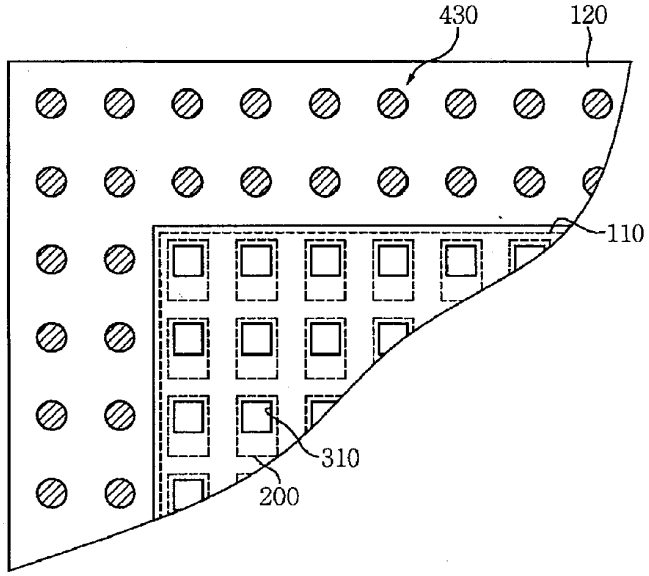
[Fig. 3]



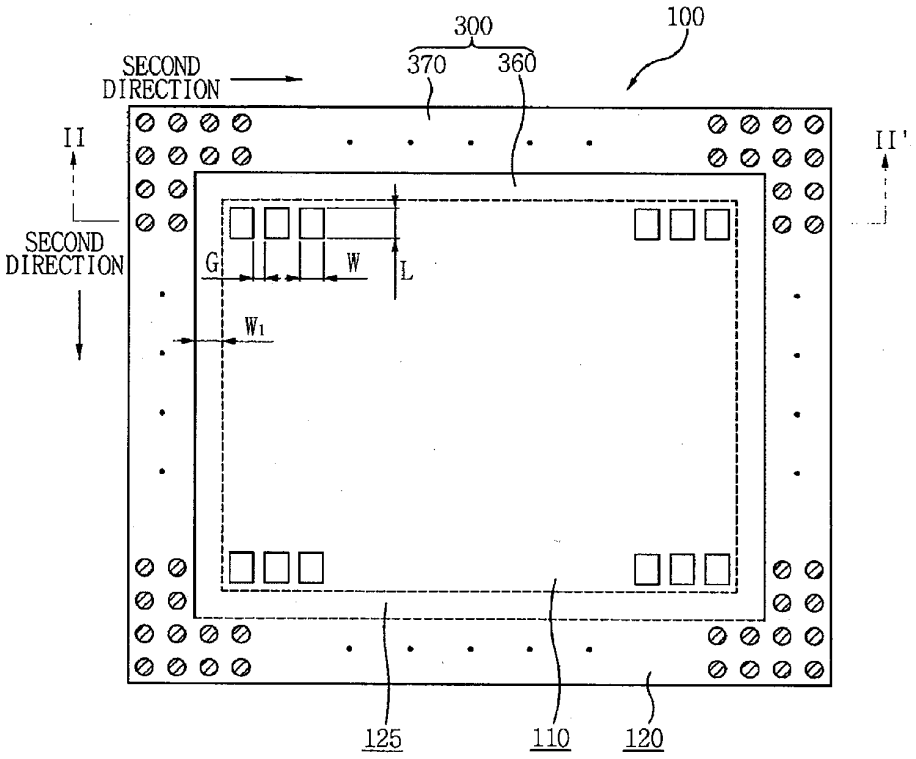
[Fig. 4]


C
430
434
432
SECOND DIRECTION
120
SECOND DIRECTION
300
410
400
420
500
200
L
110
W
G

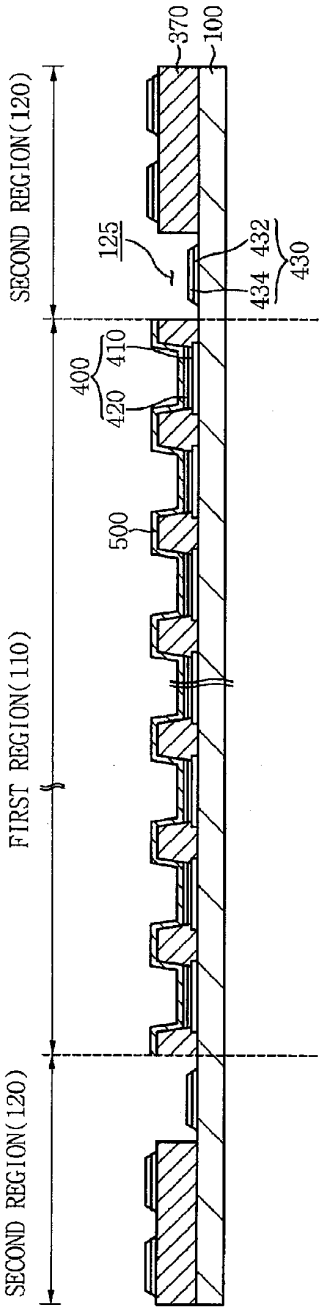
[Fig. 5]


430
120
110
310
200

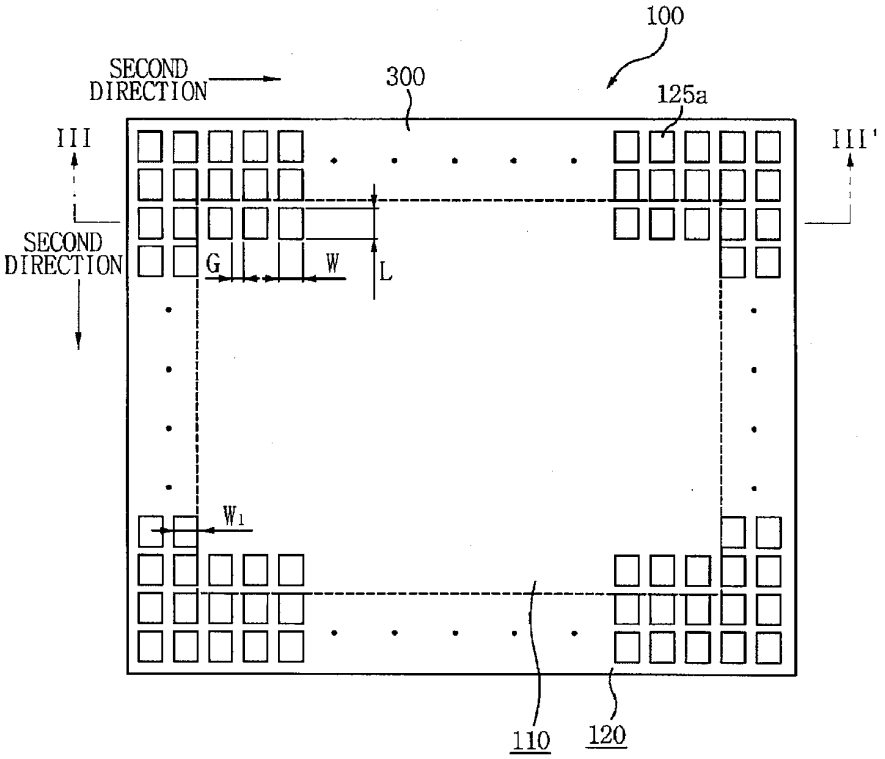
[Fig. 6]


300
370
360
100
SECOND DIRECTION
II
II'
SECOND DIRECTION
G
W
L
W1
125
110
120

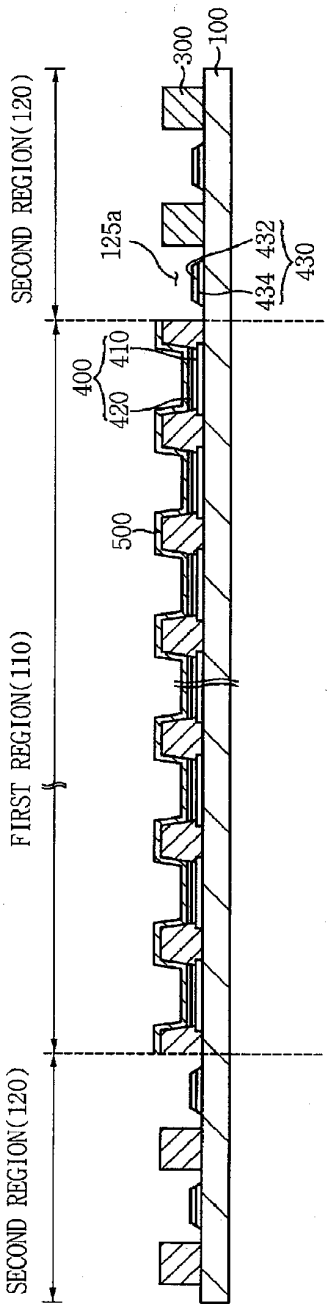
[Fig. 7]


370
100
SECOND REGION(120)
125
432
434
430
400
410
420
500
FIRST REGION(110)
SECOND REGION(120)

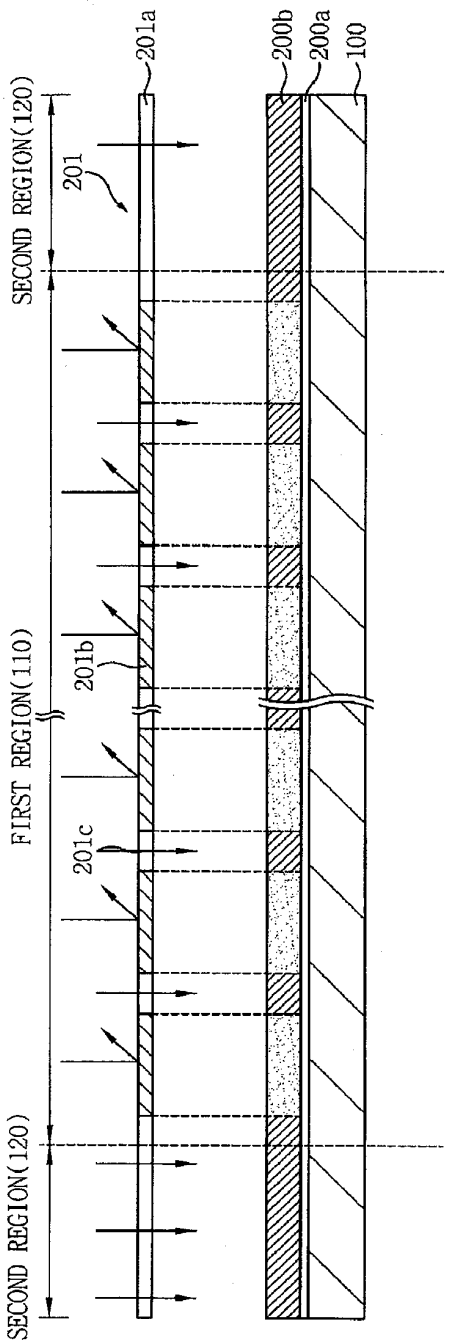
[Fig. 8]


100
SECOND DIRECTION
300
125a
III
III'
SECOND DIRECTION
G
W
L
W1
110
120

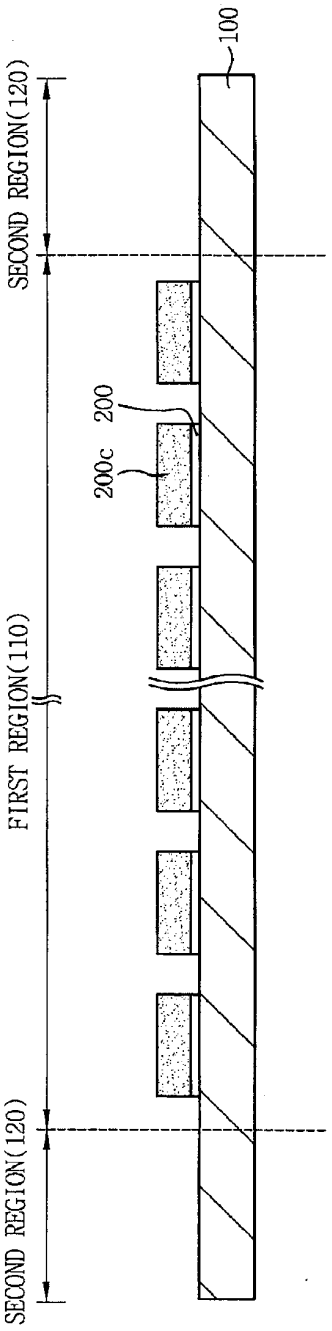
[Fig. 9]


SECOND REGION(120)
FIRST REGION(110)
SECOND REGION(120)
300
100
125a
432
430
434
400
410
420
500

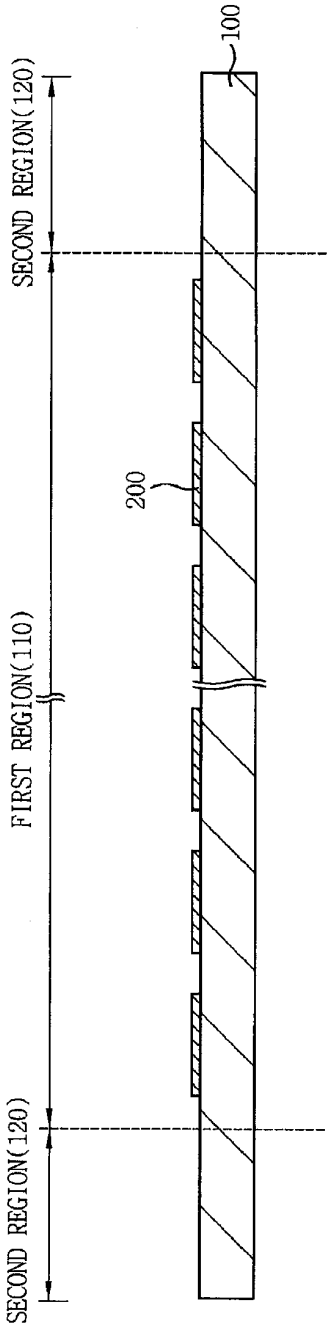
[Fig. 10]


201a
200b
200a
100
SECOND REGION(120)
201
FIRST REGION(110)
201b
201c
SECOND REGION(120)

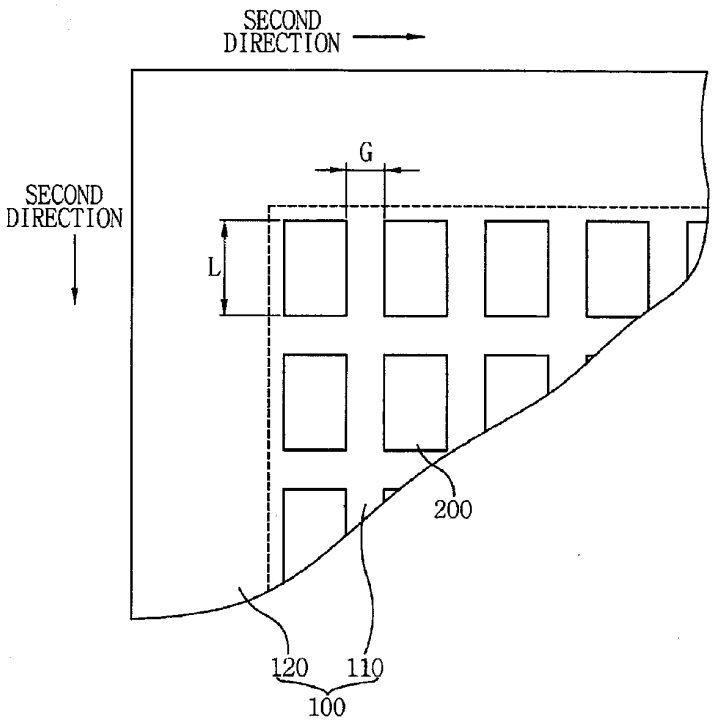
[Fig. 11]


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SECOND REGION(120)
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200c
FIRST REGION(110)
SECOND REGION(120)

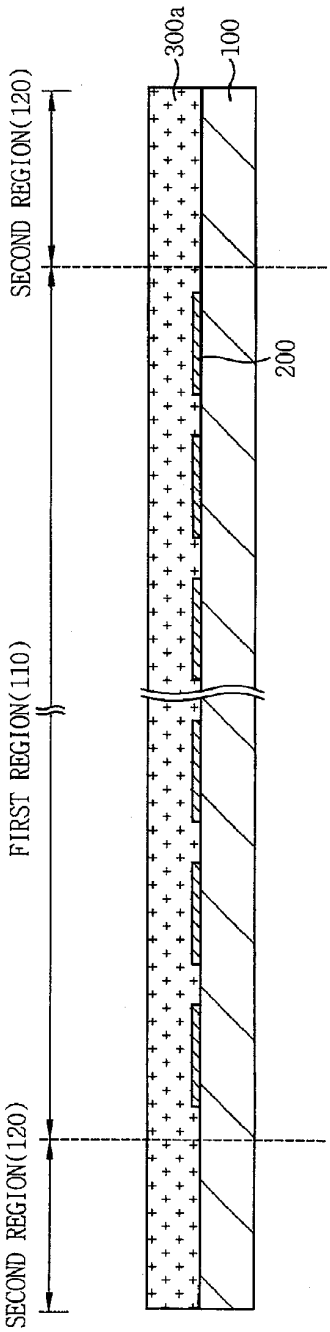
[Fig. 12]


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SECOND REGION(120)
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FIRST REGION(110)
SECOND REGION(120)

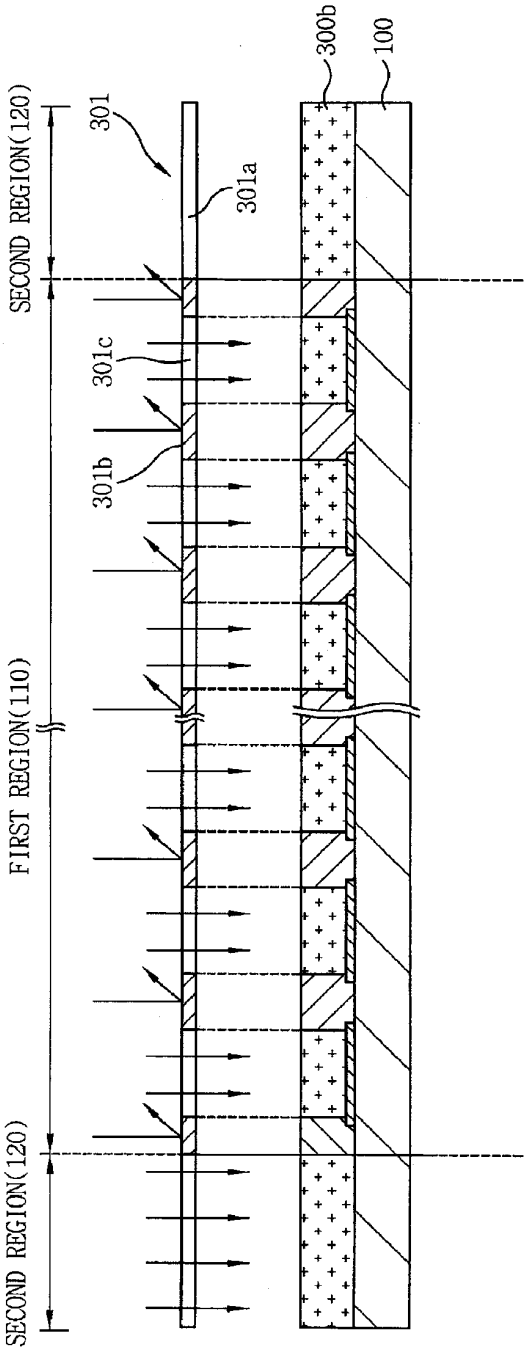
[Fig. 13]



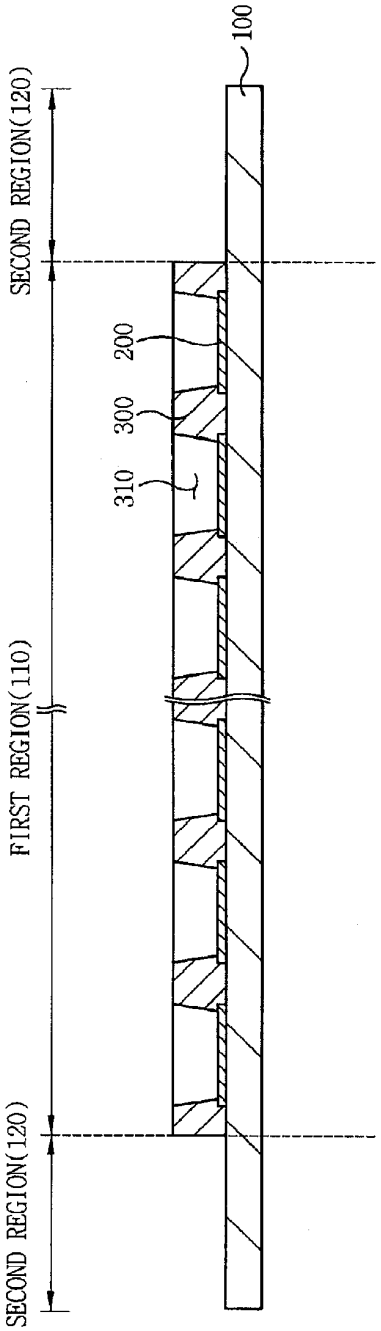
[Fig. 14]


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FIRST REGION(110)
SECOND REGION(120)

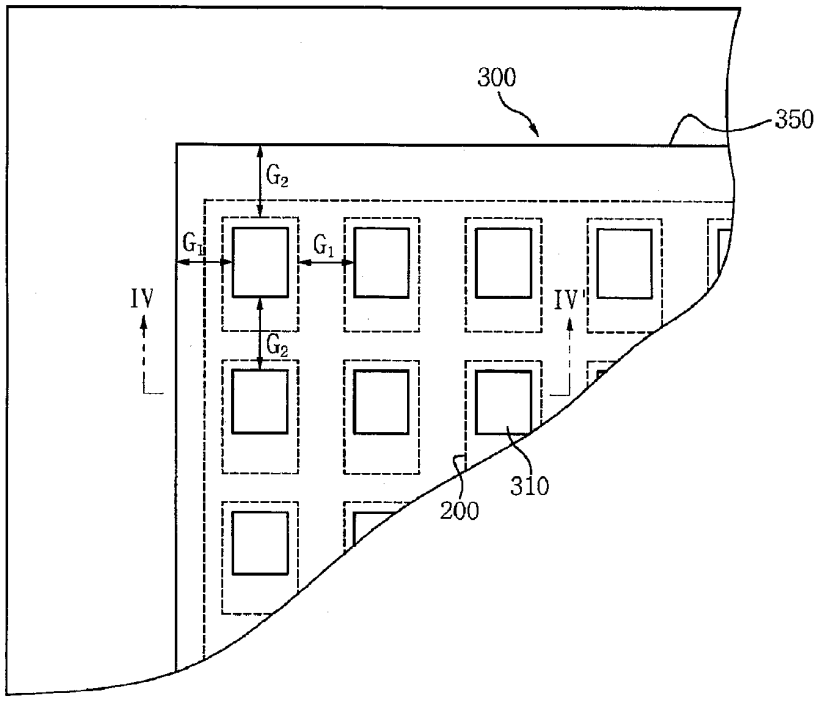
[Fig. 15]


300b
100
301
301a
SECOND REGION(120)
301c
301b
FIRST REGION(110)
SECOND REGION(120)

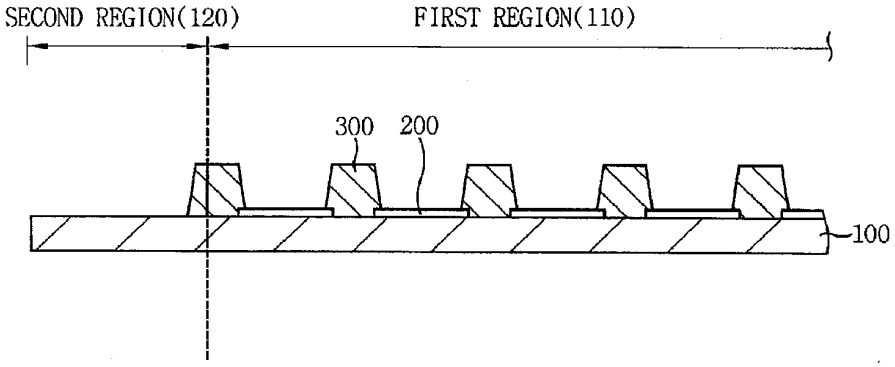
[Fig. 16]


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SECOND REGION(120)
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FIRST REGION(110)
SECOND REGION(120)

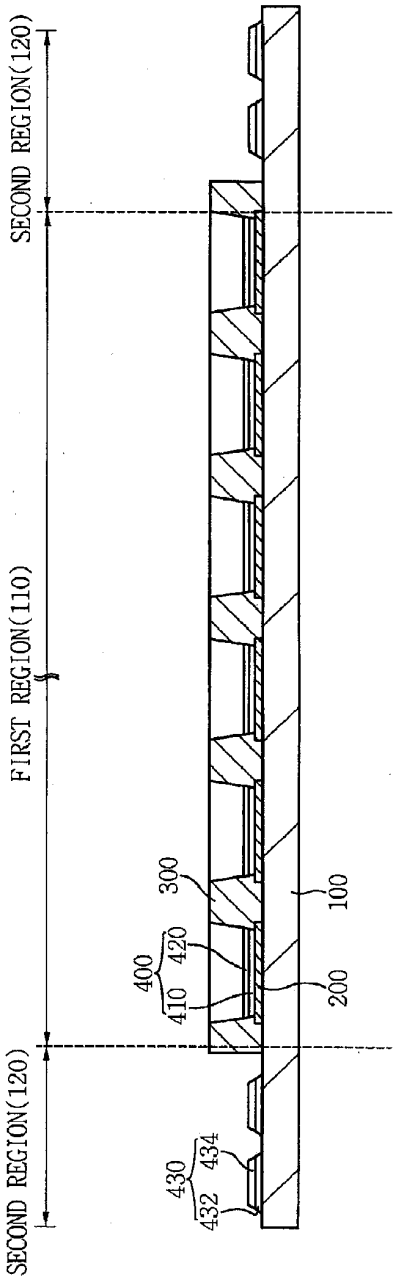
[Fig. 17]


300
350
G2
G1
G1
IV
IV'
G2
310
200

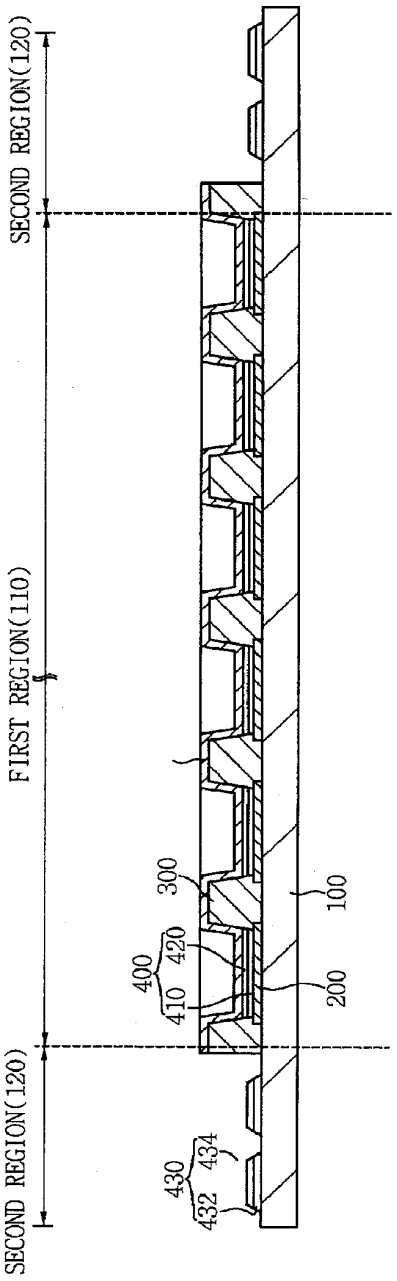
[Fig. 18]


SECOND REGION(120)
FIRST REGION(110)
300
200
100

[Fig. 19]


SECOND REGION(120)
FIRST REGION(110)
SECOND REGION(120)
300
100
400
420
410
200
430
434
432

[Fig. 20]


SECOND REGION(120)
FIRST REGION(110)
SECOND REGION(120)
300
100
400
420
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200
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434
432

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 2004/003430

A. CLASSIFICATION OF SUBJECT MATTER
IPC[7]: H05B 33/12
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC[7]: H05B, H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPODOC, WPI, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | EP 1367647 A2 (SEIKO EPSON CORPORATION) 3 December 2003 (03.12.2003) *fig 2-5; page 5, paragraph [0049]; page 6, paragraphs [0058] - [0064]; page 6, paragraph [0069]; page 7, paragraph [0077].* | 1-5,7,8,10-22, 24-26 |
| Y | | 9 |
| A | | 6,23 |
| Y | GB 2106317 A (SUN CHEMICAL CORPORATION) 7 April 1983 (07.04.1983) *figs 3,6; page 1, lines 32-35; page 2, lines 2-10.* | 9 |

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 20 April 2005 (20.04.2005) | 11 May 2005 (11.05.2005) |

| Name and mailing address of the ISA/ AT | Authorized officer |
|---|---|
| **Austrian Patent Office**<br>Dresdner Straße 87, A-1200 Vienna | WENNINGER W. |
| Facsimile No. +43 / 1 / 534 24 / 535 | Telephone No. +43 / 1 / 534 24 / 325 |

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 2004/003430

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | WO 2002/089211 A1 (KONINKLIJKE PHILIPS ELECTRONICS N.V.) 7 November 2002 (07.11.2002)<br>*figs 3,10; page 7, line 31 - page 8, line 33; page 10, line 32 - page 11, line 6.*<br>---- | 1,11,15,18 |

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 2004/003430

| Patent document cited in search report | | | Publication date | Patent family member(s) | | | Publication date |
|---|---|---|---|---|---|---|---|
| EP | A2 | 1367647 | 2003-12-03 | CN | Y | 2627785Y | 2004-07-21 |
| | | | | US | A1 | 2004070808 | 2004-04-15 |
| | | | | CN | A | 1463172 | 2003-12-24 |
| | | | | JP | A | 2004006137 | 2004-01-08 |
| GB | A | 2106317 | 1983-04-07 | FR | A1 | 2513415 | 1983-03-25 |
| | | | | JP | A | 58056583 | 1983-04-07 |
| | | | | CA | A1 | 1223054 | 1987-06-16 |
| | | | | DE | A1 | 3231727 | 1983-04-07 |
| WO | A | 20020892 11 | | | | none | |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 19891511 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Youg E. Jeon/Diane Goss |
| **Filer Authorized By:** | Jun-Youg E. Jeon |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 18-AUG-2014 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 15:32:13 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

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| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
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| 1 | | 69657ids.pdf | 108722<br>587a427b06cd6558d5a9ba191d802d718b23963c | yes | 3 |

| | Multipart Description/PDF files in .zip description | | | | |
|---|---|---|---|---|---|
| | Document Description | | Start | End | |
| | Transmittal Letter | | 1 | 2 | |
| | Information Disclosure Statement (IDS) Form (SB08) | | 3 | 3 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Foreign Reference | JP_813.pdf | 344594<br>19bc3ceed380f5464dff38aa3722c501eae2d982 | no | 13 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Foreign Reference | JP_760.pdf | 524588<br>728d6fa0ca48114f26003423ad51a10b90b23c87 | no | 18 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 4 | Foreign Reference | WO_352.pdf | 493043<br>b2e72994dad969f525789a3bcf6e08da3ed7b6db | no | 41 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 5 | Non Patent Literature | EP_SearchRpt-7_9.pdf | 341842<br>22afa0ef875c13ecb3b5418fb918091e96aa906c | no | 8 |
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| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 1812789 | | |

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**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on August 18, 2014 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Diane L. Goss

| | | |
|---|---|---|
| Inventor | : Sang-Shin Lee | Confirmation No. 4264 |
| Application No. | : 13/614,197 | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| Grp./Div. | : 2691 | |
| Examiner | : Kwang-Su Yang | |
| Docket No. | : 69657/S1437 | |

**INFORMATION DISCLOSURE STATEMENT**
**37 CFR § 1.97(b)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
August 18, 2014

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is FORM PTO/SB/08A/B listing the references that are known to applicant. Copies of each of the listed non-U.S. references are enclosed. This filing is timely because it is made during one of the periods described in 37 CFR § 1.97(b).

It is respectfully requested that the listed references be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of FORM PTO/SB/08A/B be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

**Application No.: 13/614,197**

The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
CHRISTIE, PARKER & HALE, LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/dg
Enclosures: PTO/SB/08A/B, w/references

DLG PAS1313570.1-*-08/18/14 8:43 AM



Petitioner Ex 1015, p. 718
BOE et al. v. Samsung, IPR2023-00988

| FORM PTO/SB/08A/B (10-01)<br>Substitute for PTO-1449A/B<br><br>**INFORMATION DISCLOSURE**<br><br>**STATEMENT BY APPLICANT**<br><br>(use as many sheets as necessary) | | |
|---|---|---|
| | **Attorney Docket Number** | 69657/S1437 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
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# (54) 유기전계발광표시장치의 제조방법

(57) 요약

본 발명은 유기전계발광표시장치에 관한 것으로서, 보다 구체적으로는 화소부 외측, 즉 화소정의막이 형성된 영역 상의 상부 전극 또는 최외각에 형성된 패시베이션막의 상부에 레이저 열전사법(특히, LITI)을 이용하여 스페이서(spacer)를 형성함으로써, 외부 충격으로부터 화소부의 유기막이나 상부 전극 등을 보호할 수 있는 유기전계발광표시장치에 관한 것이다.

대표도

도 3a

## 특허청구의 범위

### 청구항 1.



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기판을 형성하는 단계;

상기 기판 상에 하부 전극, 발광층을 포함하는 유기막과 상부 전극으로 구성된 화소부를 형성하는 단계; 및

상기 화소부 외측의 화소정의막 상부에 스페이서를 레이저 열전사법에 의해 형성하는 단계;를 포함하는 것을 특징으로 하는 유기전계발광표시장치의 제조방법.

## 청구항 2.

제 1항에 있어서,

상기 스페이서는 화소부 외측의 상부 전극 상에 형성하는 것을 특징으로 하는 유기전계발광표시장치의 제조방법.

## 청구항 3.

제 1항에 있어서,

상기 스페이서 상부에 패시베이션막을 더욱 포함하는 것을 특징으로 하는 유기전계발광표시장치의 제조방법.

## 청구항 4.

제 1항에 있어서,

상기 스페이서는 수지로 형성하는 것을 특징으로 하는 유기전계발광표시장치의 제조방법.

## 청구항 5.

제 1항에 있어서,

상기 스페이서는 폴리스티렌 또는 폴리 메틸 메타크릴레이트 중 어느 하나로 형성하는 것을 특징으로 하는 유기전계발광표시장치의 제조방법.

## 청구항 6.

제 1항에 있어서,

상기 스페이서는 유리, 실리카 또는 알루미나 중 어느 하나로 형성하는 것을 특징으로 하는 유기전계발광표시장치의 제조방법.

## 청구항 7.

제 1항에 있어서,

상기 화소정의막과 스페이서 사이에 패시베이션막을 더욱 포함하는 것을 특징으로 하는 유기전계발광표시장치의 제조방법.



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## 청구항 8.

제 1항에 있어서,

상기 스페이서는 스트라이프 형태로 형성하는 것을 특징으로 하는 유기전계발광표시장치의 제조방법.

## 청구항 9.

제 8항에 있어서,

상기 스트라이프 형태는 도트(dot) 형태로 형성하는 것을 특징으로 하는 유기전계발광표시장치의 제조방법.

## 청구항 10.

제 1항에 있어서,

상기 스페이서는 델타 형태로 형성하는 것을 특징으로 하는 유기전계발광표시장치의 제조방법.

명세서

# 발명의 상세한 설명

### 발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

본 발명은 유기전계발광표시장치에 관한 것으로서, 보다 구체적으로는 화소부 외측, 즉 화소정의막이 형성된 영역 상의 상부 전극 또는 최외각에 형성된 패시베이션막의 상부에 레이저 열 전사법(특히, LITI)을 이용하여 스페이서(spacer)를 형성함으로써, 외부 충격으로부터 화소부의 유기막이나 상부 전극 등이 보호될 수 있는 유기전계발광표시장치에 관한 것이다.

일반적으로, 유기전계발광표시장치는 전자(electron) 주입 전극(cathode)과 정공(hole) 주입 전극(anode)으로부터 각각 전자(electron)와 정공(hole)을 발광층 내부로 주입시켜, 주입된 전자(electron)와 정공(hole)이 결합한 엑시톤(exciton)이 여기 상태로부터 기저 상태로 떨어질 때 발광하는 발광 표시장치이다. 이러한 원리로 인해 종래의 액정 박막 표시 소자와는 달리 별도의 광원을 필요로 하지 않으므로 소자의 부피와 무게를 줄일 수 있는 장점이 있다.

상기 유기전계발광표시장치를 구동하는 방식은 수동 매트릭스 방식(passive matrix type)과 능동 매트릭스 방식(active matrix type)으로 나눌 수 있다.

상기 수동 매트릭스 방식 유기전계발광표시장치는 그 구성이 단순하여 제조 방법 또한 단순하나 높은 소비 전력과 표시 소자의 대면적화에 어려움이 있으며, 배선의 수가 증가하면 할수록 개구율이 저하되는 단점이 있다.

따라서, 소형의 표시 소자에 적용할 경우에는 수동 매트릭스 방식 유기전계발광표시장치를 사용하는 반면, 대면적의 표시 소자에 적용할 경우에는 능동 매트릭스 방식 유기전계발광표시장치를 사용한다.

또한, 유기전계발광표시장치는 유기발광층으로부터 발생된 광이 방출되는 방향에 따라 배면발광구조와 전면발광구조로 나눌 수 있는데, 배면발광구조는 형성된 기판쪽으로 광이 방출되는 것으로서 상부전극으로 반사전극이나 반사막이 형성되고 하부전극으로 투명전극이 형성된다. 여기서, 유기전계발광표시장치가 박막트랜지스터가 형성되는 능동 매트릭스 방식을 채택할 경우에 박막트랜지스터가 형성된 부분은 광이 투과하지 못하게 되므로 빛이 나올 수 있는 면적이 줄어들 수 있



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다. 이와 달리, 전면발광구조는 상부전극으로 투명전극이 형성되고 하부전극으로 반사전극이나 반사막이 형성됨으로써 광이 기판과 반대되는 방향으로 방출되어 지므로 빛이 투과하는 면적이 넓어지므로 휘도가 향상될 수 있다. 현재는 하나의 기판 상에 전면발광과 배면발광을 동시에 구현할 수 있는 양면 발광 유기전계발광표시장치가 주목받고 있다.

일반적으로 레이저 열 전사법(LITI:Laser Induced Thermal Imaging)은 적어도 레이저빔, 억셉터 기판 및 도너 기판을 필요로 한다. 상기 도너 기판은 기재기판, 광열 변환층 및 전사층을 구비하며, 상기 전사층은 유기물질로 이루어질 수 있다.

레이저 열전사 공정에 있어서는 상기 전사층을 상기 억셉터 기판에 대향하도록 하여 상기 도너 기판을 상기 억셉터 기판 상에 라미네이션한 후, 상기 기재기판 상에 레이저빔을 조사한다. 상기 기재기판 상에 조사된 레이저빔은 상기 광열 변환층에 흡수되어 열에너지로 변환되고, 상기 열에너지에 의해 상기 전사층은 상기 억셉터 기판 상으로 전사된다. 그 결과, 상기 억셉터 기판 상에 전사층 패턴이 형성되게 된다.

이러한 레이저 열 전사법은 상기 전사층 특히, 유기막층을 미세하게 패터닝할 수 있고, 대면적에 사용할 수 있으며 고해상도에 유리하다는 장점이 있다. 따라서, 유기전계발광표시장치를 이루는 발광층을 비롯한 유기막 등을 형성하는데 이용되고 있다.

이하 첨부된 도면을 참조하여 종래 기술에 대하여 설명한다.

도 1은 종래의 유기전계발광표시장치의 단면도를 도시한 것이다.

도 1을 참조하면, 기판(100)상에 버퍼층(110)과, 상기 버퍼층(110)의 상부에 비정질 실리콘을 증착하고 결정화하여 폴리실리콘막을 형성한다. 그런 다음, 상기 폴리실리콘막을 패터닝하여 반도체층(130)을 형성한다. 그 후, 상기 기판(100) 상에 게이트 절연막(120)을 증착한다.

상기 게이트 절연막(120) 상부에 게이트 메탈을 증착하고, 상기 게이트 메탈을 패터닝하여 반도체층(130) 상부의 게이트 절연막(120) 상에 게이트 전극(138)을 형성한다. 그리고, 상기 게이트 전극(138)을 마스크로 사용하여 도전형의 불순물을 소정 도핑함으로써 소오스 영역(132)과 드레인 영역(136)을 형성한다. 상기 소오스 영역(132)과 드레인 영역(136)의 사이에 위치한 불순물이 도핑되지 않은 영역은 채널 영역(134)으로 작용한다.

상기 소오스 영역과(132) 드레인 영역(136)이 형성된 기판(100) 상에 산화막으로 이루어지는 층간 절연막(140)을 형성하고, 상기 층간 절연막(140)을 사진 식각하여 소오스 영역(132)과 드레인 영역(136)의 일부를 노출시키는 콘택홀(156,158)을 형성한다.

상기 콘택홀(156,158)을 포함한 층간 절연막(140) 상에 도전 물질을 증착한 후, 상기 도전 물질을 패터닝하여 콘택홀(156)을 통해 소오스 영역(132)에 연결되는 소오스 전극(152)과 콘택홀(158)을 통해 드레인 영역(136)에 연결되는 드레인 전극(154)을 형성한다.

상기 소오스/드레인 전극(152,154)이 형성된 기판(100) 상에 평탄화막(150)을 증착하고, 상기 평탄화막(150)에 소오스 전극(152) 또는 드레인 전극(154) 중의 어느 하나, 예를 들면 드레인 전극(154)의 일부분을 노출시키는 비아홀(160)을 형성한다. 이는 후속 공정에서 형성될 하부 전극(165)과 드레인 전극(154)을 연결하기 위함이다.

상기 비아홀(160)을 포함한 평탄화막(150) 상에 하부 전극 물질을 증착한 후, 상기 하부 전극 물질을 패터닝하여 비아홀(160)을 통하여 드레인 전극(154)과 연결되는 하부 전극(165)을 형성한다.

상기 형성된 하부 전극(165) 상에는 하부 전극(165)의 표면 일부를 노출시키는 화소정의막(170)과 적어도 유기발광층을 포함하는 유기막(180)을 형성한다. 이어서, 상기 유기막(180) 상에 투명 전극으로 상부 전극(190)을 형성한다.

유기전계발광표시장치의 상부 전극과 하부 전극 사이에 적층되는 유기물은 산소 또는 수분과 쉽게 반응하고, 이에 따라 제작된 유기박막의 결정화 및 조성변화 등의 심각한 현상이 발생하게 되므로 유기전계발광표시장치의 특성이 저하되는 현상이 발생한다. 이에, 유기막 등에서 발생하는 가스 및 외부로부터의 수분과 산소의 영향을 감소시키기 위하여 건조제를 장착하고 상기 건조제를 캡의 내부 일정 공간에 형성하는데, 상기 캡은 고분자 필름이나 스테인레스 스틸 등의 재질로 형성되며 유기막 상부에 형성되어 유기막 등을 보호한다.



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그러나, 상기한 방법에 의한 종래의 유기전계발광표시장치는 상기 캡이 유기막이나 상부전극 등과 맞닿아 있어 캡에 전달되는 외부의 충격에 의해 유기막이나 상부전극이 쉽게 손상을 입게 되어, 결과적으로 표시장치의 수명이 단축되는 문제점이 있었다.

또한, 상기의 문제점을 해결하기 위하여 화소정의막의 상부전극 상에 스페이서를 형성하였으나, 이는 별도의 마스크를 이용하여 포토레지스트 공정을 수행해야 하므로 비용이 추가되고 공정의 복잡함 및 유기막 손상 등의 문제점이 발생된다.

발명이 이루고자 하는 기술적 과제

본 발명은 상기한 종래 기술의 문제점을 해결하기 위한 것으로서 화소부 외측, 즉 화소정의막이 형성된 영역 상의 상부 전극 또는 최외각에 형성된 패시베이션막의 상부에 레이저 열 전사법(특히, LITI)을 이용하여 스페이서(spacer)를 형성함으로써, 외부 충격으로부터 화소부의 유기막이나 상부 전극 등을 보호할 수 있고 공정비용을 절감할 수 있는 유기전계발광표시장치를 제공하는데 본 발명의 목적이 있다.

**발명의 구성**

상기한 목적을 달성하기 위하여 본 발명에 따른 유기전계발광표시장치의 제조방법은,

소자가 구비된 기판을 형성하는 단계;

상기 기판 상에 하부전극, 적어도 발광층을 포함하는 유기막과 상부전극으로 구성된 화소부를 형성하는 단계; 및

상기 화소부 외측의 화소정의막패턴 상부에 스페이서를 레이저 열 전사법에 의해 형성하는 단계;를 포함하는 것을 특징으로 하는 유기전계발광표시장치의 제조방법과,

상기 스페이서는 화소부 외측의 상부전극 상에 형성하는 것과,

상기 스페이서 상부에 패시베이션막을 더욱 포함하는 것과,

상기 스페이서는 수지로 형성하는 것과,

상기 스페이서는 폴리스티렌, 폴리 메틸 메타크릴레이트로 형성하는 것과,

상기 스페이서는 유리, 실리카 또는 알루미나 중 어느 하나로 형성하는 것과,

상기 화소정의막과 스페이서 사이에 패시베이션막을 더욱 포함하는 것과,

상기 스페이서는 스트라이프 형태로 형성하는 것과,

상기 스트라이프 형태는 짧은 도트(dot) 형태로 형성하는 것과,

상기 스페이서는 델타 형태로 형성하는 것을 특징으로 한다.

이하, 본 발명에 따른 바람직한 실시예를 첨부하는 도면을 참조하여 더욱 상세하게 설명한다.

본 발명은 전면발광 유기전계발광표시장치에 대하여 설명하지만, 이에 한정되지 않고 배면발광 유기전계발광표시장치 및 양면발광 유기전계발광표시장치 등에서도 동일하게 적용될 수 있으며, 또한 여기서 설명되어지는 실시예에 한정되지 않고 본 발명의 정신을 벗어나지 않는 범위 내에서 당해 발명이 속하는 기술분야에서 통상의 지식을 가진 자에 의해 다양한 변형과 수정이 가능할 것이다.

또한, 본 발명의 실시예에 있어서 스페이서는 유기전계발광표시장치의 기판상에 형성되어 있는 R, G, B의 화소 영역의 형태에 따라 스페이서의 형성 형태가 달라지게 된다.



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즉, 유기전계발광표시장치의 화소 영역이 매트릭스 형의 스트라이프 형태이면 이에 따라 동일하게 스페이서를 형성하는 필름의 패턴 형태 역시 스트라이프 형태로 형성된다. 또한, 상기 스트라이프 형태는 짧은 도트(dot) 형태로 형성될 수도 있다.

또한, 유기전계발광표시장치의 화소 영역이 델타 형태이면 이에 맞추어 스페이서를 형성하는 필름의 패턴 역시 델타 형태로 형성된다.

따라서, 본 발명에 있어서는 스페이서가 형성된 전면발광 유기전계발광표시장치의 단면도로 언급하나, 이는 단지 본 발명의 실시예일 뿐이고, 유기전계발광표시장치의 기판 상에 형성되어 있는 화소 영역의 패턴 구조에 따라 통상의 기술 수준에서 변경이 가능하다.

(실시예 1)

도 2는 본 발명에 따른 유기전계발광표시장치의 단위 화소에 대한 평면도이며, 도 3a는 도 2의 단위 화소의 A-A'에 대한 단면도로서, 본 발명에 따른 유기전계발광표시장치의 실시예 1을 나타내는 단면도이고, 도 4a 내지 도 4j는 본 발명의 실시예 1에 따른 유기전계발광표시장치를 제조하는 공정을 순서적으로 보여주는 단면도들이다.

도 2를 참고하면, 일방향으로 배열된 스캔라인(1), 상기 스캔라인(1)과 서로 절연되면서 교차하는 데이터라인(2) 및 상기 스캔라인(1)과 서로 절연되면서 교차하고 상기 데이터라인(2)에 평행하게 공통전원라인(3)이 위치한다. 상기 스캔라인(1), 상기 데이터라인(2) 및 공통전원라인(3)에 의해 다수의 단위 화소, 예를 들면, 적색(R), 녹색(G) 및 청색(B) 중의 어느 하나를 나타내는 단위 화소로 정의된다.

이로써, 상기 단위 화소에는 상기 스캔라인(1)에 인가된 신호에 따라 상기 데이터라인(2)에 인가된 데이터 신호를, 예를 들면, 데이터 전압과 상기 공통전원라인(3)에 인가된 전압차에 따른 전하를 축적하는 캐패시터(7) 및 상기 캐패시터(7)에 축적된 전하에 의한 신호를 상기 스위칭 박막트랜지스터(5)를 통해 구동 박막트랜지스터(6)로 입력한다. 이어서 데이터 신호를 입력받은 상기 구동 박막트랜지스터(6)는 하부전극(8), 상부전극 및 두 전극 사이에 적어도 유기발광층을 포함하는 유기막을 구비한 상기 화소부(9)에 전기적 신호를 보내 광을 방출하게 한다.

도 3a, 도 3b 및 도 4a에 도시되어 있는 바와 같이, 본 발명에 따른 유기전계발광표시장치는 유리나 합성 수지, 스테인레스 스틸 등의 재질로 이루어진 기판(200) 상에 소정의 두께로 선택적으로 버퍼층(210)을 형성한다. 이때, 상기 버퍼층(210)은 후속 공정으로 형성되는 비정질 실리콘의 결정화 공정시 상기 기판(200) 내의 불순물이 확산되는 것을 방지한다.

다음으로 도 4b에 도시되어 있는 바와 같이, 상기 버퍼층(210)의 상부에 소정의 두께로 비정질 실리콘(도시안됨)을 증착한 후, 상기 비정질 실리콘을 결정화하고 사진 식각공정으로 패터닝하여 반도체층(230)을 형성하며, 상기 기판(200) 상의 전체 표면 상부에 게이트 절연막(220)을 증착한다. 이때, 상기 게이트 절연막(220)은 실리콘산화막($SiO_2$), 실리콘질화막($SiN_x$) 또는 그 적층구조를 사용하여 형성할 수 있다.

계속해서, 상기 게이트절연막(220) 상부에 알루미늄(Al) 또는 알루미늄- 네오디뮴(Al-Nd)과 같은 알루미늄 합금의 단일층이나, 크롬(Cr) 또는 몰리브덴(Mo) 합금 위에 알루미늄 합금이 적층된 다중 층으로 게이트전극용 금속층(도시안됨)을 형성하고, 사진식각공정으로 상기 게이트전극용 금속층을 식각하여 상기 반도체층(230)과 대응되는 소정 부분에 게이트 전극(238)을 형성한다. 이어서, 상기 게이트 전극(238)을 마스크로 사용하여 도전형의 불순물을 소정 도핑하여 소오스 영역(232)과 드레인 영역(236)을 형성한다. 상기 소오스 영역(232)과 드레인 영역(236)의 사이에 위치한 불순물이 도핑되지 않은 영역은 채널 영역(234)으로 작용한다. 그러나, 상기 도핑 공정은 게이트전극(238)을 형성하기 전에 포토레지스트를 형성하여 진행할 수도 있다.

다음으로, 도 4c에 도시되어 있는 바와 같이, 상기 기판(200) 상에 무기 절연막을 증착하여 소정 두께의 층간 절연막(240)을 형성하고, 상기 층간 절연막(240) 및 게이트 절연막(220)을 사진 식각하여 소오스 영역(232)과 드레인 영역(236)의 일부를 노출시키는 콘택홀(256,258)을 형성한다.



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이어서, 도 4d에 도시되어 있는 바와 같이 상기 콘택홀(256,258)을 포함한 층간 절연막(240) 상부에 도전 물질을 증착한 후, 상기 도전 물질을 패터닝하여 콘택홀(256)을 통해 소오스 영역(232)에 연결되는 소오스 전극(252)과 콘택홀(258)을 통해 드레인 영역(236)에 연결되는 드레인 전극(254)을 형성한다. 이때, 상기 도전 물질로는 몰리텅스텐(MoW) 또는 알루미늄-네오디뮴(Al-Nd) 등이 사용될 수 있다.

다음으로, 도 4e에 도시되어 있는 바와 같이 전체표면 상부에 평탄화막(250)을 형성하는데, 소오스/드레인 전극(252,254)이 형성된 기판(200) 상부 전체 표면에 평탄화막(250)을 형성한다.

이어서, 도 4f에 도시되어 있는 바와 같이 상기 평탄화막(250)에 소오스 전극(252) 또는 드레인 전극(254) 중의 어느 하나, 예를 들어 드레인 전극(254)의 일부분을 노출시키는 비아홀(265)을 형성한다. 이는 후속 공정에서 형성될 하부 전극(270)과 드레인 전극(254)을 연결하기 위함이다.

그 다음, 도 4g에 도시되어 있는 바와 같이 비아홀(265)을 포함한 상면이 평탄한 평탄화막(250) 상에 도전성 물질을 증착하여 비아홀(265)을 통하여 상기 소오스/드레인 전극(252,254) 중 어느 하나, 예를 들면 드레인 전극(254)에 접속되는 하부 전극(270)을 형성한다.

상기 하부 전극(270)은 기판(200) 상에 반사막과 상기 반사막 상의 투명전극으로 되어 있는데, 상기 반사막은 후속 공정에서 형성되는 유기막(도 3a에 도시된 290)에서 나오는 빛을 기판(200)과 반대 방향으로 반사시키기 위하여 형성한다. 여기서, 상기 하부 전극(270)은 통상 애노드 전극으로 작용한다.

이때, 반사막의 물질로는 은(Ag), 알루미늄(Al), 크롬(Cr), 몰리브덴(Mo), 텅스텐(W), 티타늄(Ti) 및 탈륨(Ta)의 단일 금속 및 이들의 합금 등이 사용되고 있으며, 상기 하부 전극(270)의 투명 전극의 구성 물질로는 일함수가 높은 ITO(Indium Tin Oxide) 또는 IZO(Indium Zinc Oxide) 등이 사용될 수 있고, 반사 효율 및 일함수 등을 고려하여 알루미늄(Al) 또는 이의 합금과 은(Ag) 또는 은(Ag)합금이 가장 폭 넓게 사용되고 있다.

이어서, 전체 표면 상부에 화소정의막 물질(도시안됨)을 형성한다. 이때, 상기 화소정의막 물질은 폴리이마이드(polyimide), 벤조사이클로부틴계 수지(benzocyclobutene series resin), 페놀계 수지(phenol resin) 및 아크릴레이트(acrylate)로 이루어진 군에서 선택되는 1종의 물질로 형성할 수 있다. 상기와 같은 박막은 노광 및 현상 공정으로 실시되는 사진 공정에 의해 패터닝이 가능하다.

그 다음, 도 4h에 도시되어 있는 바와 같이 사진 공정으로 상기 화소정의막 물질을 패터닝하여 발광영역을 노출시키는 화소정의막(280)을 형성한다.

계속해서, 도 4i에 도시된 바와 같이 상기 화소정의막(280)에 의해 노출되는 하부 전극(270)의 표면에 적어도 유기발광층을 포함하는 유기막(290)을 형성한다.

다음, 기판(200) 상의 상기 유기막(290) 상부에 상부 전극(300)을 형성한다. 상기 상부 전극(300)은 캐소드 전극으로 작용하며 투명 전극으로 형성하되, 일함수가 낮은 도전성의 금속으로 Mg, Ca, Al, Ag 및 이들의 합금으로 이루어진 군에서 선택된 1종의 물질로 형성하거나 MgAg와 같이 2종의 물질을 공증착하기도 한다.

이어서, 도 4j 및 도3a에 도시되어 있는 바와 같이 상기 기판(200) 상에 레이저 전사를 위한 필름(320)을 위치하여 스페이서(310a, 310b)를 형성한다. 상기 스페이서(310a, 310b)는 화소부(Ⅰ) 외측의 화소정의막(280) 상부의 상부전극(300) 상에 형성하되, 상기 필름(320)의 재료는 폴리스티렌(polystylene), 폴리 메틸 메타크릴레이트(poly methyl methacrylate)와 같은 폴리머 또는 유리(glass), 실리카(silica) 혹은 알루미나(alumina)와 같은 무기 재료나 수지와 같은 유기 재료 등을 사용할 수 있는데, 바람직하게는 유기 재료를 사용한다.

다음, 상기 화소부(Ⅰ)에 형성되어 있는 유기막(290) 등을 보호하기 위하여 상기 스페이서(310a, 310b)를 포함한 상부 전극(300) 상에 패시베이션막(285)을 형성한다.

(실시예 2)

도 3b는 도 2의 단위 화소의 A-A'에 대한 단면도로서, 본 발명에 따른 유기전계발광표시장치의 실시예 2를 나타내는 단면도이다.



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본 발명의 실시예 2는 실시예 1과 스페이서(310a', 310b')의 위치만 상이하고, 도 4a 내지도 4i까지의 공정은 동일하게 적용될 수 있는 바, 이하에서는 실시예 2의 스페이서(310a', 310b')에 대해서만 설명한다.

도 3b를 참조하면, 화소부(Ⅰ)에 형성되어 있는 유기막(290) 등을 보호하기 위하여 기판(200)의 상부 전극(300) 상에 패시베이션막(285')을 형성한다.

이어서, 실시예 1의 도 4j에 도시된 것과 동일한 공정으로 상기 패시베이션막(285') 상에 레이저 전사를 위한 필름을 위치하여 스페이서(310a', 310b')를 형성한다. 상기 스페이서(310a', 310b')는 화소부(Ⅰ) 외측의 화소정의막(280) 상부의 패시베이션막(285') 상에 형성하되, 상기 필름(320)의 재료는 폴리스티렌(polystylene), 폴리 메틸 메타크릴레이트(poly methyl methacrylate)와 같은 폴리머 또는 유리(glass), 실리카(silica) 혹은 알루미나(alumina)와 같은 무기 재료나 수지와 같은 유기 재료 등을 사용할 수 있는데, 바람직하게는 유기 재료를 사용한다.

상기와 같은 공정을 수행한 후, 유기전계발광표시장치의 제작에 사용되는 유기막 등을 수분 또는 산소 등으로부터 보호하기 위한 방법으로 유기막(290) 등이 증착된 기판(200)에 일정 공간을 유지한 상태로 고분자 필름이나 스테인레스 스틸 등을 주재료로 하는 캡(도시하지 않음)을 덮어 씌우는 봉지공정(encapsulation)을 하게 되며 상기 캡은 내부에 건조제가 장착되어 유기막(290) 등에서 발생하는 가스 및 외부로부터의 수분과 산소의 영향을 감소시키도록 제조된다.

**발명의 효과**

상기한 바와 같이 본 발명에 따르면, 화소부의 외측, 즉 화소정의막이 형성된 영역 상의 상부 전극 또는 최외각에 형성된 패시베이션막의 상부에 레이저 열 전사법(특히, LITI)을 이용하여 스페이서(spacer)를 형성함으로써, 외부 충격으로부터 화소부의 유기막이나 상부 전극 등을 보호할 수 있고 공정비용을 대폭적으로 절감할 수 있는 유기전계발광표시장치를 제공할 수 있다.

또한, 별도의 마스크를 이용한 포토레지스트 공정을 수행하지 않고 본 발명은 간단한 레이저 조사 공정으로 이루어질 수 있어 비용이 절감되며 공정의 복잡함 및 유기막 손상 등의 문제점을 해결할 수 있다.

## 도면의 간단한 설명

도 1은 종래의 유기전계발광표시장치의 단면도이다.

도 2는 본 발명에 따른 유기전계발광표시장치의 단위화소에 대한 평면도이다.

도 3a 및 도 3b는 도 2의 A-A' 선을 따라 절단한 단면도로서, 본 발명에 따른 전면발광 유기전계발광표시장치의 단면도이다.

도 4a 내지 도 4j는 본 발명에 따른 전면발광 유기전계발광표시장치를 제조하는 공정을 순서적으로 보여주는 단면도들이다.

<도면의 주요 부분에 대한 부호의 설명>

1. 스캔라인 2. 데이터라인

3. 공통전원라인 5. 스위칭 박막트랜지스터

6. 구동 박막트랜지스터 7. 캐패시터

8. 하부전극 9, Ⅰ. 화소부

100, 200. 기판 110, 210. 버퍼층

120, 220. 게이트절연막 130, 230. 반도체층



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132, 232. 소오스영역 134, 234. 채널영역

136, 236. 드레인영역 138, 238. 게이트전극

140, 240. 층간절연막 150, 250. 평탄화막

152, 252. 소오스전극 154, 254. 드레인전극

156, 158, 256, 258. 콘택홀 160, 265. 비아홀

165, 270. 하부전극 170, 280. 화소정의막패턴

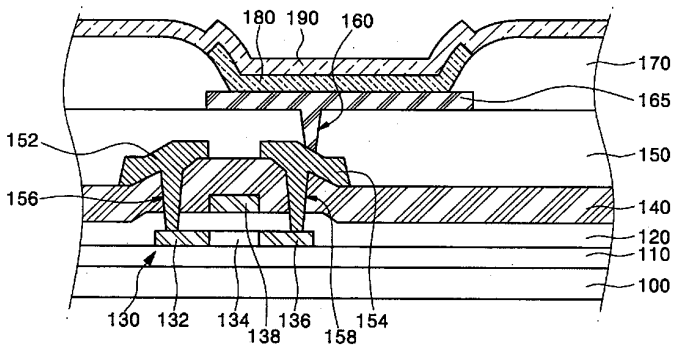
180, 290. 유기막 190, 300, 상부전극

285, 285'. 패시베이션막 310a, 310b, 310a', 310b'. 스페이서

320. 필름 330. 레이저

도면

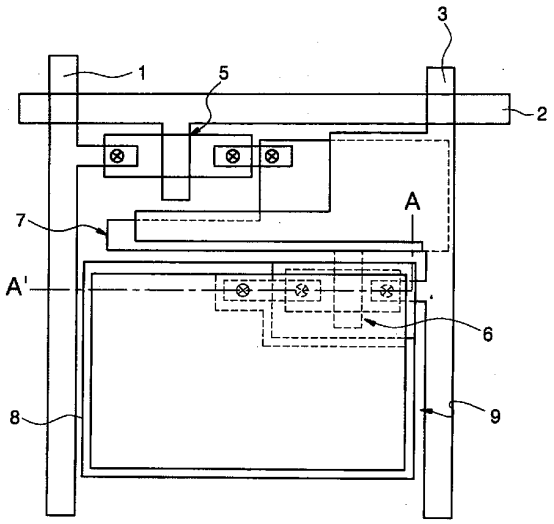
도면1



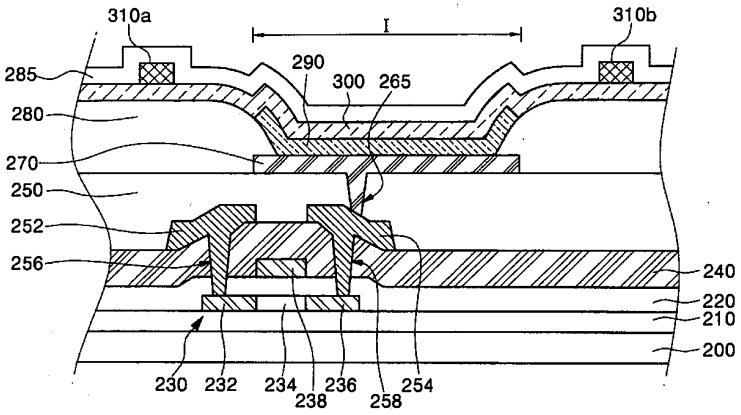



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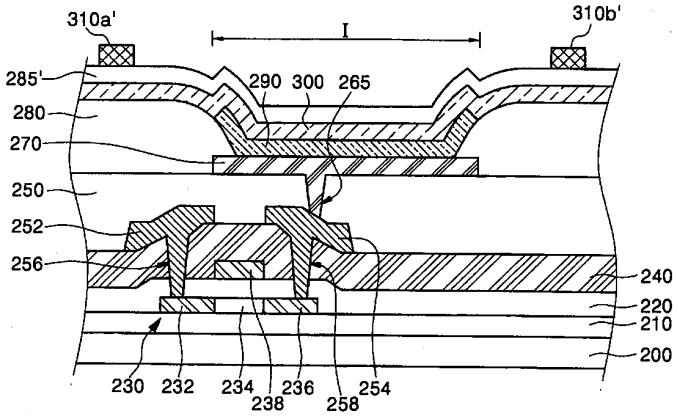
도면2




도면3a




도면3b



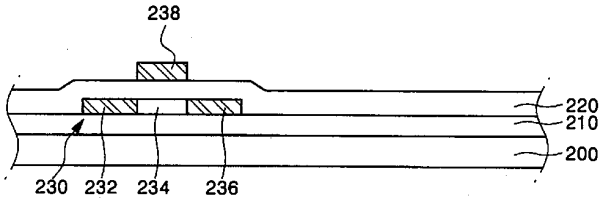



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BOE et al. v. Samsung, IPR2023-00988

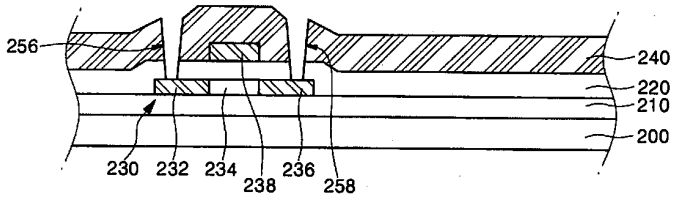
도면4a



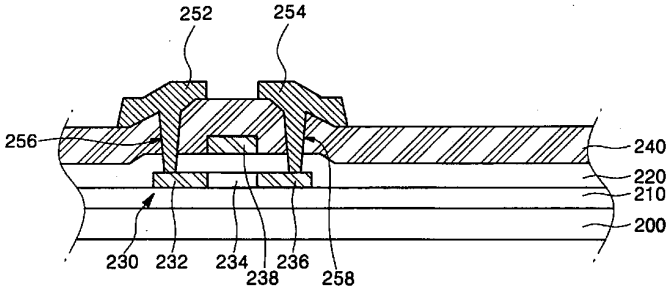

도면4b




도면4c



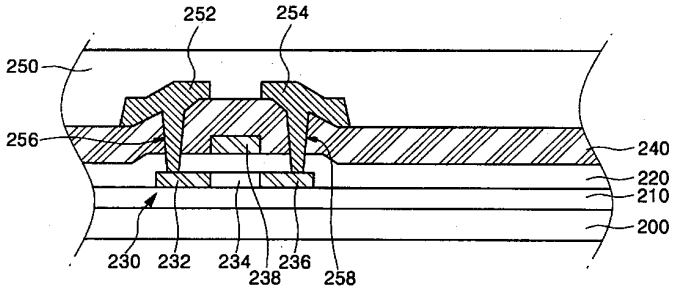

도면4d



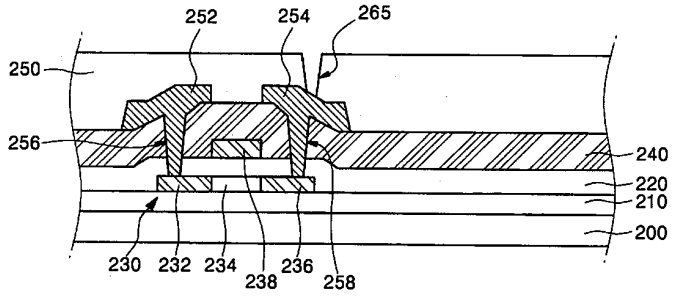



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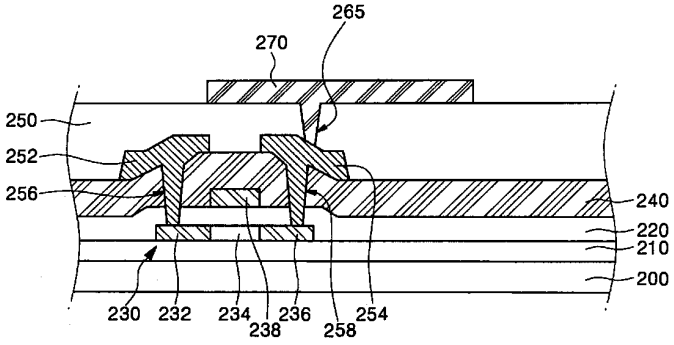
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도면4f



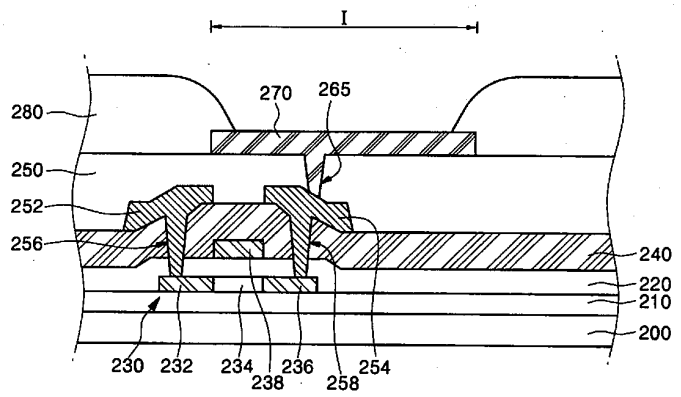

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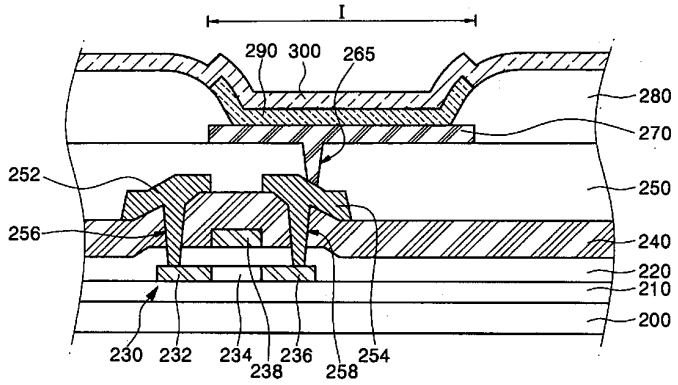



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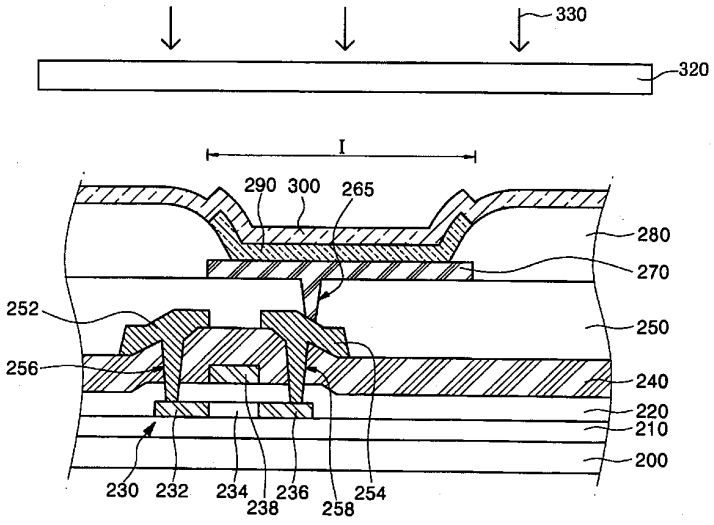
도면4h




도면4i




도면4j






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# Electronic Acknowledgement Receipt

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|---|---|
| **EFS ID:** | 19008190 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Youg E. Jeon/Diane Goss |
| **Filer Authorized By:** | Jun-Youg E. Jeon |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 12-MAY-2014 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 17:10:24 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

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| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
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| **Warnings:** | | | | | |
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| | Other Reference-Patent/App/Search documents | 1 | 1 |
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| 3 | Other Reference-Patent/App/Search documents | EP_SearchRpt-12_20.pdf | 367857<br>2d2028480800462710f355dccd42a648d30ebcda | no | 9 |
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| | | **Total Files Size (in bytes):** | 723071 | | |

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**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on May 12, 2014 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Diane L. Goss

| | | |
|---|---|---|
| Inventor | : Sang-Shin Lee | Confirmation No. 4264 |
| Application No. | : 13/614,197 | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| Grp./Div. | : 2691 | |
| Examiner | : Kwang-Su Yang | |
| Docket No. | : 69657/S1437 | |

**INFORMATION DISCLOSURE STATEMENT**
**37 CFR § 1.97(b)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
May 12, 2014

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is FORM PTO/SB/08A/B listing the references that are known to applicant. Copies of each of the listed non-U.S. references are enclosed. This filing is timely because it is made during one of the periods described in 37 CFR § 1.97(b).

It is respectfully requested that the listed references be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of FORM PTO/SB/08A/B be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

**Application No.: 13/614,197**

The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
CHRISTIE, PARKER & HALE, LLP

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JEJ/dg
Enclosures: PTO/SB/08A/B, w/references

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| FORM PTO/SB/08A/B (10-01)<br>Substitute for PTO-1449A/B<br><br>**INFORMATION DISCLOSURE**<br><br>**STATEMENT BY APPLICANT**<br><br>(use as many sheets as necessary) | | |
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| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2696 |
| | **Examiner Name** | Bipin H. Shalwala |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER<br>Number - Kind Code[2] (If Known) | PUBLICATION DATE<br>MM-DD-YYYY | NAME OF PATENTEE |
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**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document<br>Country Code[3] - Number[4] - Kind Code[5]<br>(If Known) | Publication Date<br>MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6]<br>(✓) |
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**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
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|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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# KOREAN PATENT ABSTRACTS

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(71) Applicant: SEKISUI CHEMICAL CO., LTD.

(72) Inventor: NAKANO, Yoshinori
YARA, Takuya

## (54) METHOD AND DEVICE FOR TREATING FILM SURFACE AND METHOD FOR PRODUCTION OF POLARISING PLATE

**ABSTRACT**

Disclosed is a means to reliably improve the adhesive properties of non easily-adhesive resin film, wherein a non easily-adhesive resin film (11) which is to be bonded to an easily-adhesive resin film (12) is placed in a near-atmospheric pressure treatment space (22). Gas which includes a first polymerisable monomer vapour, such as acrylic acid, passes through a first supply channel (36) and is guided to the vicinity of the non easily-adhesive resin film (11). Gas which includes a second polymerisable monomer vapour, such as HEMA, does not mix with the aforementioned first polymerisable monomer but passes through a second supply channel (46) and is guided to the vicinity of the non easily-adhesive resin film (11). These first and second polymerisable monomers are activated by a near-atmospheric pressure plasma and react with the non easily-adhesive resin film (11).

(19) 대한민국특허청(KR)
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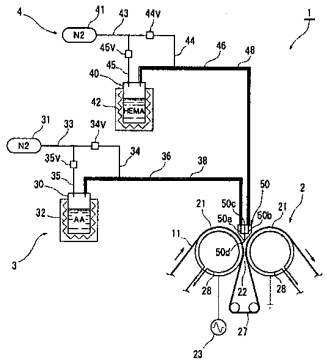
(54) 발명의 명칭 **필름의 표면 처리 방법 및 장치, 및 편광판의 제조 방법**

*(57) 요 약*

본 발명은 난접착성 수지 필름의 접착성을 확실하게 향상시킨다.

이접착성 수지 필름 (12)와 접착될 난접착성 수지 필름 (11)을 대기압 근방의 처리 공간 (22)에 배치한다. 아크릴산 등의 제1 중합성 단량체 증기를 함유하는 가스를 제1 공급로 (36)에 통과시키고, 난접착성 수지 필름 (11)의 근방까지 유도한다. HEMA 등의 제2 중합성 단량체 증기를 함유하는 가스를 상기 제1 중합성 단량체와 혼합하지 않고 제2 공급로 (46)에 통과시키고, 난접착성 수지 필름 (11)의 근방까지 유도한다. 이들 제1 및 제2 중합성 단량체를 대기압 근방의 플라즈마에 의해 활성화시켜 난접착성 수지 필름 (11)과 반응시킨다.

*대 표 도* - 도1






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**마츠자키, 쥰이치**

일본 300-4247 이바라끼켄 츠쿠바시 와다이 32 세키스이가가쿠 고교가부시키가이샤 내

**하세가와, 다이라**

일본 601-8105 교토후 교토시 미나미쿠 가미토바카미초시초 2-2 세키스이가가쿠 고교가부시키가이샤 내



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*특허청구의 범위*

**청구항 1**

이접착성 수지 필름과 접착될 난접착성 수지 필름의 표면을 대기압 근방 하에서 처리하는 방법으로서,

제1 중합성 단량체를 증기 상태로 상기 난접착성 수지 필름의 근방까지 유도하는 제1 공급 공정과,

상기 제1 중합성 단량체와는 다른 종류의 제2 중합성 단량체를 증기 상태로, 또한 상기 제1 중합성 단량체와 혼합시키지 않고 상기 난접착성 수지 필름의 근방까지 유도하는 제2 공급 공정과,

상기 제1 및 제2 중합성 단량체를 대기압 근방의 플라즈마에 의해 활성화시켜, 상기 난접착성 수지 필름과 반응시키는 플라즈마 처리 공정

을 구비한 것을 특징으로 하는 필름 표면 처리 방법.

**청구항 2**

제1항에 있어서, 상기 제1 및 제2 중합성 단량체끼리를 상기 플라즈마 처리 공정 직전 또는 상기 플라즈마 처리 공정과 병행하여 서로 혼합하는 혼합 공정을 더 구비한 것을 특징으로 하는 필름 표면 처리 방법.

**청구항 3**

제1항에 있어서, 상기 플라즈마 처리 공정이, 상기 제1 중합성 단량체를 대기압 근방의 플라즈마에 의해 활성화시켜, 상기 난접착성 수지 필름의 소정 부위와 반응시키는 제1 플라즈마 처리 공정과, 상기 제1 플라즈마 처리 공정 후, 상기 제2 중합성 단량체를 상기 활성화 전의 제1 중합성 단량체와 혼합시키지 않고 대기압 근방의 플라즈마에 의해 활성화시켜, 상기 난접착성 수지 필름의 상기 소정 부위와 반응시키는 제2 플라즈마 처리 공정을 포함하는 것을 특징으로 하는 필름 표면 처리 방법.

**청구항 4**

제3항에 있어서, 상기 제2 플라즈마 처리 공정에서 상기 대기압 근방의 플라즈마를 형성하기 위한 전계 강도가, 상기 제1 플라즈마 처리 공정에서 상기 대기압 근방의 플라즈마를 형성하기 위한 전계 강도보다 큰 것을 특징으로 하는 필름 표면 처리 방법.

**청구항 5**

제1항에 있어서, 상기 제1 및 제2 중합성 단량체를 상기 난접착성 수지 필름에 접촉시켜 상기 난접착성 수지 필름 상에 응축시키고, 그 후 상기 플라즈마 처리 공정을 행하는 것을 특징으로 하는 필름 표면 처리 방법.

**청구항 6**

상기 난접착성 수지 필름이 투명한 보호 필름이고, 상기 이접착성 수지 필름이 편광 필름이며, 제1항 내지 제5항 중 어느 한 항에 기재된 필름 표면 처리 방법을 실행한 후, 상기 난접착성 수지 필름을 이접착성 수지 필름에 투명한 접착제를 통해 접착하는 것을 특징으로 하는 편광판의 제조 방법.

**청구항 7**

이접착성 수지 필름과 접착될 난접착성 수지 필름의 표면을 대기압 근방 하에서 처리하는 장치로서,

상기 난접착성 수지 필름을 지지하는 지지 수단과,

제1 중합성 단량체를 증기화하는 제1 기화기와,

상기 제1 기화기로부터 연장되고, 상기 증기화한 제1 중합성 단량체를 상기 난접착성 수지 필름의 근방까지 유도하는 제1 공급로와,

상기 제1 중합성 단량체와는 다른 종류의 제2 중합성 단량체를, 상기 제1 중합성 단량체와는 별개로 증기화하는 제2 기화기와,



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상기 제2 기화기로부터 연장되고, 상기 증기화한 제2 중합성 단량체를 상기 제1 중합성 단량체와는 별개로 상기 난접착성 수지 필름의 근방까지 유도하는 제2 공급로와,

상기 제1 공급로로부터의 상기 제1 중합성 단량체를 대기압 근방의 플라즈마에 의해 활성화시켜, 상기 난접착성 수지 필름과 반응시키는 제1 플라즈마 처리부와,

상기 제2 공급로로부터의 상기 제2 중합성 단량체를 대기압 근방의 플라즈마에 의해 활성화시켜, 상기 난접착성 수지 필름과 반응시키는 제2 플라즈마 처리부

를 구비한 것을 특징으로 하는 필름 표면 처리 장치.

**청구항 8**

제7항에 있어서, 상기 제1 및 제2 플라즈마 처리부가 서로 공통의 플라즈마 처리부로 구성되어 있고, 상기 공통의 플라즈마 처리부가 대기압 근방의 방전 공간을 서로의 사이에 형성하는 한 쌍의 전극을 포함하며, 분사 노즐을 더 구비하고, 상기 분사 노즐의 기단이 상기 제1 공급로의 선단 및 상기 제2 공급로의 선단에 연속해 있고, 상기 분사 노즐의 선단이 상기 방전 공간을 향하고 있는 것을 특징으로 하는 필름 표면 처리 장치.

**청구항 9**

제7항에 있어서, 상기 제1, 제2의 각 플라즈마 처리부가 대기압 근방의 방전 공간을 서로의 사이에 형성하는 한 쌍의 전극을 포함하고 있고,

상기 제1 공급로의 선단에 설치되며, 상기 제1 플라즈마 처리부의 상기 방전 공간을 향하는 제1 분사 노즐과,

상기 제2 공급로의 선단에 설치되며, 상기 제2 플라즈마 처리부의 상기 방전 공간을 향하는 제2 분사 노즐과,

상기 난접착성 수지 필름의 소정 부위가 상기 제1 플라즈마 처리부에서 처리되고, 그 후 상기 제2 플라즈마 처리부에서 처리되도록, 상기 난접착성 수지 필름을 상기 제1, 제2 플라즈마 처리부에 대하여 상대 이동시키는 이동 수단

을 더 구비한 것을 특징으로 하는 필름 표면 처리 장치.

**청구항 10**

제9항에 있어서, 상기 제2 플라즈마 처리부에서의 상기 대기압 근방의 플라즈마를 형성하기 위한 전계 강도가, 상기 제1 플라즈마 처리부에서의 상기 대기압 근방의 플라즈마를 형성하기 위한 전계 강도보다 큰 것을 특징으로 하는 필름 표면 처리 장치.

**청구항 11**

제7항에 있어서, 상기 제1 및 제2 플라즈마 처리부가 서로 공통의 플라즈마 처리부로 구성되어 있고, 상기 공통의 플라즈마 처리부가 대기압 근방의 방전 공간을 서로의 사이에 형성하는 한 쌍의 전극을 포함하며,

상기 난접착성 수지 필름을 상기 공통의 플라즈마 처리부에 대하여 한 방향으로 상대 이동시키는 이동 수단과 분사 노즐을 더 구비하고, 상기 분사 노즐의 기단이 상기 제1 공급로의 선단 및 상기 제2 공급로의 선단에 연속해 있고, 상기 분사 노즐의 선단이 상기 방전 공간보다 상기 이동 방향의 상류측에 배치되어 있는 것을 특징으로 하는 필름 표면 처리 장치.

**청구항 12**

제8항 내지 제11항 중 어느 한 항에 있어서, 상기 한 쌍의 전극이 한 쌍의 롤 전극인 것을 특징으로 하는 필름 표면 처리 장치.

## *명 세 서*

### *기 술 분 야*

[0001] 본 발명은 수지 필름의 표면을 처리하는 방법 및 장치, 및 편광판의 제조 방법에 관한 것으로, 특히 난접착성의



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수지 필름과 이접착성의 수지 필름을 접착함에 있어서 상기 난접착성 수지 필름에 대하여 행하는 표면 처리 방법 등에 관한 것이다.

### 배 경 기 술

[0002] 액정 표시 장치에는 편광판이 조립되어 있다. 편광판은 폴리비닐 알코올(PVA: polyvinyl alcohol)을 주성분으로 포함하는 수지 필름(이하, 적절히 "PVA 필름"이라 칭함)을 포함하는 편광 필름에 트리아세테이트 셀룰로오스(TAC: triacetate cellulose)를 주성분으로 포함하는 수지 필름(이하, 적절히 "TAC 필름"이라 칭함)을 포함하는 보호 필름을 접착제를 이용하여 접착한 것이다. 접착제로서는, 폴리비닐 알코올계나 폴리에테르계 등의 수계 접착제가 이용되고 있다. PVA 필름은 이들 접착제와의 접착성이 양호하지만, TAC 필름은 접착성이 양호하지 않다. 따라서, 일반적으로 TAC 필름은 접착에 앞서 수산화나트륨이나 수산화칼륨 등의 알칼리 수용액에 침지되어, 비누화 처리된다. 이에 따라, TAC 필름의 표면이 가수분해에 의해 친수성이 높아져, 접착제가 TAC 필름에 붙기 쉬워진다.

[0003] 비누화 처리 이외의 표면 처리 방법으로서, 예를 들면 특허문헌 1에서는 헬륨과 아르곤의 혼합 가스로 피처리물의 표면을 대기압하에서 플라즈마 처리한 후, 아크릴산을 스프레이건에 의해 분무하고, 아크릴산을 그래프트 중합시켜 피처리물의 표면을 개질시키는 방법이 제안되어 있다.

[0004] 특허문헌 2에서는 질소, 아르곤 등의 불활성 가스와 유기계의 박막 형성용 가스를 혼합하고, 이 혼합 가스를 대기압 하에서 플라즈마 방전시켜 피처리물에 공급하여, 피처리물의 친수성을 높이는 방법이 제안되어 있다.

### 선행기술문헌

#### 특허문헌

[0005] (특허문헌 0001) 일본 특허 제3292924호 공보

(특허문헌 0002) 일본 특허 공개 제2006-299000호 공보

### 발명의 내용

#### 해결하려는 과제

[0006] 일반적으로 편광 필름은 PVA 필름을 염색?일축 연신함으로써 제조되고 있다. 편광 필름의 제조 방법, 보관 방법 등에 따라 편광 필름의 함수율이 크게 변화한다. 편광 필름의 함수율은 편광 필름과 보호 필름의 접착 강도에도 큰 영향을 미친다. 따라서, 편광 필름의 상태에 따라서는 보호 필름의 표면 처리(즉 접착성)를 보다 강하게 할 필요성이 생긴다. 또한, 최근에는 편광판의 비용 절감 등을 위해 보호 필름으로서 TAC 필름 이외에도 폴리에틸렌(PE: polyethylene), 폴리메타크릴산메틸(PMMA: polymethyl methacrylate), 폴리프로필렌(PP: polypropylene), 폴리에틸렌테레프탈레이트(PET: polyethylene terephthalate), 시클로올레핀 중합체(COP: cyclo olefin polymer), 시클로올레핀 공중합체(COC: cyclo olefin copolymer) 등의 광학 등급의 필름을 적용하는 것이 검토되고 있다. 이들 필름은 난접착성이면서 알칼리에 의한 가수분해 반응이 생기지 않기 때문에, 종래의 비누화 처리로는 접착성의 향상은 기대할 수 없다. 또한, 특허문헌 1, 2에 있는 아크릴산이나 유기계의 박막 형성용 가스를 이용한 표면 처리로도 충분한 접착 강도를 달성할 수 없었다.

#### 과제의 해결 수단

[0007] 본 발명자는 상기 사정을 감안하여, 난접착성 수지 필름의 접착성을 높이기 위해 예의 연구를 행하였다. 그 결과, 중합성 단량체를 2종 이상 조합하고, 이들 중합성 단량체를 활성화시켜 난접착성 수지 필름에 접촉시키면, 공중합 반응에 의해 접착성을 높일 수 있다는 지견을 얻었다. 한편, 2종의 중합성 단량체를 공통의 공급로에 통과시키면, 공급로 내에서 공중합물이 형성될 가능성이 있고, 그렇게 하면 공급로가 폐색되게 된다. 또한, 중합성 단량체의 종류가 다르면, 통상 비점이나 증기압도 다르다. 이 때문에, 2종 이상의 중합성 단량체의 혼합 증기를 만들면, 일부의 중합성 단량체가 액화하거나 기상 중에서 중합되는 경우도 있을 수 있다.

[0008] 본 발명은 상기 지견 및 고찰에 기초하여 이루어진 것으로서, 이접착성 수지 필름과 접착될 난접착성 수지 필름의 표면을 대기압 근방 하에서 처리하는 방법으로서,



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[0009] 제1 중합성 단량체를 증기 상태로 상기 난접착성 수지 필름의 근방까지 유도하는 제1 공급 공정과,

[0010] 상기 제1 중합성 단량체와는 다른 종류의 제2 중합성 단량체를 증기 상태로, 또한 상기 제1 중합성 단량체와 혼합시키지 않고 상기 난접착성 수지 필름의 근방까지 유도하는 제2 공급 공정과,

[0011] 상기 제1 및 제2 중합성 단량체를 대기압 근방의 플라즈마에 의해 활성화시켜 상기 난접착성 수지 필름과 반응시키는 플라즈마 처리 공정

[0012] 을 구비한 것을 특징으로 한다.

[0013] 상기 특징 구성에 따르면, 제1 중합성 단량체와 제2 중합성 단량체를 난접착성 수지 필름의 근방까지 혼합하지 않고 따로따로 공급함으로써, 공급로의 내부에서 서로 공중합 반응을 일으키는 것을 회피할 수 있다. 따라서, 공급로가 폐색되는 것을 방지할 수 있다. 또한, 제1 및 제2 중합성 단량체의 비점 및 증기압이 서로 상이하더라도, 이들 중합성 단량체의 일부가 공급로 내에서 액화하는 것을 확실하게 방지할 수 있다. 이에 따라, 제1 및 제2 중합성 단량체를 서로 원하는 유량비로 난접착성 수지 필름의 근방까지 확실하게 공급할 수 있다. 상기 난접착성 수지 필름의 "근방"의 위치에서부터 상기 난접착성 수지 필름의 표면까지의 거리는, 바람직하게는 0 ㎜ 내지 100 ㎜ 정도이다. 제1, 제2 중합성 단량체가 상기 난접착성 수지 필름의 "근방"의 위치로부터 상기 난접착성 수지 필름의 표면에 도달하기까지의 시간은, 바람직하게는 0초 내지 5초 정도이다. 이들 중합성 단량체를 대기압 근방의 플라즈마에 의해 활성화한다. 중합성 단량체의 활성화는 중합성 단량체의 개열, 중합, 분해를 포함한다. 제1 및 제2 중합성 단량체에 의한 중합 형태로서는, 공중합(랜덤, 블록, 교대), 그래프트 중합이 있을 수 있다. 중합성 단량체의 조합 및 혼합비에 의해 바람직한 중합 구조가 얻어지도록 제어할 수 있다. 또한, 활성화한 중합성 단량체가 난접착성 수지 필름과 반응한다. 예를 들면, 난접착성 수지 필름의 표면의 C-C, C-O, C-H 등의 결합이 플라즈마 가스와의 접촉이나 플라즈마광의 조사에 의해 절단된다. 이 결합 절단부에 중합성 단량체의 중합물이 결합한다고 생각된다. 이에 따라, 난접착성 수지 필름의 표면에 원하는 중합 구조를 포함하는 접착성 촉진층이 형성된다고 생각된다. 그 결과, 난접착성 수지 필름의 접착성을 높일 수 있다.

[0014] 본 발명의 방법은, 상기 제1 및 제2 중합성 단량체끼리를 상기 플라즈마 처리 공정 직전 또는 상기 플라즈마 처리 공정과 병행하여 서로 혼합하는 혼합 공정을 더 구비하는 것이 바람직하다.

[0015] 혼합 공정 전에 제1, 제2 중합성 단량체가 중합하거나 액화하는 것을 방지할 수 있다. 또한, 제1 및 제2 중합성 단량체를 확실하게 원하는 혼합비로 혼합할 수 있다. 나아가서는, 원하는 공중합체를 확실하게 생성할 수 있다. 그 결과, 난접착성 수지 필름의 표면에 원하는 공중합 구조를 포함하는 접착성 촉진층을 확실하게 형성할 수 있어, 난접착성 수지 필름의 접착성을 확실하게 높일 수 있다.

[0016] 상기 플라즈마 처리 공정이, 상기 제1 중합성 단량체를 대기압 근방의 플라즈마에 의해 활성화시켜, 상기 난접착성 수지 필름의 소정 부위와 반응시키는 제1 플라즈마 처리 공정과, 상기 제1 플라즈마 처리 공정 후, 상기 제2 중합성 단량체를 상기 활성화 전의 제1 중합성 단량체와 혼합시키지 않고 대기압 근방의 플라즈마에 의해 활성화시켜, 상기 난접착성 수지 필름의 상기 소정 부위와 반응시키는 제2 플라즈마 처리 공정을 포함할 수도 있다. 이에 따라, 제1 중합성 단량체와 제2 중합성 단량체를 시간적으로 어긋나게 하여 난접착성 수지 필름의 표면에 공급할 수 있다. 따라서, 공급로 내에서 공중합 반응이 일어나는 것을 확실하게 회피할 수 있어, 공급로가 폐색되는 것을 확실하게 방지할 수 있다. 제1 플라즈마 처리 공정에 의해, 난접착성 수지 필름의 표면에 제1 중합성 단량체에 의한 중합물의 층을 형성할 수 있다. 다음으로, 제2 플라즈마 처리 공정에 의해 제2 중합성 단량체에 의한 중합물을 형성할 수 있고, 또한 상기 난접착성 수지 필름 표면의 제1 중합성 단량체에 의한 중합물을 재활성화할 수 있고, 2종의 중합물을 결합시킬 수 있다. 또한, 제1 중합성 단량체에 의한 중합물의 표면을 거칠게 하여 요철로 할 수 있고, 이 요철의 표면에 제2 중합성 단량체에 의한 중합물을 결합시킬 수 있다. 이에 따라, 난접착성 수지 필름의 표면에, 제1 및 제2 중합성 단량체에 의한 공중합(특히 블록 중합), 그래프트 중합, 중합체 얼로이 등의 중합물을 포함하는 접착성 촉진층을 형성할 수 있다.

[0017] 상기 제2 플라즈마 처리 공정에서 상기 대기압 근방의 플라즈마를 형성하기 위한 전계 강도가, 상기 제1 플라즈마 처리 공정에서 상기 대기압 근방의 플라즈마를 형성하기 위한 전계 강도보다 큰 것이 바람직하다.

[0018] 이에 따라, 제1 플라즈마 처리 공정에서 난접착성 수지 필름 상에 형성된 중합물을, 제2 플라즈마 처리 공정에서 확실하게 재활성화할 수 있거나, 또는 그의 표면을 확실하게 거칠게 할 수 있다. 따라서, 난접착성 수지 필름의 표면에, 공중합, 그래프트 중합, 중합체 얼로이 등의 중합물을 포함하는 접착성 촉진층을 확실하게 형성할 수 있다.



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[0019] 상기 제1, 제2 중합성 단량체의 상기 난접착성 수지 필름에의 공급과 대기압 근방 플라즈마에 의한 활성화가 시간적 또는 공간적으로 떨어져 있을 수도 있다(실시예 11 내지 18 참조). 상기 제1 및 제2 중합성 단량체를 상기 난접착성 수지 필름에 접촉시켜 상기 난접착성 수지 필름 상에 응축시키고, 그 후 상기 플라즈마 처리 공정을 행할 수도 있다. 즉, 상기 제1, 제2 중합성 단량체를 플라즈마화하지 않고 상기 난접착성 수지 필름에 접촉시켜, 상기 제1, 제2 중합성 단량체를 상기 난접착성 수지 필름의 피처리 부분에 응축시키고, 그 후 상기 피처리 부분에 대기압 근방 플라즈마를 조사할 수도 있다.

[0020] 또한, 본 발명은 이접착성 수지 필름과 접착될 난접착성 수지 필름의 표면을 대기압 근방 하에서 처리하는 장치로서,

[0021] 상기 난접착성 수지 필름을 지지하는 지지 수단과,

[0022] 제1 중합성 단량체를 증기화하는 제1 기화기와,

[0023] 상기 제1 기화기로부터 연장되고, 상기 증기화한 제1 중합성 단량체를 상기 난접착성 수지 필름의 근방까지 유도하는 제1 공급로와,

[0024] 상기 제1 중합성 단량체와는 다른 종류의 제2 중합성 단량체를, 상기 제1 중합성 단량체와는 별개로 증기화하는 제2 기화기와,

[0025] 상기 제2 기화기로부터 연장되고, 상기 증기화한 제2 중합성 단량체를 상기 제1 중합성 단량체와는 별개로 상기 난접착성 수지 필름의 근방까지 유도하는 제2 공급로와,

[0026] 상기 제1 공급로로부터의 상기 제1 중합성 단량체를 대기압 근방의 플라즈마에 의해 활성화시켜, 상기 난접착성 수지 필름과 반응시키는 제1 플라즈마 처리부와,

[0027] 상기 제2 공급로로부터의 상기 제2 중합성 단량체를 대기압 근방의 플라즈마에 의해 활성화시켜, 상기 난접착성 수지 필름과 반응시키는 제2 플라즈마 처리부

[0028] 를 구비한 것을 특징으로 한다.

[0029] 상기 특징 구성에 따르면, 제1 중합성 단량체와 제2 중합성 단량체를 서로 따로따로 기화하고, 서로 따로따로의 공급로에 의해 난접착성 수지 필름의 근방까지 반송할 수 있다. 따라서, 공급로 내에 중합물이 형성되는 것을 방지할 수 있어, 공급로가 폐색되는 것을 방지할 수 있다. 또한, 공급로 내에서의 중합성 단량체 증기의 액화를 확실하게 방지할 수 있다. 그리고, 제1 및 제2 플라즈마 처리부에 의해, 난접착성 수지 필름의 표면에 제1 및 제2 중합성 단량체에 의한 공중합물, 그래프트 중합물, 중합체 얼로이 등의 중합물을 포함하는 접착성 촉진층을 형성할 수 있다. 그 결과, 난접착성 수지 필름의 접착성을 높일 수 있다.

[0030] 상기 제1 및 제2 플라즈마 처리부가 서로 공통의 플라즈마 처리부로 구성될 수도 있다. 상기 공통의 플라즈마 처리부가 대기압 근방의 방전 공간을 서로의 사이에 형성하는 한 쌍의 전극을 포함하는 것이 바람직하다. 추가로 분사 노즐을 구비하고, 상기 분사 노즐의 기단이 상기 제1 공급로의 선단 및 상기 제2 공급로의 선단에 연속해 있고, 상기 분사 노즐의 선단이 상기 공통의 플라즈마 처리부의 상기 방전 공간을 향하고 있는 것이 바람직하다.

[0031] 제1 중합성 단량체와 제2 중합성 단량체를 분사 노즐로 혼합하면서 공통의 플라즈마 처리부에 도입할 수 있다. 이에 따라, 제1 중합성 단량체와 제2 중합성 단량체의 혼합 증기가 공통의 플라즈마 처리부에서 활성화되고, 서로 중합하여 난접착성 수지 필름에 접촉한다. 그 결과, 난접착성 수지 필름의 표면에 원하는 공중합 구조를 포함하는 접착성 촉진층을 확실하게 형성할 수 있어, 난접착성 수지 필름의 접착성을 확실하게 높일 수 있다. 플라즈마 처리부 및 분사 노즐을 1개로 함으로써, 장치 구조를 간소화할 수 있어 설비 비용을 삭감할 수 있다.

[0032] 제1 중합성 단량체의 분사 방향과 제2 중합성 단량체의 분사 방향이 평행하면서 동일한 방향인 것이 바람직하다. 이에 따라, 접착성 촉진층에 불균일이 생기는 것을 억제할 수 있다.

[0033] 상기 제1, 제2의 각 플라즈마 처리부가 대기압 근방의 방전 공간을 서로의 사이에 형성하는 한 쌍의 전극을 포함할 수도 있다. 또한, 본 발명 장치가, 상기 제1 공급로의 선단에 설치되며, 상기 제1 플라즈마 처리부의 상기 방전 공간을 향하는 제1 분사 노즐과, 상기 제2 공급로의 선단에 설치되며, 상기 제2 플라즈마 처리부의 상기 방전 공간을 향하는 제2 분사 노즐과, 상기 난접착성 수지 필름의 소정 부위가 상기 제1 플라즈마 처리부에서 처리되고, 그 후 상기 제2 플라즈마 처리부에서 처리되도록, 상기 난접착성 수지 필름을 상기 제1, 제2 플라



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즈마 처리부에 대하여 상대 이동시키는 이동 수단을 구비할 수도 있다.

[0034] 이에 따라, 제1 중합성 단량체와 제2 중합성 단량체를 서로 별도의 분사 노즐로부터 별도의 플라즈마 처리부에 도입할 수 있다. 따라서, 공급로 내에서는 물론, 분사 노즐의 내부에서도 공중합 반응이 일어나는 것을 확실하게 회피할 수 있어, 분사 노즐 내의 가스로가 폐색되는 것을 확실하게 방지할 수 있다. 제1 중합성 단량체는 제1 분사 노즐로부터 제1 플라즈마 처리부에 도입되어 활성화된다. 제2 중합성 단량체는 제2 분사 노즐로부터 제2 플라즈마 처리부에 도입되어 활성화된다. 난접착성 수지 필름의 소정 부위는 우선 제1 플라즈마 처리부에서 처리되고, 다음으로 제2 플라즈마 처리부에서 처리된다. 제1 플라즈마 처리부에서, 난접착성 수지 필름의 소정 부위에 제1 중합성 단량체를 활성화하여 이루어지는 중합물의 층을 형성할 수 있다. 제2 플라즈마 처리부에서, 난접착성 수지 필름의 소정 부위에, 제1 및 제2 중합성 단량체에 의한 공중합(특히 블록 중합), 그래프트 중합, 중합체 얼로이 등의 중합물을 포함하는 접착성 촉진층을 형성할 수 있다.

[0035] 상기 제2 플라즈마 처리부에서의 상기 대기압 근방의 플라즈마를 형성하기 위한 전계 강도가 상기 제1 플라즈마 처리부에서의 상기 대기압 근방의 플라즈마를 형성하기 위한 전계 강도보다 큰 것이 바람직하다. 즉, 상기 제2 플라즈마 처리부의 상기 한 쌍의 전극 사이에 인가되는 전계 강도가 상기 제1 플라즈마 처리부의 상기 한 쌍의 전극 사이에 인가되는 전계 강도보다 큰 것이 바람직하다.

[0036] 이에 따라, 제1 플라즈마 처리부에서 난접착성 수지 필름의 소정 부위에 형성된 중합물을 제2 플라즈마 처리부에서 확실하게 재활성화할 수 있거나, 또는 그의 표면을 확실하게 거칠게 할 수 있다. 따라서, 난접착성 수지 필름의 소정 부위에, 공중합, 그래프트 중합, 중합체 얼로이 등의 중합물을 포함하는 접착성 촉진층을 확실하게 형성할 수 있다.

[0037] 상기 제1 및 제2 플라즈마 처리부가 서로 공통의 플라즈마 처리부로 구성되고, 상기 공통의 플라즈마 처리부가 대기압 근방의 방전 공간을 서로의 사이에 형성하는 한 쌍의 전극을 포함하며, 또한 본 발명 장치가 상기 난접착성 수지 필름을 상기 공통의 플라즈마 처리부에 대하여 한 방향으로 상대 이동시키는 이동 수단과 분사 노즐을 구비하고, 상기 분사 노즐의 기단이 상기 제1 공급로의 선단 및 상기 제2 공급로의 선단에 연속해 있고, 상기 분사 노즐의 선단이 상기 방전 공간보다 상기 이동 방향의 상류측에 배치될 수도 있다(도 3).

[0038] 상기 제1 및 제2 중합성 단량체를 상기 분사 노즐의 선단으로부터 분출함으로써, 상기 난접착성 수지 필름에서의 상기 방전 공간보다 상기 이동 방향의 상류측 부분에 상기 제1 및 제2 중합성 단량체를 접촉시켜 응축시킬 수 있다. 이 응축 부분이 이동 수단에 의해 상기 방전 공간에 도입되고, 대기압 근방 플라즈마가 조사된다. 이에 따라, 상기 제1 및 제2 중합성 단량체의 중합 반응을 기상 중이 아닌 상기 난접착성 수지 필름의 표면 상에서 일으킬 수 있어, 이들 중합성 단량체를 상기 난접착성 수지 필름의 표면 분자에 그래프트 공중합시킬 수 있다.

[0039] 상기 한 쌍의 전극이 한 쌍의 롤 전극인 것이 바람직하다. 상기 난접착성 필름이 연속 필름인 경우, 상기 한 쌍의 롤 전극에 상기 연속 필름상의 난접착성 필름을 걸어 돌려 반송할 수 있다. 상기 한 쌍의 롤 전극이 상기 지지 수단 및 상기 이동 수단을 겸할 수 있다.

[0040] 제1, 제2 플라즈마 처리부 내의 산소 농도는 3000 ppm 이하가 바람직하고, 1000 ppm 이하가 보다 바람직하다. 이에 따라, 산소에 의한 중합성 단량체의 중합 저해를 방지할 수 있어, 난접착성 수지 필름의 접착성을 한층 향상시킬 수 있다.

[0041] 상기 제1, 제2 플라즈마 처리부의 처리 공간은 대기에 연통 또는 대기에 개방되어 있을 수도 있다.

[0042] 상기 제1, 제2 플라즈마 처리부에서의 플라즈마 처리는 대기압 근방의 압력 하에서 이루어진다. 여기서, 대기압 근방이란, $1.013\times10^4$ 내지 $50.663\times10^4$ Pa의 범위를 말하고, 압력 조정의 용이화나 장치 구성의 간편화를 고려하면, $1.333\times10^4$ 내지 $10.664\times10^4$ Pa가 바람직하고, $9.331\times10^4$ 내지 $10.397\times10^4$ Pa가 보다 바람직하다.

[0043] 난접착성 수지 필름이란, 상기 필름과 접착되는 상대측의 필름보다 접착제에 대한 접착성이 상대적으로 낮은 필름을 말한다. 이접착성 수지 필름이란, 상기 필름과 접착되는 상대측의 필름보다 접착제에 대한 접착성이 상대적으로 높은 필름을 말한다. 동일한 필름이, 접착되는 상대측의 필름에 따라 난접착성 수지 필름이 될 수도 있고, 이접착성 수지 필름이 될 수도 있다.

[0044] 상기 난접착성 수지 필름의 주성분으로서는, 예를 들면 트리아세테이트 셀룰로오스(TAC), 폴리프로필렌(PP), 폴리에틸렌(PE), 시클로올레핀 중합체(COP), 시클로올레핀 공중합체(COC), 폴리에틸렌테레프탈레이트(PET), 폴리



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메타크릴산메틸(PMMA), 폴리이미드(PI: polyimide), 폴리스티렌(PSt: polystyrene), 폴리카보네이트(PC: polycarbonate) 등을 들 수 있다. 상기 난접착성 수지 필름이 이들의 공중합 필름일 수도 있다.

[0045] 상기 이접착성 수지 필름의 주성분으로서는, 예를 들면 폴리비닐 알코올(PVA), 에틸렌아세트산비닐 공중합체(EVA: ethylene vinyl acetate copolymer) 등을 들 수 있다.

[0046] 상기 제1, 제2 중합성 단량체는 실온 부근에서 액체인 것이 바람직하고, 또한 가스화가 용이한 것이 바람직하다.

[0047] 상기 제1, 제2 중합성 단량체는, 바람직하게는 불포화 결합을 갖고, 더욱 바람직하게는 소정의 관능기를 갖는다. 상기 제1, 제2 중합성 단량체가 함께 불포화 결합 및 상기 소정의 관능기를 가질 수도 있다. 상기 제1 중합성 단량체가 불포화 결합 및 상기 소정의 관능기를 갖는 단량체이고, 또한 상기 제2 중합성 단량체가 불포화 결합을 갖지만 상기 소정의 관능기를 갖지 않는 단량체일 수도 있다.

[0048] 상기 소정의 관능기는 카르복실기, 수산기, 아세틸기, 글리시딜기, 에폭시기, 탄소수 1 내지 10의 에스테르기, 술폰기, 알데히드기, 시아노기, 아미드기, 페닐기로부터 선택되는 것이 바람직하고, 특히 카르복실기나 수산기 등의 친수기가 바람직하다. 중합성 단량체가, 올레핀계 단량체 등의 불포화 결합을 갖지만 상기 소정의 관능기를 갖지 않는 단량체일 수도 있다.

[0049] 수산기를 갖는 단량체로서는, 메타크릴산 에틸렌글리콜(ethyleneglycol methacrylate), 알릴 알코올(allyl alcohol), 메타크릴산 히드록시에틸(HEMA: hydroxyethyl methacrylate), 비닐 알코올(vinyl alcohol), 비닐 알코올의 이성체인 아세트알데히드(acetaldehyde) 등을 들 수 있다.

[0050] 카르복실기를 갖는 단량체로서는, 아크릴산(acrylic acid), 메타크릴산(methacrylic acid), 이타콘산(itaconic acid), 말레산(maleic acid), 2-메타크릴로일 프로피온산(2-methacryloyl propionate) 등을 들 수 있다.

[0051] 아세틸기를 갖는 단량체로서는, 아세트산비닐(vinyl acetate) 등을 들 수 있다.

[0052] 글리시딜기를 갖는 단량체로서는 메타크릴산 글리시딜(glycidyl methacrylate) 등을 들 수 있다.

[0053] 에스테르기를 갖는 단량체로서는, 아크릴산메틸(methyl acrylate), 아크릴산에틸(ethyl acrylate), 아크릴산부틸(butyl acrylate), 아크릴산 t-부틸(t-butyl acrylate), 아크릴산 2-에틸헥실(2-ethylhexyl acrylate), 아크릴산옥틸(octyl acrylate), 메타크릴산메틸(methyl methacrylate), 메타크릴산에틸(ethyl methacrylate), 메타크릴산부틸(butyl methacrylate), 메타크릴산 t-부틸(t-butyl methacrylate), 메타크릴산이소프로필(isopropyl methacrylate), 메타크릴산 2-에틸(2-ethyl methacrylate) 등을 들 수 있다.

[0054] 알데히드기를 갖는 단량체로서는, 아크릴알데히드(acrolein), 크로톤알데히드(crotonaldehyde) 등을 들 수 있다.

[0055] 시아노기를 갖는 단량체로서는 아크릴로니트릴(acrylonitrile)을 들 수 있다.

[0056] 아미드기를 갖는 단량체로서는 아크릴아미드(acrylamide)를 들 수 있다.

[0057] 페닐기를 갖는 단량체로서는 스티렌(styrene) 등을 들 수 있다.

[0058] 제2 중합성 단량체는 불포화 결합을 갖지만 소정의 관능기를 갖지 않는 중합성 단량체일 수도 있다. 불포화 결합을 갖지만 소정의 관능기를 갖지 않는 중합성 단량체로서 올레핀계 단량체를 들 수 있다. 올레핀계 단량체는 극성 관능기를 갖지 않는 불포화 탄화수소이고, 특히 불포화 탄화수소에 있어서도 이중 결합을 갖는 단량체를 가리킨다. 본 발명에 적용하는 올레핀계 단량체는 실온 부근에서 액체인 것이 바람직하고, 또한 가스화가 용이한 것이 바람직하다. 올레핀계 단량체의 탄소수는 5 이상 8 이하인 것이 바람직하다. 올레핀계 단량체는 직쇄상일 수도 있고, 환상일 수도 있다. 올레핀계 단량체의 이중 결합의 수는 1개로 한정되지 않고, 2개 이상일 수도 있다. 직쇄상의 올레핀계 단량체의 이중 결합의 위치는 바람직하게는 말단이지만, 여기에 한정되는 것은 아니다.

[0059] 직쇄상의 올레핀계 단량체로서, 1-펜텐(1-pentene), 1-헥센(1-hexene), 1-헵텐(1-heptene), 1-옥텐(1-octene) 등을 들 수 있다. 환상의 올레핀계 단량체로서, 시클로펜텐(cyclopentene), 시클로헥센(cyclohexene), 시클로헵텐(cycloheptene), 시클로옥텐(cyclooctene) 등을 들 수 있다. 올레핀계 단량체로서, 바람직하게는 환상 디엔을 들 수 있고, 더욱 바람직하게는 시클로펜타디엔(cyclopentadiene) 또는 디시클로펜타디엔(DCPD: dicyclopentadiene)을 들 수 있다.



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[0060] 상기에서 열거한 단량체로부터 1개를 선택하여 제1 중합성 단량체로 하고, 다른 1개를 선택하여 제2 중합성 단량체로 하는 것이 바람직하다.

[0061] 제1, 제2 중합성 단량체는 난접착성 수지 필름 및 이접착성 수지 필름의 조성에 기초하여 선택하는 것이 바람직하고, 구체적으로는 난접착성 수지 필름 및 이접착성 수지 필름과 상용성이 높은 것끼리를 조합하는 것이 바람직하다.

[0062] 예를 들면, 난접착성 수지 필름이 TAC이고, 이접착성 수지 필름이 PVA인 경우, 제1 중합성 단량체는 카르복실기를 갖는 단량체이고, 제2 중합성 단량체는 수산기 또는 글리시딜기를 갖는 단량체인 것이 바람직하다.

[0063] 난접착성 수지 필름이 PP 또는 PE이고, 이접착성 수지 필름이 PVA인 경우, 제1 중합성 단량체는 카르복실기를 갖는 단량체이고, 제2 중합성 단량체는 수산기 또는 글리시딜기를 갖는 단량체 또는 올레핀계 단량체인 것이 바람직하다.

[0064] 난접착성 수지 필름이 COP 또는 COC이고, 이접착성 수지 필름이 PVA인 경우, 제1 중합성 단량체는 카르복실기를 갖는 단량체이고, 제2 중합성 단량체는 수산기 또는 글리시딜기를 갖는 단량체 또는 올레핀계 단량체인 것이 바람직하다.

[0065] 난접착성 수지 필름이 PMMA이고, 이접착성 수지 필름이 PVA인 경우, 제1 중합성 단량체는 카르복실기를 갖는 단량체이고, 제2 중합성 단량체는 수산기 또는 글리시딜기를 갖는 단량체인 것이 바람직하다.

[0066] 난접착성 수지 필름이 PET이고, 이접착성 수지 필름이 PVA인 경우, 제1 중합성 단량체는 에폭시기를 갖는 단량체이고, 제2 중합성 단량체는 카르복실기를 갖는 단량체, 또는 수산기 또는 글리시딜기를 갖는 단량체인 것이 바람직하다.

[0067] 상기 예시에 있어서, 제1 중합성 단량체의 성분과 제2 중합성 단량체의 성분이 서로 반대일 수도 있다.

[0068] 상기 제1, 제2 중합성 단량체는 캐리어 가스에 의해 반송하도록 할 수도 있다. 캐리어 가스는, 바람직하게는 질소, 아르곤, 헬륨 등의 불활성 가스로부터 선택된다. 경제성 관점에서는 캐리어 가스로서 질소를 이용하는 것이 바람직하다.

[0069] 상기에서 열거한 중합성 단량체의 대부분은 상온 상압에서 액상이다. 액상의 중합성 단량체는 기화기에서 증기화하여 반송한다. 기화기 내에서 중합성 단량체를 불활성 가스 등의 캐리어 가스 중에 기화시키고, 중합성 단량체 증기와 캐리어 가스의 혼합 가스를 포함하는 중합성 단량체 함유 가스를 얻는 것이 바람직하다. 중합성 단량체를 캐리어 가스 중에 기화시키는 방법으로서는, 중합성 단량체액의 액면 상의 포화 증기를 캐리어 가스로 압출하는 방법, 중합성 단량체액 중에 캐리어 가스를 버블링하는 방법, 중합성 단량체액을 가열하여 증발을 촉진시키는 방법 등을 들 수 있다. 압출과 가열, 또는 버블링과 가열을 병용할 수도 있다.

[0070] 가열하여 기화시키는 경우, 가열기의 부담을 고려하여, 중합성 단량체는 비점이 300℃ 이하인 것을 선택하는 것이 바람직하다. 또한, 중합성 단량체는 가열에 의해 분해(화학 변화)되지 않는 것을 선택하는 것이 바람직하다.

[0071] 또한, 본 발명에 따른 편광판의 제조 방법은, 상기 난접착성 수지 필름이 투명한 보호 필름이고, 상기 이접착성 수지 필름이 편광 필름이고, 상기 필름 표면 처리 방법을 실행한 후, 상기 난접착성 수지 필름을 이접착성 수지 필름에 투명한 접착제를 통해 접착하는 것을 특징으로 한다.

[0072] 상기 표면 처리 방법을 채용함으로써 접착성을 확보할 수 있고, 나아가서는 편광판의 품질을 향상시킬 수 있다. 또한, 종래의 비누화 처리에서 사용된 대량의 알칼리 용액의 관리가 불필요하게 되어 환경 부하를 크게 감소시킬 수 있다.

## *발명의 효과*

[0073] 본 발명에 따르면, 난접착성 수지 필름의 접착성을 확실하게 향상시킬 수 있다. 또한, 중합성 단량체가 공급로 도중에서 중합하여 공급로가 폐색되거나 중합성 단량체가 공급로 내에서 액화되는 것을 방지할 수 있고, 중합성 단량체의 공급 유량을 원하는 크기로 유지할 수 있다.

## *도면의 간단한 설명*

[0074] 도 1은 본 발명의 제1 실시 형태에 따른 표면 처리 장치를 개략적으로 나타내는 정면도이다.



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도 2는 본 발명의 제2 실시 형태에 따른 표면 처리 장치를 개략적으로 나타내는 정면도이다.

도 3은 본 발명의 제3 실시 형태에 따른 표면 처리 장치를 개략적으로 나타내는 정면도이다.

도 4는 실시예 11 내지 17 및 비교예 7에 이용한 표면 처리 장치를 개략적으로 나타내는 정면도이다.

도 5의 (a)는 편광판의 단면도이고, (b)는 하드 코드층 부착 편광판의 단면도이다.

*발명을 실시하기 위한 구체적인 내용*

[0075] 이하, 본 발명의 실시 형태를 도면을 참조하여 설명한다.

[0076] 도 5는 본 발명의 실시 형태에 따른 표면 처리 방법을 이용하여 제조된 액정 디스플레이용의 편광판 (10)을 나타낸 것이다. 도 5의 (a)에 나타낸 바와 같이, 편광판 (10)은 편광 필름 (12)와, 이 편광 필름 (12)의 양면에 적층된 한 쌍의 보호 필름 (11)을 갖고 있다.

[0077] 보호 필름 (11)은 트리아세테이트 셀룰로오스(TAC)를 주성분으로 하는 TAC 필름으로 구성되어 있다. TAC 필름 (11)의 트리아세테이트 셀룰로오스의 함유량은 90 질량% 이상이다. TAC 필름 (11)에는 추가로 인산트리페닐 (TPP: triphenyl phosphate) 등의 인산 에스테르(phosphate) 가소제를 3 내지 10 질량% 정도 함유할 수 있고, 자외선 흡수제를 함유할 수도 있다. TAC 필름 (11)의 두께에는 특별히 한정이 없고, 예를 들면 수십 μm 내지 백수십 μm이다. TAC 필름 (11)의 제조 방법은 특별히 한정이 없고, 예를 들면 캐스팅법으로 제조된다.

[0078] 편광 필름 (12)는 폴리비닐 알코올(PVA)을 주성분으로 하는 PVA 필름 (12)로 구성되어 있다.

[0079] TAC 필름 (11)과 PVA 필름 (12)는 접착제 (13)에 의해 접착되어 있다. 접착제 (13)으로서는 특별히 한정은 없지만, 광학 필름 (10)에 적용되는 것을 고려하여 투명한 수계 접착제를 이용하는 것이 바람직하다. 수계 접착제로서, 폴리비닐 알코올 수용액, 폴리비닐 부티랄(polyvinyl butyral) 용액 등을 주성분으로 하는 폴리비닐 알코올계의 접착제액, 부틸 아크릴레이트(butyl acrylate) 등을 주성분으로 하는 비닐계 중합계 라텍스, 폴리올레핀계 폴리올(polyol) 등을 주성분으로 하는 올레핀 수성 접착제, 폴리에테르계 접착제 등을 들 수 있다. 접착제 (13)으로서는, 폴리비닐 알코올 수용액을 주성분으로 하는 폴리비닐 알코올계 접착제를 이용하는 것이 보다 바람직하다.

[0080] 도 5의 (b)에 나타내는 편광판 (10)에서는 한쪽의 TAC 필름 (11)의 표측면(PVA 필름 (12)와의 접착면과는 반대측의 면)에 기능층으로서 하드 코팅층 (14)가 적층되어 있다. 하드 코팅층 (14) 대신에 AR층, 그 밖의 기능층이 적층될 수도 있다.

[0081] TAC 필름 (11)은 접착제 (13)과의 접착성이 낮아, 난접착성 수지 필름을 구성한다. PVA 필름 (12)는 접착제 (13)과의 접착성이 높아, 이접착성 수지 필름을 구성한다. 난접착성의 TAC 필름 (11)은 이접착성의 PVA 필름 (12)와의 접착시 접착성 향상을 위한 표면 처리가 실시된다.

[0082] 도 1은 상기 표면 처리에 이용하는 표면 처리 장치 (1)을 나타낸 것이다. 표면 처리 장치 (1)은 공통 플라즈마 처리부 (2)와 제1 가스 공급계 (3)과 제2 가스 공급계 (4)를 구비하고 있다.

[0083] 플라즈마 처리부 (2)는 한 쌍의 전극 (21)과 전원 (23)을 구비하고 있다. 이들 전극 (21)은 서로 동일한 크기의 롤상(원주형)을 이루고, 축선을 도 1과 직교하는 방향으로 향하게 하여 좌우로 나란히 배열되어 있다. 이들 전극 (21) 사이의 가장 좁게 된 부분의 주변의 공간이 거의 대기압의 처리 공간 (22)로 되어 있다. 처리 공간 (22)는 협애하게 되어 있다. 전극 (21) 사이의 가장 좁게 된 부분의 두께는 바람직하게는 0.5 내지 수 ㎜ 정도이다. 처리 공간 (22)의 상하 양단은 개방되어 대기에 연통되어 있다.

[0084] 한 쌍의 전극 (21) 중 한쪽이 전원 (23)의 고압 단자에 접속되고, 다른 쪽이 전기적으로 접지되어 있다. 전원 (23)은 직류 전력을 교류 변환하여 전극 (21)에 공급한다. 이 전력 공급에 의해 전극 (21, 21) 사이에 전계가 형성되고, 상기 처리 공간 (22)가 거의 대기압의 방전 공간이 된다. 전원 (23)으로부터의 공급 전압 및 전극 (21) 사이의 전계는 예를 들면 펄스형으로 되어 있다. 펄스의 상승 시간 및/또는 하강 시간은 10 μs 이하인 것이 바람직하고, 전계 강도는 10 내지 1000 kV/cm인 것이 바람직하고, 주파수는 0.5 내지 100 kHz인 것이 바람직하다. 인가 전압 및 전계는 펄스상의 간헐파로 한정되지 않고, 정현파 등의 연속파일 수도 있다.

[0085] 연속 시트상의 TAC 필름 (11)이 2개의 롤 전극 (21, 21)에 걸쳐지고, 각 롤 전극 (21)의 상측의 둘레면에 예를 들면 반바퀴 정도 걸어 돌려져 있다. 롤 전극 (21, 21)끼리 사이의 TAC 필름 (11)은 처리 공간 (22)으로 통과되어 하측으로 연장되고, 한 쌍의 전환 롤 (27, 27)에 걸어 돌려져 전환되고 있다. 2개의 롤 전극 (21)의 회전



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에 의해 TAC 필름 (11)이 일 방향(우측 방향)으로 반송된다. 롤 전극 (21)의 회전 속도를 조절함으로써, TAC 필름 (11)의 이동 속도를 조절할 수 있다.

[0086] 한 쌍의 롤 전극 (21) 및 한 쌍의 전환 롤 (27)은 TAC 필름 (11)의 지지 수단 및 이동 수단으로서의 기능을 갖고 있다.

[0087] 각 롤 전극 (21)의 내부에 필름 온도 조절 수단 (28)이 조립되어 있다. 필름 온도 조절 수단 (28)은 온도 조절로에 의해 구성되어 있다. 소정 온도의 온도 조절 매체가 롤 전극 (21) 내의 온도 조절로를 유통한다. 온도 조절 매체로서 예를 들면 물이 이용된다. 이에 따라, 롤 전극 (21)의 온도를 조절할 수 있고, 나아가 TAC 필름 (11)의 롤 전극 (21)에 접하는 부분의 온도를 조절할 수 있다. TAC 필름 (11)의 온도는 실온 이상인 것이 바람직하다. TAC 필름 (11)의 온도는 분출 온도(분사 노즐 (50)의 설정 온도) 이하 실온 이상인 것이 보다 바람직하다. 여기서, 실온이란, 일반적으로 20 내지 25℃이고, 보다 일반적으로는 25℃이다.

[0088] 다음으로, 제1 가스 공급계 (3)에 대하여 설명한다.

[0089] 제1 가스 공급계 (3)은 제1 기화기 (30)과 제1 불활성 가스 공급원 (31)을 구비하고 있다. 제1 기화기 (30) 내의 하측부에 제1 중합성 단량체가 액체 상태로 비축되어 있다. 제1 기화기 (30) 내의 제1 중합성 단량체액의 액면보다 상측의 부분에는 제1 중합성 단량체액으로부터 기화한 제1 중합성 단량체의 포화 증기가 존재하고 있다.

[0090] 제1 중합성 단량체는 불포화 결합 및 소정의 관능기를 갖는 것이 바람직하고, 친수성을 갖는 것이 보다 바람직하다. 여기서는 제1 중합성 단량체로서 아크릴산($CH_2$=CHCOOH; 도 1에 있어서 "AA"라고 약기)이 이용되고 있다. 아크릴산은 에틸렌성 불포화 이중 결합 및 카르복실기를 갖는 친수성의 중합성 단량체이다.

[0091] 제1 중합성 단량체로서, 아크릴산 대신에 메타크릴산을 이용할 수도 있다.

[0092] 제1 기화기 (30)에는 가열기 (32)가 조립되어 있다. 제1 기화기 (30) 내의 아크릴산액이 가열기 (32)에 의해 가열되어 기화된다. 가열기 (32)에 의한 가열 온도에 의해 아크릴산의 기화량을 조절할 수 있다. 액체 아크릴산의 가열 온도는 아크릴산 증기가 폭발성인 점을 고려하여 150℃ 이하가 바람직하고, 80 내지 120℃가 보다 바람직하다. 실온 근방에서도 아크릴산의 기화량이 필요량을 만족시키는 경우에는 가열기 (32)를 생략할 수도 있다. 처리 공간을 불활성 가스로 채우는 등 하여 처리 공간의 산소 농도를 1000 ppm 이하로 한 경우, 산소 농도에 따라 액체 아크릴산의 가열 온도는 54℃ 내지 100℃ 정도가 보다 바람직하다.

[0093] 또한, 아크릴산의 발화점은 360℃이다. 아크릴산의 인화점은 54℃이다. 이와 관련하여, 메타크릴산의 발화점은 360℃이다. 메타크릴산의 인화점은 77℃이다.

[0094] 제1 불활성 가스 공급원 (31)에는 불활성 가스가 충전되어 있다. 불활성 가스는 제1 중합성 단량체 증기를 반송하는 캐리어 가스로서의 역할과, 제1 중합성 단량체 증기를 희석하는 희석 가스로서의 역할과, 처리 공간 (22) 내에 플라즈마를 생성하기 위한 플라즈마 생성용 가스로서의 역할을 담당하고 있다. 여기서는 불활성 가스로서 질소 가스가 이용되고 있다.

[0095] 질소 가스 이외에, 아르곤, 헬륨 등의 다른 불활성 가스를 이용할 수도 있다. 캐리어 가스, 희석 가스, 내지는 플라즈마 생성용 가스는 산소를 실질적으로 함유하지 않는 것이 바람직하다.

[0096] 불활성 가스 공급원 (31)로부터 불활성 가스 공급로 (33)이 연장되어 있다. 불활성 가스 공급로 (33)이 희석로 (34)와 캐리어로 (35)로 분기되어 있다. 이들 로 (34, 35)에는 유량 조절 수단 (34v, 35v)이 각각 설치되어 있다. 유량 조절 수단 (34v, 35v)는 매스플로우 컨트롤러나 유량 제어 밸브 등으로 구성되어 있다. 이들 유량 조절 수단 (34v, 35v)에 의해 불활성 가스의 각 로 (34, 35)에의 분류비가 조절된다.

[0097] 캐리어로 (35)가 제1 기화기 (30)에 접속되어 있다. 캐리어로 (35)의 선단부는 제1 기화기 (30)의 내부에 삽입되면서 아크릴산액의 액면보다 상측 부분에 위치하며, 개구되어 있다.

[0098] 캐리어로 (35)의 선단부를 아크릴산액의 내부까지 연장시켜, 아크릴산액의 내부에서 질소 가스를 버블링시킬 수도 있다.

[0099] 제1 기화기 (30)의 상측부로부터 제1 공급로 (36)이 연장되어 있다. 제1 공급로 (36)의 중도부에 희석로 (34)가 합류하고 있다. 제1 공급로 (36)은 처리 공간 (22)의 근방으로 연장되고, 나아가서는 상기 처리 공간 (22) 내의 TAC 필름 (11)의 근방으로 연장되어 있다. 제1 공급로 (36)에는 가스 온도 조절 수단 (38)이 설치되어 있다. 가스 온도 조절 수단 (38)은, 예를 들면 리본 히터로 구성되고, 제1 공급로 (36)을 구성하는 관의 외주를



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전장에 걸쳐 덮고 있다. 가스 온도 조절 수단 (38)에 의해, 제1 공급로 (36)을 통과하는 가스의 온도를 조절할 수 있다.

[0100] 다음으로, 제2 가스 공급계 (4)에 대하여 설명한다.

[0101] 제2 가스 공급계 (4)는 제2 기화기 (40)과 제2 불활성 가스 공급원 (41)을 구비하고 있다. 제2 기화기 (40) 내의 하측부에 제2 중합성 단량체가 액체 상태로 비축되어 있다. 제2 기화기 (40) 내의 제2 중합성 단량체액의 액면보다 상측 부분에는 제2 중합성 단량체액으로부터 기화한 제2 중합성 단량체의 포화 증기가 존재하고 있다.

[0102] 제2 중합성 단량체는 불포화 결합 및 소정의 관능기를 갖는 것이 바람직하고, 친수성을 갖는 것이 보다 바람직하다. 여기서는 제2 중합성 단량체로서 2-히드록시에틸메타크릴레이트(이하 "HEMA"라 약기)가 이용되고 있다.

[0103] 제2 기화기 (40)에는 가열기 (42)가 조립되어 있다. 제2 기화기 (40) 내의 HEMA의 액이 가열기 (42)에 의해 가열되어 기화된다. 가열기 (42)에 의한 가열 온도에 의해 HEMA의 기화량을 조절할 수 있다. HEMA의 가열 온도는 150℃ 이하가 바람직하고, 80℃ 내지 120℃가 보다 바람직하다.

[0104] 또한, HEMA의 인화점은 108℃이다.

[0105] 제2 불활성 가스 공급원 (41)에는 제1 불활성 가스 공급원 (31)과 마찬가지로, 질소를 포함하는 불활성 가스가 충전되어 있다.

[0106] 제1 불활성 가스 공급원 (31)이 제2 불활성 가스 공급원 (41)로서 겸용될 수도 있다. 불활성 가스로서, 질소 가스 대신에 아르곤, 헬륨 등의 다른 불활성 가스를 이용할 수도 있다. 제1 불활성 가스 공급원 (31)과 제2 불활성 가스 공급원 (41)의 불활성 가스가 서로 상이할 수도 있다.

[0107] 불활성 가스 공급원 (41)로부터 불활성 가스 공급로 (43)이 연장되어 있다. 불활성 가스 공급로 (43)이 희석로 (44)와 캐리어로 (45)로 분기되어 있다. 이들 로 (44, 45)에는 유량 조절 수단 (44v, 45v)가 각각 설치되어 있다. 유량 조절 수단 (44v, 45v)는 매스플로우 컨트롤러나 유량 제어 밸브 등으로 구성되어 있다. 이들 유량 조절 수단 (44v, 45v)에 의해 불활성 가스의 각 로 (44, 45)에의 분류비가 조절된다.

[0108] 캐리어로 (45)가 제2 기화기 (40)에 접속되어 있다. 캐리어로 (45)의 선단부는 제2 기화기 (40)의 내부에 삽입되면서 액체 HEMA의 액면보다 상측 부분에 위치하며, 개구되어 있다.

[0109] 캐리어로 (45)의 선단부를 액체 HEMA의 내부까지 연장시켜, HEMA액 중에서 질소 가스를 버블링시킬 수도 있다.

[0110] 제2 기화기 (40)의 상측부으로부터 제2 공급로 (46)이 연장되어 있다. 제2 공급로 (46)의 중도부에 희석로 (44)가 합류하고 있다. 제2 공급로 (46)은 처리 공간 (22)의 근방으로 연장되고, 나아가서는 상기 처리 공간 (22) 내의 TAC 필름 (11)로 연장되어 있다. 제2 공급로 (46)에는 가스 온도 조절 수단 (48)이 설치되어 있다. 가스 온도 조절 수단 (48)은, 예를 들면 리본 히터로 구성되고, 제2 공급로 (46)을 구성하는 관의 외주를 전장에 걸쳐 덮고 있다. 가스 온도 조절 수단 (48)에 의해, 제2 공급로 (46)을 통과하는 가스의 온도를 조절할 수 있다.

[0111] 한 쌍의 롤 전극 (21) 사이의 상측 부분에 분사 노즐 (50)이 배치되어 있다. 분사 노즐 (50)에는 한 쌍을 이루는 제1, 제2 분사로 (50a, 50b)와, 공통 분출구 (50d)가 형성되어 있다. 제1 공급로 (36)의 선단이 제1 분사로 (50a)에 연속해 있다. 제2 공급로 (46)의 선단이 제2 분사로 (50b)에 연속해 있다. 제1 분사로 (50a)와 제2 분사로 (50b)가 합류부 (50c)에서 서로 합류하고 있다. 합류부 (50c)에 공통 분출구 (50d)가 연속해 있다. 공통 분출구 (50d)가 분사 노즐 (50)의 선단면에 개구되어 있다. 분사 노즐 (50)의 선단면은 밑을 향해 있고, 처리 공간 (22)를 향하고 있다. 분사 노즐 (50)의 선단부는 밑으로 향해감에 따라 가늘어지고, 한 쌍의 롤 전극 (21, 21) 사이의 점차로 좁아지는 부분에 삽입되어 있다.

[0112] 상세한 도시는 생략하지만, 분사 노즐 (50)은 도 1의 지면과 직교하는 방향으로 TAC 필름 (11)의 폭과 거의 동일하거나 그보다 길게 연장되어 있다. 분사로 (50a, 50b)로부터 분출구 (50d)까지의 사이에는, 이들 로를 통과하는 가스를 분사 노즐 (50)의 길이 방향(도 1의 지면 직교 방향)으로 균일하게 분산시키는 정류로가 형성되어 있다. 합류부 (50c)가 상기 정류로로 되어 있을 수도 있다. 분출구 (50d)는 도 1의 지면과 직교하는 방향으로 연장되는 슬릿상으로 되어 있다.

[0113] 분출구 (50d)가, 도 1의 지면과 직교하는 방향으로 간격을 두고 배치된 다수의 소구멍 형상으로 되어 있을 수도 있다.



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[0114] 분사 노즐 (50)의 내부에는 온도 조절로(도시 생략)가 형성되어 있다. 온도 조절로에 소정 온도의 온도 조절 매체가 통과된다. 온도 조절 매체로서 예를 들면 물이 이용된다. 온도 조절 매체에 의해 분사 노즐 (50)의 구조체를 소정 온도로 유지할 수 있고, 나아가서는 분사 노즐 (50) 내를 통과하는 각 가스의 온도를 조절할 수 있고, 나아가서는 혼합 중합성 단량체 함유 가스의 분출 온도를 조절할 수 있다. 분출 온도는 가스 온도 조절 수단 (38, 48)의 설정 온도보다 낮은 것이 바람직하다. 분출 온도는 사용하는 제1 중합성 단량체, 제2 중합성 단량체의 성분에 따라 적절히 설정한다.

[0115] 상기 구성의 필름 표면 처리 장치 (1)을 이용하여 TAC 필름 (11)을 표면 처리하고, 나아가 편광판 (10)을 제조하는 방법을 설명한다.

[0116] [제1 공급 공정]

[0117] 불활성 가스 공급원 (31)의 질소 가스를 불활성 가스 공급로 (33)으로부터 희석로 (34)와 캐리어로 (35)로 분배한다. 분배비를 유량 조절 수단 (34v, 35v)으로 조절한다. 캐리어로 (35)로 분류된 질소 가스가 제1 기화기 (30)에 도입되고, 제1 기화기 (30) 내의 액체 아크릴산의 액면보다 상측의 아크릴산 증기(제1 중합성 단량체 증기)를 제1 공급로 (36)에 압출한다. 제1 공급로 (36)에서, 제1 기화기 (30)으로부터의 가스와 희석로 (34)로부터의 질소 가스가 혼합되어, 제1 중합성 단량체 함유 가스(아크릴산 증기+질소)가 생성된다. 제1 중합성 단량체 함유 가스 중의 아크릴산의 농도는 폭발 한계를 고려하여 2% 이하인 것이 바람직하고, 1% 정도가 보다 바람직하다. 아크릴산 농도는 질소 가스의 2개의 로 (34, 35)에의 분배비, 가열기 (32)에 의한 아크릴산의 가열 온도에 의해 조절할 수 있다. 제1 중합성 단량체 함유 가스는 제1 공급로 (36)을 거쳐 분사 노즐 (50)(난접착성 필름 (11)의 근방)으로 보내진다. 이 때, 가스 온도 조절 수단 (38)에 의해 공급로 (36)을 통과중인 제1 중합성 단량체 함유 가스의 온도를 원하는 바가 되도록 조절한다. 이에 따라, 공급로 (36) 내에서 제1 중합성 단량체 함유 가스 중의 아크릴산이 액화되는 것을 확실하게 방지할 수 있다.

[0118] [제2 공급 공정]

[0119] 상기 제1 공급 공정과 병행하여, 불활성 가스 공급원 (41)의 질소 가스를 불활성 가스 공급로 (43)으로부터 희석로 (44)와 캐리어로 (45)로 분배한다. 분배비를 유량 조절 수단 (44v, 45v)로 조절한다. 캐리어로 (45)로 분류된 질소 가스가 제2 기화기 (40)에 도입되고, 제2 기화기 (40) 내의 액체 HEMA의 액면보다 상측의 HEMA 증기(제2 중합성 단량체 증기)를 제2 공급로 (46)에 압출한다. 제2 공급로 (46)에 있어서, 제2 기화기 (40)으로부터의 가스와 희석로 (44)로부터의 질소 가스가 혼합되어, 원하는 농도의 제2 중합성 단량체 함유 가스(HEMA 증기+질소)가 생성된다. 제2 중합성 단량체 함유 가스 중의 HEMA 농도는 2% 이하인 것이 바람직하고, 1% 정도가 보다 바람직하다. HEMA 농도는 질소 가스의 2개의 로 (44, 45)에의 분배비, 가열기 (42)에 의한 HEMA의 가열 온도에 의해 조절할 수 있다. 제2 중합성 단량체 함유 가스는 제2 공급로 (46)을 거쳐 분사 노즐 (50), 즉 난접착성 필름 (11)의 근방에 보내진다. 이 때, 가스 온도 조절 수단 (48)에 의해 공급로 (46)을 통과중인 제2 중합성 단량체 함유 가스의 온도를 원하는 바가 되도록 조절한다. 이에 따라, 공급로 (46) 내에서 제2 중합성 단량체 함유 가스 중의 HEMA가 액화되는 것을 확실하게 방지할 수 있다.

[0120] 제1, 제2 공급 공정에 따르면, 제1 중합성 단량체의 아크릴산 증기와 제2 중합성 단량체의 HEMA 증기를 혼합하지 않고 다른 루트로 보낼 수 있다. 따라서, 이들 중합성 단량체끼리가 공급로 (36, 46)의 내부에서 공중합 반응을 일으키는 일은 없다. 따라서, 공급로 (36, 46)이 폐색되는 것을 방지할 수 있다. 또한, 제1, 제2 중합성 단량체의 비점 및 증기압은 서로 다른 것이 통상적이지만, 제1 중합성 단량체 함유 가스와 제2 중합성 단량체 함유 가스를 따로따로의 공급로 (36, 46) 내에서 따로따로 온도 조절함으로써, 한쪽 또는 양쪽의 중합성 단량체가 액화되는 것을 확실하게 방지할 수 있다.

[0121] [혼합 공정]

[0122] 분사 노즐 (50)의 제1 분사로 (50a)에는 제1 공급로 (36)으로부터의 제1 중합성 단량체 함유 가스(아크릴산+질소)를 도입한다. 제2 분사로 (50b)에는 제2 공급로 (46)으로부터의 제2 중합성 단량체 함유 가스(HEMA+질소)를 도입한다. 이들 제1, 제2 중합성 단량체 함유 가스를 합류부 (50c)에서 혼합하면서 도시하지 않은 정류부에 의해 TAC 필름 (11)의 폭 방향(도 1의 지면과 직교하는 방향)으로 균일화한다. 이하, 혼합된 제1, 제2 중합성 단량체 함유 가스를 "혼합 중합성 단량체 함유 가스"라고 칭한다. 상술한 바와 같이 제1 공급 공정 및 제2 공급 공정에서 제1, 제2 중합성 단량체의 공중합 반응이나 액화를 방지할 수 있기 때문에, 혼합 중합성 단량체 함유 가스 중의 제1 중합성 단량체와 제2 중합성 단량체의 혼합비를 확실하게 원하는 값으로 할 수 있다. 균일화 후의 혼합 중합성 단량체 함유 가스를 분출구 (50d)로부터 처리 공간 (22)로 분출한다. 제1, 제2 중합성 단량체



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의 합류 후 분출까지의 시간 및 거리가 매우 짧기 때문에, 노즐 (50)의 내부에서 공중합 반응이 일어나는 것을 충분히 방지할 수 있다. 노즐 (50) 내의 제1, 제2 중합성 단량체의 합류 후 분출까지의 시간은 바람직하게는 0.5초 내지 2.0초 정도이다. 노즐 (50) 내의 제1, 제2 중합성 단량체의 합류 후 분출까지의 거리는, 바람직하게는 5.0 mm 내지 50 mm 정도이다. 또한, 분사 노즐 (50)에 조립된 온도 조절 수단에 의해 분사 노즐 (50) 내를 통과중인 가스의 온도를 원하는 바가 되도록 조절한다. 이에 따라, 분사 노즐 (50) 내에서 중합성 단량체가 액화되는 것을 확실하게 방지할 수 있다. 또한, 혼합 중합성 단량체 함유 가스가 분사 노즐 (50)으로부터 분출될 때의 온도(이하 "분출 온도"라고 칭함)를 설정 온도로 할 수 있다. 분출 온도의 상한은 TAC 필름 (11)이 팽윤 등의 열변형을 초래하지 않는 범위로 설정하는 것이 바람직하다. TAC 필름 (11)이 팽윤 등의 열변형을 초래하지 않는 한계 온도는 처리 조건 등에 따라서도 다르지만, 예를 들면 80℃ 전후이다. 분출 온도의 하한은 가스로 (36, 46) 및 노즐 (50) 내에서의 결로를 방지하는 관점에서 실온 이상인 것이 바람직하다. 분출 온도는 35℃ 내지 80℃ 정도가 바람직하다.

[0123] [플라즈마 처리 공정]

[0124] 상기 가스 공급과 병행하여, 전원 (23)으로부터의 전압 공급에 의해, 전극 (21, 21) 사이에 대기압 방전을 형성하여, 처리 공간 (22) 내에 대기압 근방의 글로 방전을 생성한다. 이에 따라, 혼합 중합성 단량체 함유 가스 중의 질소가 플라즈마화되면서 아크릴산 증기와 HEMA 증기가 각각 활성화되어, 이중 결합의 개열, 아크릴산과 HEMA의 공중합 등이 일어난다. 또한, TAC 필름 (11)에의 질소 플라즈마의 접촉이나 질소 플라즈마로부터의 자외선(337 nm)의 조사에 의해, TAC 필름 (11)의 표면 분자의 C-C, C-O, C-H 등의 결합이 절단된다. 이 결합 절단부에 아크릴산과 HEMA의 공중합물이 결합한다. 이에 따라, TAC 필름 (11)의 표면에 아크릴산과 HEMA의 공중합물을 포함하는 접착성 촉진층이 형성된다. 제1, 제2 중합성 단량체의 조합 및 혼합비를 조절함으로써, 바람직한 공중합 구조가 얻어지도록 제어할 수 있다.

[0125] 공통 플라즈마 처리부 (2)가, 제1 중합성 단량체를 플라즈마화하는 제1 플라즈마 처리부와 제2 중합성 단량체를 플라즈마화하는 제2 플라즈마 처리부를 겸한다.

[0126] 또한, 필름 온도 조절 수단 (28)에 의해, TAC 필름 (11)의 롤 전극 (21)과 접촉하는 부분의 온도(이하 "필름 온도"라고 칭함)를 혼합 중합성 단량체 함유 가스의 분출 온도보다 낮은 원하는 온도로 유지한다. 바람직하게는, 필름 온도가 분출 온도보다 5℃ 이상 낮아지도록 한다. 보다 바람직하게는, 필름 온도가 분출 온도보다 10℃ 이상 낮아지도록 한다. 이 온도 조절에 의해, 예를 들면 10 m/분 이상의 고속 반송 하에서도 아크릴산 및 HEMA를 TAC 필름 (11)의 표면에 확실하게 응축(담지)시킬 수 있고, 나아가서는 아크릴산 및 HEMA의 공중합물을 포함하는 접착성 촉진층을 TAC 필름 (11)의 표면에 확실하게 형성할 수 있다.

[0127] [이동 공정]

[0128] 상기 제1, 제2 공급 공정 및 혼합 공정, 및 플라즈마 처리 공정과 병행하여, 롤 전극 (21, 21)을 도 1에 있어서 시계 방향으로 계속적으로 회전시켜 TAC 필름 (11)을 우측 방향으로 보낸다. TAC 필름 (11)의 각 포인트는 좌측의 롤 전극 (21)에 걸어 돌린 후, 상기 좌측의 롤 전극 (21)로부터 떨어지기 직전에 처리 공간 (22)를 통과하고, 전환 롤 (27, 27)로 전환된 후, 우측의 롤 전극 (21)에 걸려지면서 다시 처리 공간 (22)를 통과한다. TAC 필름 (11)의 각 포인트는 처리 공간 (22)를 통과할 때마다 플라즈마 처리된다. 따라서, 하나의 처리 공간 (22)에서 TAC 필름 (11)을 2회 표면 처리할 수 있다.

[0129] 여기서, 좌측의 롤 전극 (21) 상의 TAC 필름 (11)의 이동에 따라, 상기 TAC 필름 (11)의 주변의 분위기 가스(공기)가 상기 TAC 필름 (11)과 함께 처리 공간 (22)에 권입된다. TAC 필름 (11)의 이동 속도가 커질수록 공기의 권입량이 증대하는 경향이 있다. 따라서, 상기 제1 공급 공정 및 제2 공급 공정에서, 제1, 제2 중합성 단량체 함유 가스의 공급 유량을 크게 하여, 처리 공간 (22) 내의 산소 농도가 소정 이하가 되도록 한다. 캐리어로 (35)의 유량을 일정하게 유지하면서 희석로 (34)의 유량을 조절함으로써, 제1, 제2 중합성 단량체 함유 가스의 공급 유량을 조절하는 것이 바람직하다. 이에 따라, 처리 공간 (22) 내의 가스를 혼합 중합성 단량체 함유 가스(대부분이 질소, 나머지가 아크릴산 및 HEMA의 증기)로 치환하여, 처리 공간 (22)으로부터 공기, 나아가서는 산소를 추방할 수 있다.

[0130] 구체적으로는, 처리 공간 (22) 내의 산소 농도가, 바람직하게는 3000 ppm, 보다 바람직하게는 2000 ppm, 한층 바람직하게는 1000 ppm 이하가 되도록 한다. 이에 따라, 플라즈마 처리 공정에서의 아크릴산 및 HEMA의 개열이나 중합, TAC 필름 (11)의 표면 분자의 C-C, C-O, C-H 등의 결합 절단, 아크릴산과 HEMA의 공중합물과 상기 결합 절단부와의 결합 등의 반응이 저해되는 것을 방지할 수 있다. 따라서, TAC 필름 (11)의 표면에 접착성 촉진



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층을 확실하게 형성할 수 있고, 처리 품질을 안정시킬 수 있다. 게다가, 처리 공간 (22) 내에의 공기 권입을 우려하지 않고 TAC 필름 (11)의 반송 속도를 크게 할 수 있다. 따라서, 처리 시간을 단축할 수 있다.

[0131] [접착 공정]

[0132] 이상과 같이 하여 표면 처리된 난접착성 수지의 TAC 필름 (11)을 접착제 (13)에 의해 이접착성 수지의 PVA 필름 (12)와 접착한다. TAC 필름 (11)의 표면에 원하는 공중합 구조를 포함하는 접착성 촉진층이 형성되어 있기 때문에, TAC 필름 (11)을 PVA 필름 (12)에 확실히 접착할 수 있다. 이에 따라, 양호한 품질의 편광판 (10)을 얻을 수 있다.

[0133] 다음으로, 본 발명의 다른 실시 형태에 따른 표면 처리 장치에 대하여 설명한다. 이하의 실시 형태에 있어서 제1 실시 형태와 중복하는 구성에 관해서는 도면에 동일 부호를 붙여 설명을 생략한다.

[0134] 도 2는 본 발명의 제2 실시 형태를 나타낸 것이다. 제2 실시 형태에 따른 필름 표면 처리 장치 (1X)에서는 3개의 롤 전극 (21)에 의해 2개의 플라즈마 처리부 (2A, 2B)가 구성되어 있다. 3개의 전극 (21)은 서로 동일한 크기의 롤상(원주형)을 이루고, 축선을 도 2와 직교하는 방향으로 향하게 하여 좌우로 나란히 배열되어 있다. 3개의 전극 (21)을 서로 구별할 때에는 좌측의 전극 (21)을 "전극 (21L)"로 하고, 중앙의 전극 (21)을 "전극 (21C)"로 하고, 우측의 전극 (21)을 "전극 (21R)"로 한다.

[0135] 중앙의 롤 전극 (21C)가 전기적으로 접지되어 있다. 좌측의 롤 전극 (21L)이 제1 전원 (23A)에 접속되어 있다. 전원 (23A)로부터의 전압 공급에 의해, 좌측과 중앙의 전극 (21L, 21C) 사이에 전계가 형성되고, 이들 전극 사이의 가장 좁게 된 부분의 주변의 공간이 거의 대기압의 제1 처리 공간 (22A)가 된다. 좌측과 중앙의 전극 (21L, 21C) 및 전원 (23A)에 의해 제1 플라즈마 처리부 (2A)가 구성되어 있다. 우측의 롤 전극 (21R)이 제2 전원 (23B)에 접속되어 있다. 전원 (23B)로부터의 전압 공급에 의해, 중앙과 우측의 전극 (21C, 21R) 사이에 전계가 형성되고, 이들 전극 간의 가장 좁게 된 부분의 주변의 공간이 거의 대기압의 제2 처리 공간 (22B)가 된다. 중앙과 우측의 전극 (21C, 21R) 및 전원 (23B)에 의해 제2 플라즈마 처리부 (2B)가 구성되어 있다.

[0136] 연속 시트상의 TAC 필름 (11)이 3개의 롤 전극 (21)에 걸쳐 있고, 각 롤 전극 (21)의 상측의 둘레면에 예를 들면 반바퀴 정도 걸어 돌려져 있다. 인접하는 롤 전극 (21)끼리의 사이의 TAC 필름 (11)은 각 처리 공간 (22A, 22B)보다 하측으로 연장되고, 한 쌍의 전환 롤 (27, 27)에 걸어 돌려져 전환되고 있다. 3개의 롤 전극 (21)의 회전에 의해, TAC 필름 (11)이 일 방향(우측 방향)으로 반송된다. TAC 필름 (11)의 반송 방향을 따라서, 상류측에 제1 플라즈마 처리부 (2A)가 배치되고, 하류측에 제2 플라즈마 처리부 (2B)가 배치되어 있다. TAC 필름 (11)의 각 포인트(소정 부위)는 제1 플라즈마 처리부 (2A)의 처리 공간 (22A)를 통과하고, 그 후 제2 플라즈마 처리부 (2B)의 처리 공간 (22B)를 통과한다.

[0137] 3개의 롤 전극 (21)은 TAC 필름 (11)의 지지 수단 및 반송 수단으로서의 기능을 겸하고 있다.

[0138] 제2 실시 형태에서는 제1 가스 공급계 (3)이 제1 플라즈마 처리부 (2A)와 상대하고 있다. 제2 가스 공급계 (4)가 제2 플라즈마 처리부 (2B)와 상대하고 있다.

[0139] 상술하면, 제1 가스 공급계 (3)의 제1 공급로 (36)이 제1 플라즈마 처리부 (2A)로 연장되어 있다. 제1 공급로 (36)의 선단에 제1 분사 노즐 (51)이 설치되어 있다. 제1 분사 노즐 (51)은 좌측과 중앙의 롤 전극 (21L, 21C) 사이의 상측부에 배치되어 있다. 제1 분사 노즐 (51)의 선단이 하측의 방전 공간 (22A)를 향하고 있다.

[0140] 상세한 도시는 생략하지만, 제1 분사 노즐 (51)은 도 2의 지면과 직교하는 방향으로 TAC 필름 (11)의 폭과 거의 동일하거나 그보다 길게 연장되어 있다. 제1 분사 노즐 (51)의 내부에는 제1 공급로 (36)으로부터의 가스를 제1 분사 노즐 (51)의 길이 방향(도 2의 지면 직교 방향)으로 균일하게 분산시키는 정류로가 형성되어 있다. 제1 분사 노즐 (51)의 선단의 분출구는 도 2의 지면과 직교하는 방향으로 연장되는 슬릿상으로 되어 있다. 제1 분사 노즐 (51)의 분출구가, 도 2의 지면과 직교하는 방향으로 간격을 두고 배치된 다수의 소구멍 형상으로 되어 있을 수도 있다.

[0141] 제1 분사 노즐 (51)의 내부에는 온도 조절로(도시 생략)가 형성되어 있다. 온도 조절로에 소정 온도의 온도 조절 매체가 통과된다. 온도 조절 매체로서 예를 들면 물이 이용된다. 온도 조절 매체에 의해 제1 분사 노즐 (51)의 구조체를 소정 온도로 유지할 수 있고, 나아가서는 제1 분사 노즐 (51) 내를 통과하는 제1 중합성 단량체 함유 가스의 온도를 조절할 수 있고, 나아가서는 제1 중합성 단량체 함유 가스의 분출 온도를 조절할 수 있다.

[0142] 제2 가스 공급계 (4)의 제2 공급로 (46)이 제2 플라즈마 처리부 (2B)로 연장되어 있다. 제2 공급로 (46)의 선



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단에 제2 분사 노즐 (52)가 설치되어 있다. 제2 분사 노즐 (52)는 중앙과 우측의 롤 전극 (21C, 21R) 사이의 상측부에 배치되어 있다. 제2 분사 노즐 (52)의 선단이 하측의 방전 공간 (22B)를 향하고 있다.

[0143] 상세한 도시는 생략하지만, 제2 분사 노즐 (52)는 도 2의 지면과 직교하는 방향으로 TAC 필름 (11)의 폭과 거의 동일하거나 그보다 길게 연장되어 있다. 제2 분사 노즐 (52)의 내부에는 제2 공급로 (46)으로부터의 가스를 제2 분사 노즐 (52)의 길이 방향(도 2의 지면 직교 방향)으로 균일하게 분산시키는 정류로가 형성되어 있다. 제2 분사 노즐 (52)의 선단의 분출구는 도 2의 지면과 직교하는 방향으로 연장되는 슬릿상으로 되어 있다. 제2 분사 노즐 (52)의 분출구가, 도 2의 지면과 직교하는 방향으로 간격을 두고 배치된 다수의 소구멍 형상으로 되어 있을 수도 있다.

[0144] 제2 분사 노즐 (52)의 내부에는 온도 조절로(도시 생략)가 형성되어 있다. 온도 조절로에 소정 온도의 온도 조절 매체가 통과된다. 온도 조절 매체로서 예를 들면 물이 이용된다. 온도 조절 매체에 의해 제2 분사 노즐 (52)의 구조체를 소정 온도로 유지할 수 있고, 나아가서는 제2 분사 노즐 (52) 내를 통과하는 제2 중합성 단량체 함유 가스의 온도를 조절할 수 있고, 나아가서는 제2 중합성 단량체 함유 가스의 분출 온도를 조절할 수 있다.

[0145] 제2 실시 형태에서는 제1, 제2 중합성 단량체 함유 가스의 혼합 공정을 행하지 않는다. 제1 중합성 단량체 함유 가스와 제2 중합성 단량체 함유 가스는 서로 따로따로 분출된다. 또한, 플라즈마 처리 공정을, 제1 중합성 단량체 함유 가스에 의한 제1 플라즈마 처리 공정과 제2 중합성 단량체 함유 가스에 의한 제2 플라즈마 처리 공정으로 나누어 실행한다. 게다가, TAC 필름 (11)의 각 포인트(소정 부위)에 대하여, 우선 제1 플라즈마 처리 공정을 실행하고, 그 후 제2 플라즈마 처리 공정을 실행한다.

[0146] [제1 공급 공정 및 제1 플라즈마 처리 공정]

[0147] 상술하면, 제1 중합성 단량체 함유 가스(아크릴산+질소)를, 제1 공급로 (36)을 거쳐 제1 분사 노즐 (51) 내의 정류로에서 제1 분사 노즐 (51)의 폭 방향(도 2의 지면 직교 방향)으로 균일화한 후에 분출하여, 제1 플라즈마 처리부 (2A)의 처리 공간 (22A)에 도입한다. 가스 온도 조절 수단 (38)로 제1 공급로 (36)을 온도 조절함으로써, 제1 중합성 단량체가 액화되는 것을 방지할 수 있다. 병행하여, 전원 (23A)로부터의 전압 공급에 의해 처리 공간 (22A) 내에 대기압 글로 방전을 생성한다. 이에 따라, 제1 중합성 단량체 함유 가스 중의 질소를 플라즈마화함과 동시에, 아크릴산 증기를 활성화하여 중합시킬 수 있다. 또한, TAC 필름 (11) 중 처리 공간 (22A) 내에 위치하는 부분에 질소 플라즈마나 플라즈마광을 조사하여, 상기 TAC 필름 부분의 표면 분자의 C-C, C-O, C-H 등의 결합을 절단할 수 있다. 이 결합 절단부에 아크릴산의 중합물이 결합(그래프트 중합)한다. 이에 따라, TAC 필름 (11)의 표면에 아크릴산의 중합물의 층을 형성할 수 있다.

[0148] [이동 공정]

[0149] 병행하여, 3개의 롤 전극 (21) 및 2쌍의 전환 롤 (27)을 도 2에 있어서 시계 방향으로 계속적으로 회전시켜 TAC 필름 (11)을 우측 방향으로 보낸다. TAC 필름 (11)의 각 포인트는 좌측의 롤 전극 (21L)에 걸어 돌려져 제1 처리 공간 (22A)를 통과하고, 또한 좌측의 한 쌍의 전환 롤 (27, 27)로 전환된 후, 중앙의 롤 전극 (21C)에 걸리면서 다시 처리 공간 (22A)를 통과한다. 따라서, TAC 필름 (11)의 각 포인트에 대하여 제1 플라즈마 처리 공정이 2회 행해진다. 그 후, TAC 필름 (11)의 각 포인트는 제2 플라즈마 처리부 (2B)로 반송된다.

[0150] [제2 공급 공정 및 제2 플라즈마 처리 공정]

[0151] 제2 중합성 단량체 함유 가스(HEMA+질소)를, 제2 공급로 (46)을 거쳐 제2 분사 노즐 (52) 내의 정류로에서 제2 분사 노즐 (52)의 폭 방향(도 2의 지면 직교 방향)으로 균일화한 후에 분출하여, 제2 플라즈마 처리부 (2B)의 처리 공간 (22B)에 도입한다. 가스 온도 조절 수단 (48)로 제2 공급로 (46)을 온도 조절함으로써, 제2 중합성 단량체가 액화되는 것을 방지할 수 있다. 병행하여, 전원 (23B)로부터의 전압 공급에 의해 처리 공간 (22B) 내에 대기압 플라즈마를 생성한다. 이에 따라, 제2 중합성 단량체 함유 가스 중의 질소를 플라즈마화함과 동시에, HEMA 증기를 활성화하여 중합시킬 수 있다. 또한, 처리 공간 (22B) 내의 TAC 필름 (11)의 표면의 아크릴산 중합물을 재활성화할 수 있다. 이 아크릴산 중합물에 HEMA 중합물을 공중합시킬 수 있다. 또한, TAC 필름 (11)의 표면의 아크릴산 중합물의 표면을 거칠게 하여 요철로 할 수 있고, 이 요철의 표면에 HEMA 중합물을 공중합시킬 수 있다. 이에 따라, TAC 필름 (11)의 표면에 아크릴산과 HEMA의 중합물을 포함하는 접착성 촉진층을 형성할 수 있다. 그 결과, TAC 필름 (11)의 접착성을 확실하게 향상시킬 수 있다. 제2 실시 형태는 2종의 중합성 단량체가 서로 시간적으로 간격을 두고 난접착성 수지 필름에 중합되기 때문에, 공중합(특히 블록 중합), 그래프트 중합, 중합체 얼로이의 형성에 적합하다.



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[0152] 여기서, 제2 전원 (23B)로부터의 공급 전압을 제1 전원 (23A)로부터의 공급 전압보다 크게 한다. 이에 따라, 제2 처리 공간 (22B)의 전계 강도를 제1 처리 공간 (22A)의 전계 강도보다 크게 할 수 있다. 따라서, 제1 플라즈마 처리 공정에 의해 TAC 필름 (11) 상에 형성된 아크릴산 중합물을 제2 플라즈마 처리 공정에서 확실하게 재활성화할 수 있다. 또한, 아크릴산 중합물의 표면을 확실하게 거칠게 할 수 있다. 따라서, TAC 필름 (11)의 표면에, 아크릴산과 HEMA에 의한 공중합물을 포함하는 접착성 촉진층을 확실하게 형성할 수 있다.

[0153] TAC 필름 (11)의 소정 부위에 대하여 제1 중합성 단량체와 제2 중합성 단량체를 시간적으로 어긋나게 하여 공급할 수 있기 때문에, 공급로 (36, 46) 내에서 공중합 반응이 일어나는 것을 확실하게 회피할 수 있고, 공급로가 폐색되는 것을 확실하게 방지할 수 있다.

[0154] TAC 필름 (11)의 각 포인트는 중앙의 롤 전극 (21C)에 걸어 돌려져 제2 처리 공간 (22B)를 통과하고, 또한 우측의 한 쌍의 전환 롤 (27, 27)로 전환된 후, 우측의 롤 전극 (21R)에 걸쳐지면서 다시 처리 공간 (22B)를 통과한다. 따라서, TAC 필름 (11)의 각 포인트에 대하여 처리 공간 (22B)에 있어서 제2 플라즈마 처리 공정이 2회 행해진다.

[0155] 중합성 단량체 증기를 포함하는 가스를 난접착성 수지 필름에 공급하여 난접착성 수지 필름의 표면 상에 담지(응축 등)시키고, 그 후 상기 중합성 단량체 함유 가스와는 별도의 플라즈마 생성용 가스(예를 들면 질소)를 플라즈마화하여, 난접착성 수지 필름의 상기 중합성 단량체가 담지된 부분에 접촉시킬 수도 있다.

[0156] 도 3은 본 발명의 제3 실시 형태를 나타낸 것이다. 제3 실시 형태에서는 공통 플라즈마 처리부 (2)를 구비한 필름 표면 처리 장치 (1Y)에 있어서, 분사 노즐 (50)이 전극 (21, 21) 사이의 방전 공간 (22)보다 필름 (11)의 이동 방향의 상류측(도 3에 있어서 좌측)으로 조금 어긋나게 배치되어 있다. 분사 노즐 (50)의 선단(하단)이 좌측(필름 이동 방향의 상류측)의 전극 (21)의 상측부와 대향하고 있다. 분사 노즐 (50)의 기단(상단)에 제1, 제2 가스 공급계 (3, 4)가 연속해 있다(도 3에서는 공급로 (36, 46)의 선단부만 도시).

[0157] 전극 (21, 21) 사이의 중앙 위치에는 별도의 분사 노즐 (53)이 배치되어 있다. 분사 노즐 (53)에 $N_2$ 가스(플라즈마 생성용 가스)가 공급된다. 분사 노즐 (53)의 선단(하단)이 방전 공간 (22)의 상단부를 향하고 있다.

[0158] 제1, 제2 중합성 단량체 함유 가스를 공급로 (36, 46)을 거쳐 분사 노즐 (50)의 선단으로부터 분출한다. 이에 따라, 피처리 필름 (11)에서의 방전 공간 (22)보다 이동 방향의 상류측의 부분에 제1 및 제2 중합성 단량체를 접촉시켜 응축시킬 수 있다(응축 공정). 롤 전극 (21, 21)의 회전에 따라, 피처리 필름 (11)의 상기 중합성 단량체 응축 부분이 방전 공간 (22)에 도입된다. 아울러, 중앙의 분사 노즐 (53)으로부터 $N_2$ 가스를 방전 공간 (22)에 도입한다. 이에 따라, $N_2$가 플라즈마화되고, 상기 중합성 단량체의 응축층에 대기압 근방 플라즈마가 조사된다(플라즈마 처리 공정). 따라서, 제1 및 제2 중합성 단량체의 중합 반응을 기상 중이 아닌, 피처리 필름 (11)의 표면상에서 일으킬 수 있다. 따라서, 제1, 제2 중합성 단량체를 피처리 필름 (11)의 표면 분자에 확실하게 그래프트 공중합시킬 수 있다.

[0159] 본 발명은 상기 실시 형태로 한정되는 것은 아니고, 그 요지의 범위 내에서 다양한 개변을 이룰 수 있다.

[0160] 예를 들면, 난접착성 수지 필름 (11)은 TAC 필름으로 한정되지 않고, COP, COC, PP, PE, PET 등의 난접착성의 수지 필름을 이용할 수도 있다.

[0161] 제1 중합성 단량체로서 아크릴산 대신에 메타크릴산을 이용할 수도 있다. 제2 중합성 단량체로서 HEMA 대신에 메타크릴산글리시딜을 이용할 수도 있다. 제1 중합성 단량체로서 HEMA 또는 메타크릴산글리시딜을 이용할 수도 있고, 제2 중합성 단량체로서 아크릴산 또는 메타크릴산을 이용할 수도 있다. 그 밖에 다양한 중합성 단량체를 적절히 선택하여 제1 중합성 단량체 또는 제2 중합성 단량체로서 이용할 수도 있다. 제1 중합성 단량체로서 불포화 결합 및 소정의 관능기를 갖는 중합성 단량체를 이용하고, 또한 제2 중합성 단량체로서 올레핀계 단량체 등의 불포화 결합을 갖지만 소정의 관능기를 갖지 않는 중합성 단량체를 이용할 수도 있다. 올레핀계 단량체로서, 예를 들면 시클로펜타디엔 또는 디시클로펜타디엔을 이용할 수도 있다.

[0162] 3개 이상의 중합성 단량체를 이용할 수도 있다. 이 경우, 3개 이상의 중합성 단량체 중 1개가 제1 중합성 단량체를 구성하고, 다른 1개가 제2 중합성 단량체를 구성한다. 3개 이상의 중합성 단량체를 서로 혼합함과 동시에 공통의 처리 공간 (22)에 도입하여, 난접착성 수지 필름에 접촉시킬 수 있다.

[0163] 3개 이상의 중합성 단량체를 난접착성 수지 필름의 소정 부위에 서로 시간적으로 간격을 두고 순차적으로 접촉시킬 수 있다.



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[0164] 플라즈마 처리부, 나아가서는 처리 공간을 3개 이상 준비하고, 이들 처리 공간에 각각 별종의 중합성 단량체 함유 가스를 공급하고, 또한 난접착성 수지 필름이 상기 3개 이상의 처리 공간을 순차적으로 통과하도록 난접착성 수지 필름 및 플라즈마 처리부를 상대 이동시키도록 할 수도 있다. 이 경우, 3개 이상의 플라즈마 처리부 중 임의의 2개의 플라즈마 처리부에서의, 난접착성 수지 필름의 이동 방향의 상류측에 배치된 플라즈마 처리부가 "제1 플라즈마 처리부"를 구성하고, 그 플라즈마 처리부에 의해 실행되는 처리가 제1 플라즈마 처리 공정이 된다. 또한, 상기 임의의 2개의 플라즈마 처리부에서의, 난접착성 수지 필름의 이동 방향의 하류측에 배치된 플라즈마 처리부가 "제2 플라즈마 처리부"를 구성하고, 그 플라즈마 처리부에 의해 실행되는 처리가 제2 플라즈마 처리 공정이 된다. 난접착성 수지 필름의 이동 방향을 따라서 후단의 플라즈마 처리부일수록 전계 강도를 강하게 할 수도 있다.

[0165] 제1, 제2 플라즈마 처리부를 서로 공통의 플라즈마 처리부로 구성하고, 제1 공급로 (36)을 상기 공통의 플라즈마 처리부와 연통시켜 제1 플라즈마 처리 공정을 실행하고, 계속해서 상기 제1 공급로 (36)을 차단한 후, 제2 공급로 (46)을 상기 공통의 플라즈마 처리부와 연통시켜 제2 플라즈마 처리 공정을 실행하도록 할 수도 있다. 제1, 제2 플라즈마 처리부를 서로 공통의 플라즈마 처리부로 구성하고, 제2 실시 형태의 제1, 제2 분사 노즐 (51, 52)를 상기 공통의 플라즈마 처리부에 대하여 상대 이동시킴으로써, 제1 분사 노즐 (51)을 상기 공통 플라즈마 처리부를 향하게 하여 제1 플라즈마 처리 공정을 실행하고, 그 후 제2 분사 노즐 (52)를 상기 공통 플라즈마 처리부를 향하게 하여 제2 플라즈마 처리 공정을 실행하도록 할 수도 있다.

[0166] 피처리 필름 (11)이 정지되고, 플라즈마 처리부나 분사 노즐이 이동 수단에 의해 이동되도록 되어 있을 수도 있다. 피처리 필름 (11) 및 플라즈마 처리부를 상대 이동시키지 않고 플라즈마 처리를 행하도록 할 수도 있다.

[0167] 플라즈마 처리부 (2, 2A, 2B)의 전극 구조는 롤 전극 구조로 한정되지 않고, 한 쌍의 평판상 전극을 갖는 평행 평판 전극 구조일 수도 있고(도 4 참조), 평판 전극과 롤 전극을 대향시킨 구조일 수도 있고, 오목 곡면을 갖는 전극과 롤 전극을 대향시킨 구조일 수도 있다. 제2 실시 형태(도 2)에 있어서, 제1 플라즈마 처리부 (2A)와 제2 플라즈마 처리부 (2B)의 전극 구조가 상이할 수도 있다.

[0168] 제1 실시 형태에 있어서, 제1 중합성 단량체 함유 가스와 제2 중합성 단량체 함유 가스를, 플라즈마 처리 공정 직전에 분사 노즐 (50) 내에서 혼합하는 것 대신에, 따로따로의 분사 노즐로부터 공통의 처리 공간 (22) 내에 분출하고, 공통의 처리 공간 (22) 내에서 혼합하도록 할 수도 있다. 분사 노즐 (50) 내의 2개의 분사로 (50a, 50b)가 도중에 합류하지 않고 각각 분사 노즐 (50)의 선단면에 도달하여 따로따로의 분출구를 형성하고, 이들 따로따로의 분출구로부터 제1 중합성 단량체 함유 가스와 제2 중합성 단량체 함유 가스를 서로 공통의 처리 공간 (22) 내에 도입하여 혼합하도록 할 수도 있다.

[0169] 제2 실시 형태에 있어서, 제1 처리 공간 (22A)의 전계 강도를 제2 처리 공간 (22B)의 전계 강도보다 크게 할 수도 있고, 이들 처리 공간 (22A, 22B)의 전계 강도를 서로 동등하게 할 수도 있다.

[0170] 제1 내지 제3 실시 형태의 플라즈마 처리부는 처리 공간 내에서 방전이 생성되고, 처리 공간에 배치된 피처리 필름 (11)에 플라즈마가 직접적으로 조사되는 소위 다이렉트식의 플라즈마 처리 장치였지만, 본 발명은 상기 다이렉트식으로 한정되지 않고, 처리 공간과 방전 공간이 따로따로가 되어, 방전 공간에 처리 공간이 연속해 있고, 중합성 단량체 함유 가스를 방전 공간에서 플라즈마화하여 처리 공간에 도입하고, 처리 공간의 피처리 필름 (11)에 접촉시키는 소위 리모트식의 플라즈마 처리 장치에도 적용할 수 있다. 리모트식의 경우, 분사 노즐 (50, 51, 52)에 전극을 수용하여, 노즐 (50, 51, 52) 내의 분사로가 방전 공간이 되도록 할 수도 있다. 리모트식이면서 혼합 분출식인 경우, 제1 및 제2 중합성 단량체 함유 가스끼리를 혼합 후에 방전 공간에 도입하여 플라즈마화할 수도 있고, 제1, 제2 중합성 단량체 함유 가스를 따로따로 플라즈마화한 후, 혼합할 수도 있다.

[0171] 플라즈마 생성용 가스를 플라즈마화하여 난접착성 수지 필름에 접촉시키고, 그 후 중합성 단량체를 상기 난접착성 수지 필름의 상기 플라즈마 접촉 부분에 접촉시킬 수도 있다. 플라즈마 생성용 가스와 중합성 단량체 증기의 캐리어 가스가 동일 성분(예를 들면 질소)으로 구성될 수도 있고, 캐리어 가스가 플라즈마 생성용 가스를 겸할 수도 있다.

[0172] 희석로 (34, 44)의 유량 조절에 더하여, 캐리어로 (35, 45)의 유량도 조절함으로써, 중합성 단량체 함유 가스의 공급 유량을 조절할 수도 있다. 희석로 (34, 44)의 유량을 일정하게 유지하면서 캐리어로 (35, 45)의 유량을 조절함으로써, 중합성 단량체 함유 가스의 공급 유량을 조절할 수도 있다. 희석로 (34, 44)의 유량을 0으로 하고, 캐리어로 (35, 45)의 유량을 조절함으로써, 중합성 단량체 함유 가스의 공급 유량을 조절할 수도 있다.

[0173] 처리 공간 (22, 22A, 22B) 및 그 주변의 분위기 가스를 불활성 가스(예를 들면 질소)로 치환함으로써, 처리 공



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간 (22, 22A, 22B)의 산소 농도가 소정 이하, 즉 바람직하게는 3000 ppm 이하, 보다 바람직하게는 2000 ppm 이하, 한층 바람직하게는 1000 ppm 이하가 되도록 조절할 수도 있다. 처리 공간 (22, 22A, 22B) 및 그 주변을 챔버로 둘러싸고, 챔버 내부의 가스를 불활성 가스(예를 들면 질소)로 치환함으로써, 처리 공간 (22, 22A, 22B)의 산소 농도가 소정 이하가 되도록 조절할 수도 있다.

[0174] 처리 공간 (22, 22A, 22B)의 주변 부분에 불활성 가스(예를 들면 질소)의 가스 커튼을 형성하고, 이 가스 커튼으로 공기 등의 분위기 가스가 처리 공간 (22, 22A, 22B)에 들어가는 것을 저지 또는 억제함으로써, 처리 공간 (22, 22A, 22B)의 산소 농도가 소정 이하가 되도록 조절할 수도 있다.

[0175] 혼합 중합성 단량체 함유 가스, 제1 중합성 단량체 함유 가스, 제2 중합성 단량체 함유 가스에는 산소가 함유되어 있지 않은 것이 바람직하지만, 바람직하게는 3000 ppm 이하, 보다 바람직하게는 1000 ppm 이하이면 산소가 함유될 수도 있다.

[0176] 제1, 제2 플라즈마 처리 공정 후, 접착 공정 전에 난접착성 수지 필름을 수성 세정액으로 세정할 수도 있다.

[0177] 난접착성 수지 필름의 표면 처리 방법 및 표면 처리 장치는 편광판의 제조 이외의 용도에 적용할 수도 있다.

[0178] 실시예 1

[0179] 이하에 실시예를 설명하지만, 본 발명은 이들 실시예로 한정되는 것은 아니다.

[0180] 실시예 1의 표면 처리 조건 및 결과를 표 1에 나타내었다.

[0181] 실시예 1에서는 도 1에 나타내는 처리 장치 (1)을 이용하였다. 난접착성 필름 (11)을 한 쌍의 롤 전극 (21) 및 전환 롤 (27)에 걸어 돌려 반송하였다. 제1 중합성 단량체 함유 가스와 제2 중합성 단량체 함유 가스를 2개의 가스 공급계 (3, 4)로 분사 노즐 (50)까지 따로따로 공급하고, 분사 노즐 (50)에서 혼합하여 처리 공간 (22)에 도입하였다. 전원 (23)으로 직류 전력을 교류로 변환하여 전극 (21)에 공급하여, 처리 공간 (22) 내에 대기압 방전을 생성하였다. 구체적인 처리 조건은 이하와 같다.

[0182] 난접착성 수지 필름 (11): TAC 필름(폭 33 cm)

[0183] 필름 (11)의 반송 속도: 30 m/분

[0184] 필름 온도 조절 수단 (28)의 설정 온도: 25℃

[0185] 제1 중합성 단량체 함유 가스: 아크릴산+$N_2$

[0186] 불활성 가스 공급로 (33)의 $N_2$ 유량: 24 slm

[0187] 희석로 (34)의 $N_2$ 유량: 14 slm

[0188] 캐리어로 (35)의 $N_2$ 유량: 10 slm

[0189] 가열기 (32)(기화기 (30)) 및 가스 온도 조절 수단 (38)(공급로 (36))의 설정 온도: 80℃

[0190] 제2 중합성 단량체 함유 가스: HEMA+$N_2$

[0191] 불활성 가스 공급로 (43)의 $N_2$ 유량: 24 slm

[0192] 희석로 (44)의 $N_2$ 유량: 14 slm

[0193] 캐리어로 (45)의 $N_2$ 유량: 10 slm

[0194] 가열기 (42)(기화기 (40)) 및 가스 온도 조절 수단 (48)(공급로 (46))의 설정 온도: 100℃

[0195] 플라즈마 조건 및 처리 공간 (22)의 치수

[0196] 전원 (22)의 공급 전력: 656W(410V×1.6A의 직류를 교류 변환)

[0197] 전극 (21) 간의 인가 전압: Vpp=17.5 kV

[0198] 처리 공간 (22)의 가장 좁게 된 개소의 두께: 1 mm



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[0199] 처리 공간 (22)의 상하의 길이: 약 10 cm

[0200] 처리 공간 (22)의 용적: 약 0.3 L

[0201] 표면 처리 후의 필름 (11)의 폭 방향의 일단부와 타단부와 중앙부로부터 각각 시료편을 잘라내고, 각 시료편을 PVA 필름의 시료편의 양면에 접착하고, 도 5의 (a)와 동일한 단면 구조의 편광판 시료를 제조하였다. PVA 필름은 중합도 500의 부분 비누화품이었다. 접착제 (13)으로서, (A) PVA 5 중량% 수용액과 (B) 카르복시메틸셀룰로오스나트륨 2 중량% 수용액을 (A):(B)=20:1로 혼합한 수용액을 이용하였다. 접착제 (13)의 건조 조건은 80℃, 5분간으로 하였다. 접착제가 경화한 후, 접착 강도를 부동 롤러법(JIS K6854)으로 측정하였다. 그 결과, 접착 강도는 평균으로 19.2 N/인치였다. 필름 (11)의 시료편 채취 부위마다의 접착 강도의 측정 결과는 표 1을 참조할 것(이하의 실시예 및 비교예에서 동일).

[0202] 실시예 2

[0203] 실시예 2의 표면 처리 조건 및 결과를 표 1에 나타내었다.

[0204] 실시예 2에서는 실시예 1과 마찬가지로 도 1의 처리 장치 (1)을 이용하여 TAC 필름의 표면 처리를 행하였다. 제2 중합성 단량체로서 메타크릴산글리시딜(표 1에 있어서 "GMA"라고 약기)을 이용하고, 제2 기화기 (40) 및 공급로 (46)의 설정 온도를 190℃로 하였다. 실시예 2에서의 그 밖의 처리 조건은 실시예 1과 동일하게 하였다. 표면 처리 후, 실시예 1과 동일한 방법으로 편광판 시료를 제조하고, 실시예 1과 동일한 방법으로 접착 강도를 측정하였다. 접착 강도의 측정 결과는 평균으로 19.1 N/인치였다.

[0205] 실시예 3

[0206] 실시예 3의 표면 처리 조건 및 결과를 표 1에 나타내었다.

[0207] 실시예 3에서는 실시예 1과 마찬가지로 도 1의 처리 장치 (1)을 이용하여 TAC 필름의 표면 처리를 행하였다. 제1 중합성 단량체로서 메타크릴산(표 1에 있어서 "MA"라고 약기)을 이용하고, 제1 기화기 (30) 및 공급로 (36)의 설정 온도를 160℃로 하였다. 실시예 3에서의 그 밖의 처리 조건은 실시예 1과 동일하게 하였다. 표면 처리 후, 실시예 1과 동일한 방법으로 편광판 시료를 제조하고, 실시예 1과 동일한 방법으로 접착 강도를 측정하였다. 접착 강도의 측정 결과는 평균으로 19.0 N/인치였다.

[0208] 실시예 4

[0209] 실시예 4의 표면 처리 조건 및 결과를 표 1에 나타내었다.

[0210] 실시예 4에서는 실시예 1과 마찬가지로 도 1의 처리 장치 (1)을 이용하여 TAC 필름의 표면 처리를 행하였다. 제1 중합성 단량체로서 메타크릴산을 이용하고, 제1 기화기 (30) 및 공급로 (36)의 설정 온도를 160℃로 하였다. 제2 중합성 단량체로서 메타크릴산글리시딜을 이용하고, 제2 기화기 (40) 및 공급로 (46)의 설정 온도를 190℃로 하였다. 실시예 4에서의 그 밖의 처리 조건은 실시예 1과 동일하게 하였다. 표면 처리 후, 실시예 1과 동일한 방법으로 편광판 시료를 제조하고, 실시예 1과 동일한 방법으로 접착 강도를 측정하였다. 접착 강도의 측정 결과는 평균으로 19.5 N/인치였다.



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표 1

| | | 실시예 1 | 실시예 2 | 실시예 3 | 실시예 4 |
|---|---|---|---|---|---|
| 사용장치 | | 도 1 | 도 1 | 도 1 | 도 1 |
| 난접착성 수지 필름(11) | | TAC | TAC | TAC | TAC |
| 제1 중합성 단량체 | | AA | AA | MA | MA |
| 제2 중합성 단량체 | | HEMA | GMA | HEMA | GMA |
| 불활성 가스로(33)의 질소유량 [slm] | | 24 | 24 | 24 | 24 |
| 회석로(34)의 질소유량 [slm] | | 14 | 14 | 14 | 14 |
| 캐리어로(35)의 질소유량 [slm] | | 10 | 10 | 10 | 10 |
| 불활성 가스로(43)의 질소유량 [slm] | | 24 | 24 | 24 | 24 |
| 회석로(44)의 질소유량 [slm] | | 14 | 14 | 14 | 14 |
| 캐리어로(45)의 질소유량 [slm] | | 10 | 10 | 10 | 10 |
| 제1 기화기(30) 및 공급로(36)의 설정온도 [℃] | | 80 | 80 | 160 | 160 |
| 제2 기화기(40) 및 공급로(46)의 설정온도 [℃] | | 100 | 190 | 100 | 190 |
| 필름설정온도 [℃] | | 25 | 25 | 25 | 25 |
| 필름반송속도 [m/분] | | 30 | 30 | 30 | 30 |
| 공급직류전압 [V] | | 410 | 410 | 410 | 410 |
| 공급직류전류 [A] | | 1.6 | 1.6 | 1.6 | 1.6 |
| 공급전력 [W] | | 656 | 656 | 656 | 656 |
| 인가전압 [kV] | | 17.5 | 17.5 | 17.5 | 17.5 |
| 접착강도 [N/인치] | 일단부 | 19.2 | 19.3 | 18.8 | 20 |
| | 중앙부 | 19.1 | 18.9 | 19.1 | 19.3 |
| | 타단부 | 19.4 | 19.2 | 19.1 | 19.2 |
| | 평균 | 19.2 | 19.1 | 19.0 | 19.5 |

AA: 아크릴산
HEMA: 2-히드록시에틸메타크릴레이트
MA : 메타크릴산
GMA : 메타크릴산글리시딜

[0211]

[0212] 실시예 5

[0213] 실시예 5의 표면 처리 조건 및 결과를 표 2에 나타내었다.

[0214] 실시예 5에서는 도 1의 처리 장치 (1)을 이용하여, 난접착성 수지 필름 (11)로서 폴리에틸렌(PE)의 필름의 표면 처리를 행하였다. PE 필름을 처리 대상으로 하였다. 실시예 5에서의 그 밖의 처리 조건은 실시예 1과 동일하게 하였다. 표면 처리 후, 실시예 1과 동일한 방법으로 편광판 시료를 제조하고, 실시예 1과 동일한 방법으로 접착 강도를 측정하였다. 접착 강도의 측정 결과는 평균으로 16.2 N/인치였다.

[0215] 실시예 6

[0216] 실시예 6의 표면 처리 조건 및 결과를 표 2에 나타내었다.

[0217] 실시예 6에서는 도 1의 처리 장치 (1)을 이용하여, 난접착성 수지 필름 (11)로서 폴리프로필렌(PP)의 필름의 표면 처리를 행하였다. PP 필름을 처리 대상으로 하였다. 실시예 6에서의 그 밖의 처리 조건은 실시예 1과 동일하게 하였다. 표면 처리 후, 실시예 1과 동일한 방법으로 편광판 시료를 제조하고, 실시예 1과 동일한 방법으로 접착 강도를 측정하였다. 접착 강도의 측정 결과는 평균으로 18.8 N/인치였다.

[0218] 실시예 7

[0219] 실시예 7의 표면 처리 조건 및 결과를 표 2에 나타내었다.

[0220] 실시예 7에서는 도 1의 처리 장치 (1)을 이용하여, TAC 필름의 표면 처리를 행하였다. 제2 중합성 단량체로서 아세트알데히드를 이용하고, 제2 기화기 (40) 및 공급로 (46)의 설정 온도를 30℃로 하였다. 실시예 7에서의 그 밖의 처리 조건은 실시예 1과 동일하게 하였다. 표면 처리 후, 실시예 1과 동일한 방법으로 편광판 시료를 제조하고, 실시예 1과 동일한 방법으로 접착 강도를 측정하였다. 접착 강도의 측정 결과는 평균으로 19.0 N/인치였다.



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[0221] 실시예 8

[0222] 실시예 8의 표면 처리 조건 및 결과를 표 2에 나타내었다.

[0223] 실시예 8에서는 도 1의 처리 장치 (1)을 이용하여, 난접착성 수지 필름 (11)로서 폴리메타크릴산메틸(PMMA)을 포함하는 필름의 표면 처리를 행하였다. 제2 중합성 단량체로서 아세트알데히드(AcA)를 이용하고, 제2 기화기 (40) 및 공급로 (46)의 설정 온도를 30℃로 하였다. 실시예 8에서의 그 밖의 처리 조건은 실시예 1과 동일하게 하였다. 표면 처리 후, 실시예 1과 동일한 방법으로 편광판 시료를 제조하고, 실시예 1과 동일한 방법으로 접착 강도를 측정하였다. 접착 강도의 측정 결과는 평균으로 14.4 N/인치였다.

표 2

| | | 실시예 5 | 실시예 6 | 실시예 7 | 실시예 8 |
|---|---|---|---|---|---|
| 사용장치 | | 도 1 | 도 1 | 도 1 | 도 1 |
| 난접착성 수지 필름(11) | | PE | PP | TAC | PMMA |
| 제1 중합성 단량체 | | AA | AA | AA | AA |
| 제2 중합성 단량체 | | HEMA | HEMA | AcA | AcA |
| 불활성 가스로(33)의 질소유량 [slm] | | 24 | 24 | 24 | 24 |
| 희석로(34)의 질소유량 [slm] | | 14 | 14 | 14 | 14 |
| 캐리어로(35)의 질소유량 [slm] | | 10 | 10 | 10 | 10 |
| 불활성 가스로(43)의 질소유량 [slm] | | 24 | 24 | 24 | 24 |
| 희석로(44)의 질소유량 [slm] | | 14 | 14 | 14 | 14 |
| 캐리어로(45)의 질소유량 [slm] | | 10 | 10 | 10 | 10 |
| 제1 기화기(30) 및 공급로(36)의 설정온도 [℃] | | 80 | 80 | 80 | 80 |
| 제2 기화기(40) 및 공급로(46)의 설정온도 [℃] | | 100 | 100 | 30 | 30 |
| 필름설정온도 [℃] | | 25 | 25 | 25 | 25 |
| 필름반송속도 [m/분] | | 30 | 30 | 30 | 30 |
| 공급직류전압 [V] | | 410 | 410 | 410 | 410 |
| 공급직류전류 [A] | | 1.6 | 1.6 | 1.6 | 1.6 |
| 공급전력 [W] | | 656 | 656 | 656 | 656 |
| 인가전압 [kV] | | 17.5 | 17.5 | 17.5 | 17.5 |
| 접착강도 [N/인치] | 일단부 | 16.4 | 18.7 | 18.8 | 14 |
| | 중앙부 | 16.2 | 18.6 | 19.1 | 14.3 |
| | 타단부 | 15.9 | 19.2 | 19.1 | 14.8 |
| | 평균 | 16.2 | 18.8 | 19.0 | 14.4 |

AA: 아크릴산
AcA: 아세트알데히드
HEMA: 2-히드록시에틸메타크릴레이트

[0224]

[0225] [비교예 1]

[0226] 비교예 1의 표면 처리 조건 및 결과를 표 3에 나타내었다.

[0227] 비교예 1로서, 도 1의 처리 장치 (1)을 이용하고, 또한 중합성 단량체로서 아크릴산만을 이용하여, TAC 필름의 표면 처리를 행하였다. 제1 기화기 (30)에 아크릴산액을 장전하는 한편, 제2 기화기 (40) 내를 비워 두었다. 따라서, 제2 중합성 단량체의 공급량은 0이고, 100%의 질소 가스를 제2 공급로 (46)에 통과시켰다. 제2 기화기 (40) 및 제2 공급로 (46)의 설정 온도는 제1 기화기 (30) 및 제1 공급로 (36)과 동일하게 80℃로 하였다. 비교예 1에서의 그 밖의 처리 조건은 실시예 1과 동일하게 하였다. 그 후, 실시예 1과 동일한 방법으로 편광판 시료를 제조하고, 실시예 1과 동일한 방법으로 접착 강도를 측정하였다. 측정 결과는 실시예 1 내지 8보다 떨어졌고, 평균으로 14.5 N/인치였다.

[0228] [비교예 2]

[0229] 비교예 2의 표면 처리 조건 및 결과를 표 3에 나타내었다.

[0230] 비교예 2에서는 도 1의 처리 장치 (1)을 이용하고, 제1 가스 공급계 (3)으로 아크릴산과 HEMA와 질소의 혼합 가스를 공급하고, 제2 가스 공급계 (4)로 질소만을 공급하도록 하였다. 제1 기화기 (30)에 아크릴산과 HEMA의 혼합 용액을 넣었다. 혼합 용액의 혼합비는 중량비로 아크릴산:HEMA=3:1로 하였다. 기화기 (30, 40) 및 공급로



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(36, 46)의 설정 온도를 함께 100℃로 하였다. 따라서, 기화기 (30)으로부터 취출되는 혼합 가스 중의 아크릴산의 HEMA에 대한 함유율은 상기 혼합 용액 중의 아크릴산의 함유율보다 커진 것으로 생각된다. 제2 기화기 (40) 내는 비워 두었다. 따라서, 100%의 질소 가스를 제2 공급로 (46)에 통과시켰다. 그 이외의 처리 조건은 비교예 1과 동일하게 하여 TAC 필름의 표면 처리를 행하였다. 그러자, 공급로 (36) 내에 겔이나 고체가 생성되고, 공급 도중에 아크릴산과 HEMA의 공중합 등의 반응이 일어난 것이 확인되었다. 필름 (11)의 표면 처리의 균일성이 실시예 1 내지 8 및 비교예 1과 비교하여 저하되었다.

[0231] 표면 처리 후, 실시예 1과 동일한 방법으로 편광판 시료를 제조하고, 실시예 1과 동일한 방법으로 접착 강도를 측정하였다. 측정 결과는 비교예 1보다 더 떨어졌고, 평균으로 13.4 N/인치였다. 공급 가스 중의 아크릴산의 함유율이 컸던 것이 접착 강도 저하의 하나의 원인이라 생각된다.

[0232] 실시예 1 내지 4, 7 및 비교예 1, 2의 결과를 비교하면 분명한 바와 같이, 본 발명에 따르면, TAC 필름에 대하여 접착성을 향상시킬 수 있는 것이 확인되었다.

[0233] [비교예 3]

[0234] 비교예 3의 표면 처리 조건 및 결과를 표 3에 나타내었다.

[0235] 비교예 3에서는 도 1의 처리 장치 (1)을 이용하고, 또한 중합성 단량체로서 아크릴산만을 이용하여 난접착성 수지 필름 (11)의 표면 처리를 행하였다. 처리 대상인 난접착성 수지 필름 (11)은 실시예 5와 동일하게 폴리에틸렌(PE) 필름이었다. 제2 기화기 (40) 내를 비워 두고, 제2 중합성 단량체의 공급량을 0으로 하여, 100%의 질소 가스를 제2 공급로 (46)에 통과시켰다. 비교예 3에서의 그 밖의 처리 조건은 실시예 5와 동일하게 하였다. 그 후, 실시예 1과 동일한 방법으로 편광판 시료를 제조하고, 실시예 1과 동일한 방법으로 접착 강도를 측정하였다. 접착 강도의 측정 결과는 평균으로 11.6 N/인치로, 실시예 5와 비교하여 낮았다.

[0236] 실시예 5 및 비교예 3의 결과를 비교하면 분명한 바와 같이, 본 발명에 따르면, PE 필름에 대하여 접착성을 향상시킬 수 있는 것이 확인되었다.

[0237] [비교예 4]

[0238] 비교예 4의 표면 처리 조건 및 결과를 표 3에 나타내었다.

[0239] 비교예 4에서는 도 1의 처리 장치 (1)을 이용하고, 또한 중합성 단량체로서 아크릴산만을 이용하여 난접착성 수지 필름 (11)의 표면 처리를 행하였다. 처리 대상인 난접착성 수지 필름 (11)은 실시예 6과 동일하게 폴리프로필렌(PP) 필름이었다. 제2 기화기 (40) 내를 비워 두고, 제2 중합성 단량체의 공급량을 0으로 하여, 100%의 질소 가스를 제2 공급로 (46)에 통과시켰다. 비교예 4에서의 그 밖의 처리 조건은 실시예 6과 동일하게 하였다. 그 후, 실시예 1과 동일한 방법으로 편광판 시료를 제조하고, 실시예 1과 동일한 방법으로 접착 강도를 측정하였다. 접착 강도의 측정 결과는 평균으로 13.7 N/인치로, 실시예 6과 비교하여 낮았다.

[0240] 실시예 6 및 비교예 4의 결과를 비교하면 분명한 바와 같이, 본 발명에 따르면, PP 필름에 대하여 접착성을 향상시킬 수 있는 것이 확인되었다.

[0241] [비교예 5]

[0242] 비교예 5의 표면 처리 조건 및 결과를 표 3에 나타내었다.

[0243] 비교예 5에서는 도 1의 처리 장치 (1)을 이용하고, 또한 중합성 단량체로서 아크릴산만을 이용하여 난접착성 수지 필름 (11)의 표면 처리를 행하였다. 처리 대상인 난접착성 수지 필름 (11)은 실시예 8과 동일하게 폴리메타크릴산메틸(PMMA)을 포함하는 필름이었다. 제2 기화기 (40) 내를 비워 두고, 제2 중합성 단량체의 공급량을 0으로 하였다. 100%의 질소 가스를 제2 공급로 (46)에 통과시켰다. 또한, 제2 기화 (40) 및 공급로 (46)의 설정 온도를 100℃로 하였다. 비교예 5에서의 그 밖의 처리 조건은 실시예 8과 동일하게 하였다. 그 후, 실시예 1과 동일한 방법으로 편광판 시료를 제조하고, 실시예 1과 동일한 방법으로 접착 강도를 측정하였다. 접착 강도의 측정 결과는 평균으로 9.5 N/인치로, 실시예 8과 비교하여 낮았다.

[0244] 실시예 8 및 비교예 5의 결과를 비교하면 분명한 바와 같이, 본 발명에 따르면, PMMA 필름에 대하여 접착성을 향상시킬 수 있는 것이 확인되었다.



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표 3

| | | 비교예 1 | 비교예 2 | 비교예 3 | 비교예 4 | 비교예 5 |
|---|---|---|---|---|---|---|
| 사용장치 | | 도 1 | 도 1 | 도 1 | 도 1 | 도 1 |
| 난접착성 수지 필름(11) | | TAC | TAC | PE | PP | PMMA |
| 제1 중합성 단량체 | | AA | AA+HEMA | AA | AA | AA |
| 제2 중합성 단량체 | | — | — | — | — | — |
| 불활성 가스로(33)의 질소유량 [slm] | | 24 | 24 | 24 | 24 | 24 |
| 회석로(34)의 질소유량 [slm] | | 14 | 14 | 14 | 14 | 14 |
| 캐리어로(35)의 질소유량 [slm] | | 10 | 10 | 10 | 10 | 10 |
| 불활성 가스로(43)의 질소유량 [slm] | | 24 | 24 | 24 | 24 | 24 |
| 회석로(44)의 질소유량 [slm] | | 14 | 14 | 14 | 14 | 14 |
| 캐리어로(45)의 질소유량 [slm] | | 10 | 10 | 10 | 10 | 10 |
| 제1 기화기(30) 및 공급로(36)의 설정온도 [℃] | | 80 | 100 | 80 | 80 | 80 |
| 제2 기화기(40) 및 공급로(46)의 설정온도 [℃] | | 80 | 100 | 100 | 100 | 100 |
| 필름설정온도 [℃] | | 25 | 25 | 25 | 25 | 12 |
| 필름반송속도 [m/분] | | 30 | 30 | 30 | 30 | 30 |
| 공급직류전압 [V] | | 410 | 410 | 410 | 410 | 410 |
| 공급직류전류 [A] | | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |
| 공급전력 [W] | | 656 | 656 | 656 | 656 | 656 |
| 인가전압 [kV] | | 17.5 | 17.5 | 17.5 | 17.5 | 17.5 |
| 접착강도 [N/인치] | 일단부 | 14.6 | 15.6 | 11.6 | 14 | 10 |
| | 중앙부 | 14.2 | 12.5 | 11.5 | 13.8 | 9.2 |
| | 타단부 | 14.6 | 12.1 | 11.7 | 13.4 | 9.4 |
| | 평균 | 14.5 | 13.4 | 11.6 | 13.7 | 9.5 |

AA:아크릴산
HEMA:2-히드록시에틸메타크릴레이트

[0245]

[0246] 실시예 9

[0247] 실시예 9의 표면 처리 조건 및 결과를 표 4에 나타내었다.

[0248] 실시예 9에서는 도 2에 나타내는 처리 장치 (1X)를 이용하였다. 난접착성 수지 필름 (11)을 3개의 롤 전극 (21L, 21C, 21R) 및 2쌍의 전환 롤 (27)에 걸어 돌려 반송하였다. 제1 중합성 단량체 함유 가스를 제1 가스 공급계 (3)의 공급로 (36)에 통과시켜 분사 노즐 (51)로부터 분출하여, 제1 처리 공간 (22A)에 도입하였다. 전원 (23A)로 직류 전력을 교류로 변환하고 전극 (21L)에 공급하여, 처리 공간 (22A) 내에 대기압 방전을 생성하였다. 별도로, 제2 중합성 단량체 함유 가스를 제2 가스 공급계 (4)의 공급로 (46)에 통과시켜 분사 노즐 (52)로부터 분출하여, 제2 처리 공간 (22B)에 도입하였다. 전원 (23B)로 직류 전력을 교류로 변환하고 전극 (21R)에 공급하여, 제2 처리 공간 (22B) 내에 대기압 방전을 생성하였다. 제2 처리 공간 (22B)의 전계 강도를 제1 처리 공간 (22A)의 전계 강도보다 높게 하였다. 구체적인 처리 조건은 이하와 같다.

[0249] 난접착성 수지 필름 (11): TAC 필름(폭 33 cm)

[0250] 필름 (11)의 반송 속도: 30 m/분

[0251] 필름 온도 조절 수단 (28)의 설정 온도: 25℃

[0252] 제1 중합성 단량체 함유 가스: 아크릴산+$N_2$

[0253] 불활성 가스 공급로 (33)의 $N_2$ 유량: 24 slm

[0254] 희석로 (34)의 $N_2$ 유량: 14 slm

[0255] 캐리어로 (35)의 $N_2$ 유량: 10 slm

[0256] 기화기 (30) 및 공급로 (36)의 설정 온도: 80℃

[0257] 제2 중합성 단량체 함유 가스: HEMA+$N_2$



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[0258] 불활성 가스 공급로 (43)의 $N_2$ 유량: 24 slm

[0259] 희석로 (44)의 $N_2$ 유량: 14 slm

[0260] 캐리어로 (45)의 $N_2$ 유량: 10 slm

[0261] 기화기 (40) 및 공급로 (46)의 설정 온도: 100℃

[0262] 제1 플라즈마 처리부 (2A)의 플라즈마 조건 및 처리 공간 치수

[0263] 전원 (23A)의 공급 전력: 656W(410V×1.6A의 직류를 교류 변환)

[0264] 전극 (21L, 21C) 사이의 인가 전압: Vpp=17.5 kV

[0265] 처리 공간 (22A)의 가장 좁게 된 개소의 두께: 1 mm

[0266] 처리 공간 (22A)의 상하의 길이: 약 10 cm

[0267] 처리 공간 (22A)의 용적: 약 0.3 L

[0268] 제2 플라즈마 처리부 (2B)의 플라즈마 조건 및 처리 공간 치수

[0269] 전원 (23B)의 공급 전력: 850W(425V×2A의 직류를 교류 변환)

[0270] 전극 (21C, 21R) 사이의 인가 전압: Vpp=18 kV

[0271] 처리 공간 (22B)의 가장 좁게 된 개소의 두께: 1 mm

[0272] 처리 공간 (22B)의 상하의 길이: 약 10 cm

[0273] 처리 공간 (22B)의 용적: 약 0.3 L

[0274] 표면 처리 후, 실시예 1과 동일한 방법으로 편광판 시료를 제조하고, 실시예 1과 동일한 방법으로 접착 강도를 측정하였다. 접착 강도의 측정 결과는 평균으로 19.9 N/인치였다.

[0275] 실시예 10

[0276] 실시예 10의 표면 처리 조건 및 결과를 표 4에 나타내었다.

[0277] 실시예 10에서는 실시예 9와 마찬가지로 도 2의 처리 장치 (1X)를 이용하여 TAC 필름의 표면 처리를 행하였다. 제1 중합성 단량체로서 메타크릴산을 이용하고, 제2 중합성 단량체로서 메타크릴산글리시딜을 이용하였다. 제1 기화기 (30) 및 공급로 (36)의 설정 온도를 160℃로 하고, 제2 기화기 (40) 및 공급로 (46)의 설정 온도를 190℃로 하였다. 실시예 10에서의 그 밖의 처리 조건은 실시예 9와 동일하게 하였다. 표면 처리 후, 실시예 1과 동일한 방법으로 편광판 시료를 제조하고, 실시예 1과 동일한 방법으로 접착 강도를 측정하였다. 접착 강도의 측정 결과는 평균으로 19.1 N/인치였다.

[0278] [비교예 6]

[0279] 비교예 6의 표면 처리 조건 및 결과를 표 4에 나타내었다.

[0280] 비교예 6에서는 도 2의 처리 장치 (1X)를 이용하고, 또한 중합성 단량체로서 아크릴산만을 이용하여 TAC 필름을 표면 처리하였다. 제1 가스 공급계 (3)의 조작은 실시예 9와 동일하게 하여, 아크릴산을 이용하고, 제1 처리 공간 (22A)에 있어서 실시예 9와 동일한 조건으로 제1 플라즈마 처리 공정을 실행하였다. 제2 가스 공급계 (4)에 대해서는 제2 기화기 (40) 내를 비워 두었다. 따라서, 제2 중합성 단량체를 포함하지 않는, 100%의 질소 가스를 공급로 (46)에 통과시켰다. 이 100%의 질소 가스를 노즐 (52)로부터 제2 처리 공간 (22B)에 도입하고, 질소 플라즈마에 의한 제2 플라즈마 처리 공정을 행하였다. 제2 기화기 (40) 및 공급로 (46)의 설정 온도를 제1 기화기 (30) 및 공급로 (36)과 동일하게 80℃로 하였다. 제2 플라즈마 처리부 (2B)의 공급 전력 및 인가 전압은 실시예 9와 동일하게 하였다.

[0281] 표면 처리 후, 실시예 1과 동일한 방법으로 편광판 시료를 제조하고, 실시예 1과 동일한 방법으로 접착 강도를 측정하였다. 측정 결과는 TAC 필름의 실시예 1 내지 4, 7, 9, 10보다 떨어졌고, 평균으로 16.1 N/인치였다. 실시예 5와는 대략 동일 정도의 접착 강도였다. 비교예 6의 접착 강도가 비교예 1보다 양호하였던 이유는 제1 플라즈마 처리 공정에서 미반응 아크릴산이 제2 플라즈마 처리 공정에서 활성화되어 접착성 촉진층의 형성에 기



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여했기 때문이라 생각된다.

표 4

| | | 실시예 9 | 실시예 10 | 비교예 6 |
|---|---|---|---|---|
| 사용장치 | | 도 2 | 도 2 | 도 2 |
| 난접착성 수지 필름(11) | | TAC | TAC | TAC |
| 제1 중합성 단량체 | | AA | MA | AA |
| 제2 중합성 단량체 | | HEMA | GMA | — |
| 불활성 가스로(33)의 질소유량 [slm] | | 24 | 24 | 24 |
| 회석로(34)의 질소유량 [slm] | | 14 | 14 | 14 |
| 캐리어로(35)의 질소유량 [slm] | | 10 | 10 | 10 |
| 불활성 가스로(43)의 질소유량 [slm] | | 24 | 24 | 24 |
| 회석로(44)의 질소유량 [slm] | | 14 | 14 | 14 |
| 캐리어로(45)의 질소유량 [slm] | | 10 | 10 | 10 |
| 제1 기화기(30) 및 공급로(36)의 설정온도[℃] | | 80 | 160 | 80 |
| 제2 기화기(40) 및 공급로(46)의 설정온도[℃] | | 100 | 190 | 80 |
| 필름 설정 온도[℃] | | 25 | 25 | 25 |
| 필름 반송 속도 [m/분] | | 30 | 30 | 30 |
| 플라즈마 처리부(2A) | 공급직류전압[V] | 410 | 410 | 410 |
| | 공급직류전류[A] | 1.6 | 1.6 | 1.6 |
| | 공급전력[W] | 656 | 656 | 656 |
| | 인가전압[kV] | 17.5 | 17.5 | 17.5 |
| 플라즈마 처리부(2B) | 공급직류전압[V] | 425 | 425 | 425 |
| | 공급직류전류[A] | 2 | 2 | 2 |
| | 공급전력[W] | 850 | 850 | 850 |
| | 인가전압[kV] | 18 | 18 | 18 |
| 접착강도[N/인치] | 일단부 | 19.8 | 19.1 | 15 |
| | 중앙부 | 19.6 | 19 | 16.8 |
| | 타단부 | 20.2 | 19.2 | 16.4 |
| | 평균 | 19.9 | 19.1 | 16.1 |

AA:아크릴산
HEMA:2-히드록시에틸메타크릴레이트
MA:메타크릴산
GMA:메타크릴산글리시딜

[0282]

[0283] 실시예 11

[0284] 실시예 11의 표면 처리 조건 및 결과를 표 5에 나타내었다.

[0285] 도 4에 나타낸 바와 같이, 실시예 11에서는 평행 평판 전극 구조의 플라즈마 표면 처리 장치 (1Z)를 이용하였다. 접지 전극을 겸한 스테이지 (60)의 상측에 평판상의 전계 인가 전극 (71)을 포함하는 처리 헤드 (70)을 배치하였다. 처리 헤드 (70)은 스테이지 (60)에 대하여 도 4의 좌우 방향으로 이동 가능하였다. 전계 인가 전극 (71)의 길이 방향(도 4의 지면과 직교하는 방향)의 치수는 200 mm였다. 전계 인가 전극 (71)의 하면과 스테이지 겸 접지 전극 (60)의 상면 간의 거리는 2.7 mm였다. 전계 인가 전극 (71)의 하면과 스테이지 겸 접지 전극 (60)의 상면에는 각각 두께 1 mm의 고체 유전체층 (61, 72)를 설치하였다. 상하의 고체 유전체층 (61, 72) 사이의 갭의 두께는 0.7 mm였다.

[0286] 하측의 고체 유전체층 (61)의 상면에 매엽상의 난접착성 수지 필름 (11)을 배치하였다. 난접착성 필름 (11)로서 폴리프로필렌 필름(도요보 제조, 상품명 파일렌 필름, 형식 CT)을 이용하였다. 필름 (11)의 폭(처리 헤드 (70)의 이동 방향과 직교하는 방향의 치수)은 150 mm였다. 필름 (11)의 길이(처리 헤드 (70)의 이동 방향을 따른 치수)는 200 mm였다. 필름 (11)의 두께는 80 μm였다.

[0287] 도 4에 있어서 도시를 생략하지만, 실시예 11에서의 제1 가스 공급계 (3) 및 제2 가스 공급계 (4)의 구성은 도 1과 실질적으로 동일하였다. 제1 중합성 단량체로서 아크릴산(AA)을 이용하였다. 불활성 가스 공급로 (33)에 $N_2$ 2 slm을 흐르게 하고, 그 전량을 기화기 (30)에 도입하였다. 기화기 (30)의 설정 온도를 50℃로 하고, 공급로 (36)의 설정 온도를 60℃로 하였다. 제2 중합성 단량체로서 디시클로펜타디엔(DCPD)을 이용하였다. DCPD는



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올레핀계 단량체에 속한다. 불활성 가스 공급로 (43)에 $N_2$ 8 slm을 흐르게 하고, 그 전량을 기화기 (40)에 도입하였다. 기화기 (40)의 설정 온도를 80℃로 하고, 공급로 (46)의 설정 온도를 90℃로 하였다. 이들 제1, 제2 중합성 단량체 함유 가스를 처리 헤드 (70)의 내부(필름 (11)의 근방)에서 혼합하고 처리 헤드 (70)의 분출구 (73)으로부터 분출하여, 필름 (11)에 분무하였다. 제1, 제2 중합성 단량체 함유 가스의 혼합 가스 중의 아크릴산 농도는 0.085 vol%(계산치)이고, DCPD 농도는 0.339 vol%(계산치)이고, 나머지는 질소였다. 단량체(아크릴산 및 디시클로펜타디엔)의 농도는, 별도로 공급계 (3, 4)에 캐리어 가스($N_2$) 10 slm을 10분간 흐르게 하고, 각 기화기 (30, 40) 내의 단량체액의 중량 변화(기화량)를 측정하여, 이 측정 결과로부터 환산하였다(이하의 실시예 12 내지 18에서 동일). 필름 온도 조절 수단 (28)의 설정 온도를 25℃로 하였다. 상기 제1, 제2 중합성 단량체 함유 가스의 분무와 병행하여 처리 헤드 (70)을 왕복 이동시켰다. 처리 헤드 (70)의 이동 속도는 0.5 m/분으로 하였다. 처리 헤드 (70)의 이동 회수는 왕방향, 복방향의 편도 이동을 1회로 하여 5회로 하였다. 처리 헤드 (70)의 편도 1회분의 이동 거리는 400 mm였다. 그 후, 제1, 제2 중합성 단량체 함유 가스의 분무를 정지하였다.

[0288] 계속해서, 100%의 질소 가스를 처리 헤드 (70)의 분출구 (73)으로부터 분출하였다. 질소 가스의 유량은 10 slm으로 하였다. 이와 병행하여, 전원 (23)으로부터 전극 (71)에 전력을 공급하였다. 전원 (23)에서의 펄스 변환 전의 직류 전압은 110V, 직류 전류는 3.8A이고, 투입 전력은 418W였다. 전계 인가 전극 (71)과 스테이지 겸 접지 전극 (60) 사이의 인가 전압은 Vpp=16.5 kV였다. 이에 따라, 전계 인가 전극 (71)과 스테이지 겸 접지 전극 (60) 사이에 대기압 플라즈마 방전을 생성하여, 질소 가스를 플라즈마화하고, 필름 (11)에 질소 플라즈마를 조사하였다. 플라즈마 조사와 병행하여, 처리 헤드 (70)을 편도 1회만 이동시켰다. 처리 헤드 (70)의 이동 거리는 400 mm이고, 이동 속도는 1 m/분으로 하였다.

[0289] 또한, 상기 제1, 제2 중합성 단량체 함유 가스 및 플라즈마 생성용의 질소 가스의 분출과 병행하여, 처리 헤드 (70)의 이동 방향의 양단으로부터 커튼 가스를 분출하였다. 커튼 가스로서 $N_2$를 이용하였다. 커튼 가스의 유량은 30 slm였다.

[0290] 표면 처리 후, 실시예 1과 동일한 조성의 접착제 (13)을 피처리 필름 (11)에 도포하였다. 이 필름 (11)을 PVA 필름의 형면에 접착하였다. 또한, 비누화한 TAC 필름을 PVA 필름의 반대 단부측의 면에 PVA 접착제로 접착하였다. 접착제 (13)의 건조 조건은 80℃, 5분간으로 하였다. 이에 따라, 편광판 시료를 제조하였다. 이 편광판 시료에서의 피처리 필름 (11)과 PVA 필름 사이의 접착 강도를 부동 롤러법(JIS K6854)으로 측정하였다. 표 5에 나타낸 바와 같이, 측정 결과는 10.4 N/인치로, 충분한 접착 강도가 얻어졌다.

[0291] 실시예 12

[0292] 실시예 12의 표면 처리 조건 및 결과를 표 5에 나타내었다.

[0293] 실시예 12에서는 실시예 11과 동일한 장치 (1Z)를 이용하였다. 처리 대상인 난접착성 수지 필름 (11)로서 COP 필름(세키스이 가가꾸 고교 제조, 상품명 에스시나)를 이용하였다. 필름 (11)의 크기는 실시예 11과 동일하게 하였다.

[0294] 제1 중합성 단량체로서 아세트알데히드($CH_3CHO$)를 이용하였다. 불활성 가스 공급로 (33)에 $N_2$ 0.5 slm을 흐르게 하고, 그 전량을 기화기 (30)에 도입하였다. 기화기 (30)의 설정 온도를 25℃로 하고, 공급로 (36)의 설정 온도를 30℃로 하였다. 제2 중합성 단량체로서 디시클로펜타디엔(DCPD)을 이용하였다. 불활성 가스 공급로 (43)에 $N_2$ 9.5 slm을 흐르게 하고, 그 전량을 기화기 (40)에 도입하였다. 제1, 제2 중합성 단량체 함유 가스의 혼합 가스 중의 아세트알데히드 농도는 0.174 vol%(계산치)이고, DCPD 농도는 0.403 vol%(계산치)였다. 기화기 (40)의 설정 온도를 80℃로 하고, 공급로 (46)의 설정 온도를 90℃로 하였다. 실시예 12에서의 그 밖의 처리 조건은 실시예 11과 동일하게 하였다.

[0295] 표면 처리 후, 실시예 11과 동일하게 하여 편광판 시료를 제조하였다. 이 시료의 필름 (11)과 PVA 필름 사이의 접착 강도를 실시예 11과 동일 방법으로 측정한 바, 결과는 9.2 N/인치로, 충분한 접착 강도가 얻어졌다.

[0296] 실시예 13

[0297] 실시예 13의 표면 처리 조건 및 결과를 표 5에 나타내었다.

[0298] 실시예 13에서는 실시예 11과 동일한 장치 (1Z)를 이용하였다. 처리 대상인 난접착성 수지 필름 (11)로서 실시예 12와 동일한 COP 필름을 이용하였다.



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[0299] 제1 중합성 단량체로서 아크릴산(AA)을 이용하였다. 불활성 가스 공급로 (33)에 $N_2$ 4 slm을 흐르게 하고, 그 전량을 기화기 (30)에 도입하였다. 기화기 (30)의 설정 온도를 50℃로 하고, 공급로 (36)의 설정 온도를 60℃로 하였다. 제2 중합성 단량체로서 디시클로펜타디엔(DCPD)을 이용하였다. 불활성 가스 공급로 (43)에 $N_2$ 6 slm을 흐르게 하고, 그 전량을 기화기 (40)에 도입하였다. 제1, 제2 중합성 단량체 함유 가스의 혼합 가스 중의 아크릴산 농도는 0.17 vol%(계산치)가 되고, DCPD 농도는 0.254 vol%(계산치)였다. 기화기 (40)의 설정 온도를 80℃로 하고, 공급로 (46)의 설정 온도를 90℃로 하였다. 실시예 13에서의 그 밖의 처리 조건은 실시예 11과 동일하게 하였다.

[0300] 표면 처리 후, 실시예 11과 동일하게 하여 편광판 시료를 제조하였다. 이 시료의 필름 (11)과 PVA 필름 사이의 접착 강도를 실시예 11과 동일 방법으로 측정한 바, 결과는 10.1 N/인치로, 충분한 접착 강도가 얻어졌다.

[0301] 실시예 14

[0302] 실시예 14의 표면 처리 조건 및 결과를 표 5에 나타내었다.

[0303] 실시예 14에서는 실시예 11과 동일한 장치 (1Z)를 이용하였다. 처리 대상인 난접착성 수지 필름 (11)로서는 실시예 12와 동일한 COP 필름을 이용하였다.

[0304] 제1 중합성 단량체로서 아크릴산(AA)을 이용하였다. 불활성 가스 공급로 (33)에 $N_2$ 3 slm을 흐르게 하고, 그 전량을 기화기 (30)에 도입하였다. 기화기 (30)의 설정 온도를 50℃로 하고, 공급로 (36)의 설정 온도를 60℃로 하였다. 제2 중합성 단량체로서 디시클로펜타디엔(DCPD)을 이용하였다. 불활성 가스 공급로 (43)에 $N_2$ 7 slm을 흐르게 하고, 그 전량을 기화기 (40)에 도입하였다. 제1, 제2 중합성 단량체 함유 가스의 혼합 가스 중의 아크릴산 농도는 0.127 vol%(계산치)이고, DCPD 농도는 0.297 vol%(계산치)였다. 기화기 (40)의 설정 온도를 80℃로 하고, 공급로 (46)의 설정 온도를 90℃로 하였다. 실시예 14에서의 그 밖의 처리 조건은 실시예 11과 동일하게 하였다.

[0305] 표면 처리 후, 실시예 11과 동일하게 하여 편광판 시료를 제조하였다. 이 시료의 필름 (11)과 PVA 필름 사이의 접착 강도를 실시예 11과 동일 방법으로 측정한 바, 결과는 10.2 N/인치로, 충분한 접착 강도가 얻어졌다.

표 5

| | 실시예 11 | 실시예 12 | 실시예 13 | 실시예 14 |
|---|---|---|---|---|
| 사용장치 | 도 4 | 도 4 | 도 4 | 도 4 |
| 난접착성 수지 필름(11) | PP | COP | COP | COP |
| 제1 중합성 단량체 | AA | AcA | AA | AA |
| 제2 중합성 단량체 | DCPD | DCPD | DCPD | DCPD |
| 불활성 가스로(33)의 질소유량[slm] | 2 | 0.5 | 4 | 3 |
| 불활성 가스로(43)의 질소유량[slm] | 8 | 9.5 | 6 | 7 |
| 제1 기화기(30) / 공급로(36)의 온도[℃] | 50/60 | 25/30 | 50/60 | 50/60 |
| 제2 기화기(40) / 공급로(46)의 온도[℃] | 80/90 | 80/90 | 80/90 | 80/90 |
| 필름 온도[℃] | 25 | 25 | 25 | 25 |
| 질소 커튼 유량[slm] | 30 | 30 | 30 | 30 |
| 단량체 분무시 처리헤드속도[m/분] | 0.5 | 0.5 | 0.5 | 0.5 |
| 단량체 분무시 처리헤드 이동회수 | 5 | 5 | 5 | 5 |
| 플라즈마 생성용 질소유량[slm] | 10 | 10 | 10 | 10 |
| 플라즈마 조사시 처리헤드속도[m/분] | 1 | 1 | 1 | 1 |
| 플라즈마 조사시 처리헤드 이동회수 | 1 | 1 | 1 | 1 |
| 공급직류전압[V] | 110 | 110 | 110 | 110 |
| 공급직류전류[A] | 3.8 | 3.8 | 3.8 | 3.8 |
| 공급전력[W] | 418 | 418 | 418 | 418 |
| 인가전압[kV] | 16.5 | 16.5 | 16.5 | 16.5 |
| 평가결과 : 접착강도 [N/인치] | 10.4 | 9.2 | 10.1 | 10.2 |

AA: 아크릴산
AcA: 아세트알데히드
DCPD: 디시클로펜타디엔

[0306]



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[0307] 실시예 15

[0308] 실시예 15의 표면 처리 조건 및 결과를 표 6에 나타내었다.

[0309] 실시예 15에서는 실시예 11과 동일한 장치 (1Z)를 이용하였다. 처리 대상인 난접착성 수지 필름 (11)로서는 실시예 12와 동일한 COP 필름을 이용하였다.

[0310] 제1 중합성 단량체로서 아크릴산(AA)을 이용하였다. 불활성 가스 공급로 (33)에 $N_2$ 2 slm을 흐르게 하고, 그 전량을 기화기 (30)에 도입하였다. 기화기 (30)의 설정 온도를 50℃로 하고, 공급로 (36)의 설정 온도를 60℃로 하였다. 제2 중합성 단량체로서 디시클로펜타디엔(DCPD)을 이용하였다. 불활성 가스 공급로 (43)에 $N_2$ 8 slm을 흐르게 하고, 그 전량을 기화기 (40)에 도입하였다. 제1, 제2 중합성 단량체 함유 가스의 혼합 가스 중의 아크릴산 농도는 0.085 vol%(계산치)이고, DCPD 농도는 0.339 vol%(계산치)였다. 기화기 (40)의 설정 온도를 80℃로 하고, 공급로 (46)의 설정 온도를 90℃로 하였다. 실시예 15에서의 그 밖의 처리 조건은 실시예 11과 동일하게 하였다.

[0311] 표면 처리 후, 실시예 11과 동일하게 하여 편광판 시료를 제조하였다. 이 시료의 필름 (11)과 PVA 필름 사이의 접착 강도를 실시예 11과 동일 방법으로 측정한 바, 결과는 10.3 N/인치로, 충분한 접착 강도가 얻어졌다.

[0312] 실시예 16

[0313] 실시예 16의 표면 처리 조건 및 결과를 표 6에 나타내었다.

[0314] 실시예 16에서는 실시예 11과 동일한 장치 (1Z)를 이용하였다. 처리 대상인 난접착성 수지 필름 (11)로서는 실시예 12와 동일한 COP 필름을 이용하였다.

[0315] 제1 중합성 단량체로서 아크릴산(AA)을 이용하였다. 불활성 가스 공급로 (33)에 $N_2$ 1 slm을 흐르게 하고, 그 전량을 기화기 (30)에 도입하였다. 기화기 (30)의 설정 온도를 50℃로 하고, 공급로 (36)의 설정 온도를 60℃로 하였다. 제2 중합성 단량체로서 디시클로펜타디엔(DCPD)을 이용하였다. 불활성 가스 공급로 (43)에 $N_2$ 9 slm을 흐르게 하고, 그 전량을 기화기 (40)에 도입하였다. 제1, 제2 중합성 단량체 함유 가스의 혼합 가스 중의 아크릴산 농도는 0.042 vol%(계산치)이고, DCPD 농도는 0.382 vol%(계산치)였다. 기화기 (40)의 설정 온도를 80℃로 하고, 공급로 (46)의 설정 온도를 90℃로 하였다. 실시예 16에서의 그 밖의 처리 조건은 실시예 11과 동일하게 하였다.

[0316] 표면 처리 후, 실시예 11과 동일하게 하여 편광판 시료를 제조하였다. 이 시료의 필름 (11)과 PVA 필름 사이의 접착 강도를 실시예 11과 동일 방법으로 측정한 바, 결과는 8.5 N/인치이고, 충분한 접착 강도가 얻어졌다.

[0317] 실시예 17

[0318] 실시예 17의 표면 처리 조건 및 결과를 표 6에 나타내었다.

[0319] 실시예 17에서는 실시예 11과 동일한 장치 (1Z)를 이용하였다. 처리 대상인 난접착성 수지 필름 (11)로서는 COP와 PE의 공중합체를 포함하는 COC 필름(세키스이 가가꾸 고교 제조, 상품명 에스시나)을 이용하였다. 필름의 크기는 실시예 11과 동일하게 하였다. 실시예 17에서의 그 이외의 처리 조건은 실시예 15와 동일하게 하였다.

[0320] 표면 처리 후, 실시예 11과 동일하게 하여 편광판 시료를 제조하였다. 이 시료의 필름 (11)과 PVA 필름 사이의 접착 강도를 실시예 11과 동일 방법으로 측정한 바, 결과는 10.2 N/인치로, 충분한 접착 강도가 얻어졌다.

[0321] [비교예 7]

[0322] 비교예 7의 표면 처리 조건 및 결과를 표 6에 나타내었다.

[0323] 비교예 7에서는 실시예 11과 동일한 장치(도 4)를 이용하였다. 피처리 필름 (11)로서 실시예 12와 동일한 COP 필름을 이용하였다.

[0324] 비교예 7에서는 제1 중합성 단량체 함유 가스의 공급을 정지하고, 제2 중합성 단량체 함유 가스만 공급하였다. 제2 중합성 단량체로서 디시클로펜타디엔(DCPD)을 이용하였다. 제2 가스 공급계 (4)의 캐리어 가스($N_2$)의 유량은 10 slm으로 하였다. 기화기 (40)의 설정 온도를 80℃로 하였다. 공급로 (46)의 온도는 90℃로 하였다. 비교예 7에서의 그 이외의 처리 조건은 실시예 11과 동일하게 하였다.



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[0325] 표면 처리 후, 실시예 11과 동일하게 하여 편광판 시료를 제조하였다. 이 시료의 필름 (11)과 PVA 필름 사이의 접착 강도를 실시예 11과 동일 방법으로 측정한 바, 결과는 0.8 N/인치로, 요구되는 접착 강도가 얻어지지 않았다.

표 6

| | 실시예 15 | 실시예 16 | 실시예 17 | 비교예 7 |
|---|---|---|---|---|
| 사용장치 | 도 4 | 도 4 | 도 4 | 도 4 |
| 난접착성 수지 필름(11) | COP | COP | COC | COP |
| 제1 중합성 단량체 | AA | AA | AA | — |
| 제2 중합성 단량체 | DCPD | DCPD | DCPD | DCPD |
| 불활성 가스로(33)의 질소유량[slm] | 2 | 1 | 2 | — |
| 불활성 가스로(43)의 질소유량[slm] | 8 | 9 | 8 | 10 |
| 제1 기화기(30) / 공급로(36)의 온도[℃] | 50/60 | 50/60 | 50/60 | — |
| 제2 기화기(40) / 공급로(46)의 온도[℃] | 80/90 | 80/90 | 80/90 | 80/90 |
| 필름 온도[℃] | 25 | 25 | 25 | 25 |
| 질소 커튼 유량[slm] | 30 | 30 | 30 | 30 |
| 단량체 분무시 처리헤드속도 [m/분] | 0.5 | 0.5 | 0.5 | 0.5 |
| 단량체 분무시 처리헤드 이동회수 | 5 | 5 | 5 | 5 |
| 플라즈마 생성용 질소유량[slm] | 10 | 10 | 10 | 10 |
| 플라즈마 조사시 처리헤드속도 [m/분] | 1 | 1 | 1 | 1 |
| 플라즈마 조사시 처리헤드 이동회수 | 1 | 1 | 1 | 1 |
| 공급직류전압[V] | 110 | 110 | 110 | 110 |
| 공급직류전류[A] | 3.8 | 3.8 | 3.8 | 3.8 |
| 공급전력[W] | 418 | 418 | 418 | 418 |
| 인가전압[kV] | 16.5 | 16.5 | 16.5 | 16.5 |
| 평가결과 : 접착강도 [N/인치] | 10.3 | 8.5 | 10.2 | 0.8 |

AA: 아크릴산
DCPD: 디시클로펜타디엔

[0326]

[0327] 실시예 18

[0328] 실시예 18의 표면 처리 조건 및 결과를 표 7에 나타내었다.

[0329] 실시예 18에서는 도 3에 나타내는 플라즈마 표면 처리 장치 (1Y)를 이용하였다. 롤 전극 (21, 21)의 외주면끼리 사이의 가장 좁게 된 개소의 거리는 2.7 mm였다. 각 롤 전극 (21, 21)의 외주면에는 고체 유전체층으로서 두께 1 mm의 실리콘 고무를 피막하였다. 전극간 공간 (22)의 가장 좁은 개소의 갭은 0.7 mm였다.

[0330] 처리 대상인 난접착성 수지 필름 (11)로서는 실시예 12와 동일한 COP 필름을 포함하는 연속 필름을 이용하였다. 필름 (11)의 폭(전극 (21)의 축 방향을 따르는 치수)은 150 mm였다. 필름 (11)을 전극 (21, 21)에 감았다. 롤 전극 (21, 21)을 도 3에 있어서 시계 방향으로 회전시켜 필름 (11)을 우측 방향(화살표 방향 a)으로 반송하였다. 필름 (11)의 반송 속도는 10 m/분이었다.

[0331] 제1 중합성 단량체로서 아크릴산(AA)을 이용하였다. 불활성 가스 공급로 (33)에 $N_2$ 2 slm을 흐르게 하고, 그 전량을 기화기 (30)에 도입하였다. 기화기 (30)의 설정 온도를 50℃로 하고, 공급로 (36)의 설정 온도를 60℃로 하였다. 제2 중합성 단량체로서 디시클로펜타디엔(DCPD)을 이용하였다. 불활성 가스 공급로 (43)에 $N_2$ 8 slm을 흐르게 하고, 그 전량을 기화기 (40)에 도입하였다. 기화기 (40)의 설정 온도를 80℃로 하고, 공급로 (46)의 설정 온도를 90℃로 하였다. 이들 제1, 제2 중합성 단량체 함유 가스를 분사 노즐 (50)의 내부(필름 (11)의 근방)에서 혼합하고 분사 노즐 (50)으로부터 분출하여, 필름 (11)에 분무하였다. 제1, 제2 중합성 단량체 함유 가스의 혼합 가스 중의 아크릴산 농도는 0.085 vol%(계산치)이고, DCPD 농도는 0.339 vol%(계산치)였다. 필름 온도 조절 수단 (28)의 설정 온도를 25℃로 하였다.

[0332] 분사 노즐 (53)으로부터 $N_2$ 10 slm을 전극간 공간 (22)에 분출하였다. 아울러, 전원 (23)으로부터의 전력 공급에 의해 롤 전극 (21, 21) 사이에 전계를 인가하여, 전극간 공간 (22)에 대기압 플라즈마 방전을 생성하였다. 전원 (23)의 출력은 실시예 11과 동일하게 하였다.



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[0333] 표면 처리 후, 실시예 11과 동일하게 하여 편광판 시료를 제조하였다. 이 시료의 필름 (11)과 PVA 필름 사이의 접착 강도를 실시예 11과 동일 방법으로 측정한 바, 결과는 10.2 N/인치로, 충분한 접착 강도가 얻어졌다.

표 7

| | 실시예 18 |
|---|---|
| 사용장치 | 도 3 |
| 난접착성 수지 필름(11) | COP |
| 제1 중합성 단량체 | AA |
| 제2 중합성 단량체 | DCPD |
| 불활성 가스로(33)의 질소유량 [slm] | 2 |
| 불활성 가스로(43)의 질소유량 [slm] | 8 |
| 제1 기화기(30) / 공급로(36)의 온도[℃] | 50/60 |
| 제2 기화기(40) / 공급로(46)의 온도[℃] | 80/90 |
| 필름 온도[℃] | 25 |
| 플라즈마 생성용 질소유량 [slm] | 10 |
| 필름반송속도[m/분] | 10 |
| 공급직류전압[V] | 110 |
| 공급직류전류[A] | 3.8 |
| 공급전력[W] | 418 |
| 인가전압[kV] | 16.5 |
| 평가결과: 접착강도[N/인치] | 10.2 |

AA: 아크릴산
DCPD: 디시클로펜타디엔

[0334]

[0335] 이상의 결과로부터, 본 발명에 따른 실시예에 따르면, 난접착성 수지 필름의 접착성을 향상시킬 수 있으면서 공급로 내에서의 중합 반응을 회피할 수 있어, 공급로의 폐색을 방지할 수 있는 것이 확인되었다.

## 산업상 이용가능성

[0336] 본 발명은 예를 들면 액정 표시 패널의 편광판의 제조에 적용 가능하다.

## 부호의 설명

[0337] 1, 1X, 1Y, 1Z: 표면 처리 장치

10: 편광판

11: TAC 필름(난접착성 수지 필름)

12: PVA 필름(이접착성 수지 필름)

13: 접착제

2: 공통 플라즈마 처리부

2A: 제1 플라즈마 처리부

2B: 제2 플라즈마 처리부

21: 롤 전극(지지 수단, 이동 수단)

22: 공통 처리 공간

22A: 제1 처리 공간

22B: 제2 처리 공간

23: 공통 전원

23A: 제1 전원



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23B: 제2 전원

27: 전환 롤(지지 수단, 이동 수단)

28: 필름 온도 조절 수단

3: 제1 가스 공급계

30: 제1 기화기

31: 불활성 가스 공급원

32: 가열기

33: 불활성 가스 공급로

34: 희석로

35: 캐리어로

36: 제1 공급로

38: 가스 온도 조절 수단

4: 제2 가스 공급계

40: 제2 기화기

41: 불활성 가스 공급원

42: 가열기

43: 불활성 가스 공급로

44: 희석로

45: 캐리어로

46: 제2 공급로

48: 가스 온도 조절 수단

50: 공통 분사 노즐

50a: 제1 분사로

50b: 제2 분사로

50c: 합류부

50d: 공통 분출구

51: 제1 분사 노즐

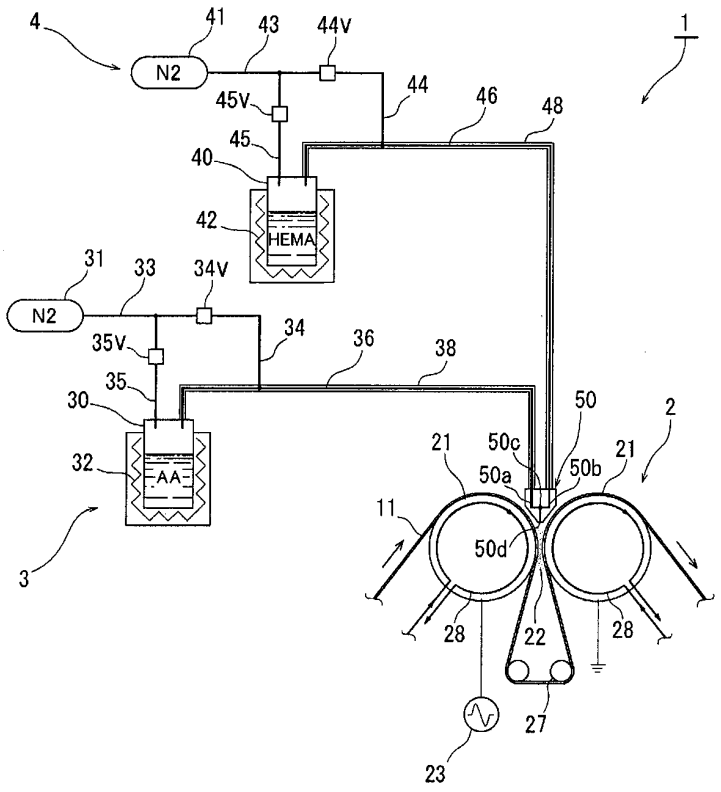
52: 제2 분사 노즐



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도면

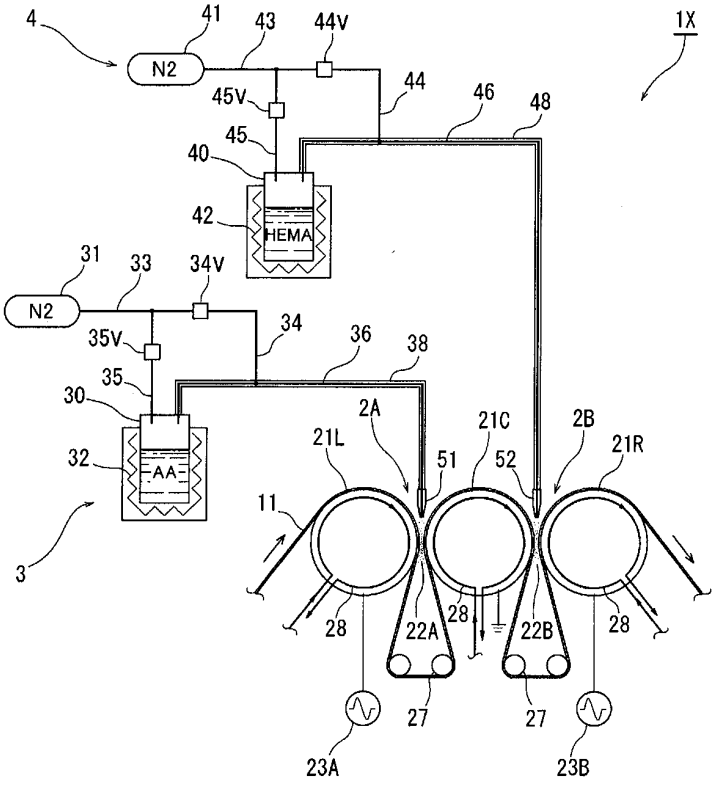
도면1



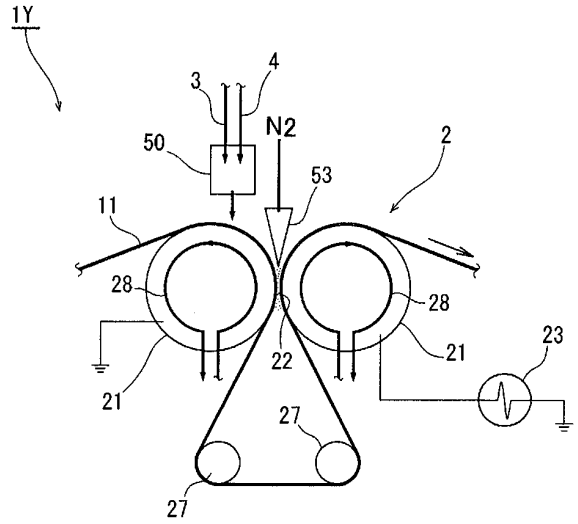



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도면2



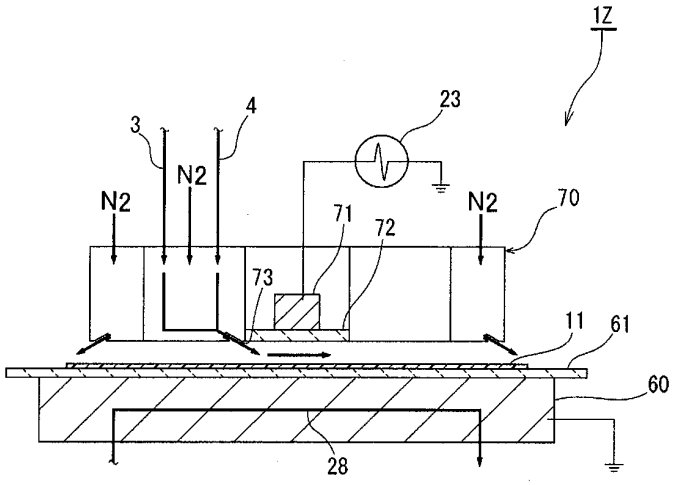

도면3



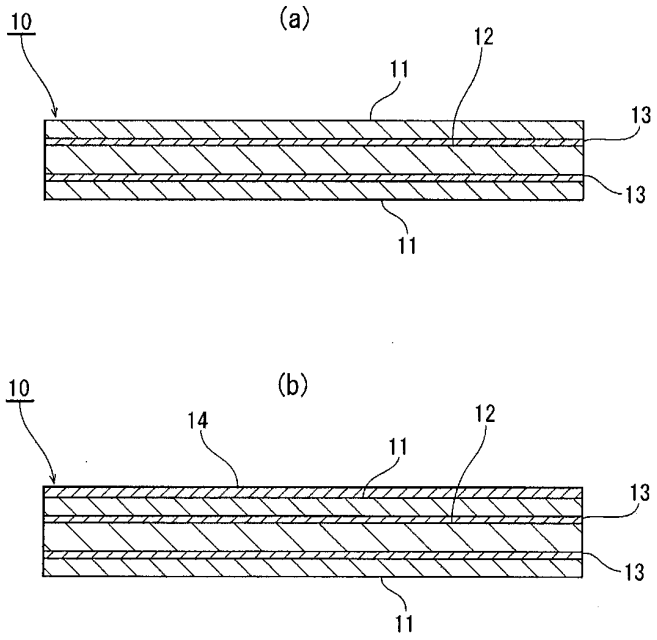



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도면4




도면5






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# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 17608950 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Youg E. Jeon/Diane Goss |
| **Filer Authorized By:** | Jun-Youg E. Jeon |
| **Attorney Docket Number:** | 69657/S1437 |
| **Receipt Date:** | 09-DEC-2013 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 18:33:30 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 69657ids.pdf | 107216<br>ae1567af9dac44811cdeea9f0318ce343198a84a | yes | 3 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Transmittal Letter | 1 | 2 |
| | Information Disclosure Statement (IDS) Form (SB08) | 3 | 3 |

| | | | | | |
|---|---|---|---|---|---|
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Foreign Reference | KR_967.pdf | 882965<br>5a44f46e7c9a9cf18ae3dc42f387a6321448f207 | no | 37 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 990181 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on December 9, 2013 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Diane L. Goss

| | | |
|---|---|---|
| Inventor | : Sang-Shin Lee | Confirmation No. 4264 |
| Application No. | : 13/614,197 | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| Grp./Div. | : 2696 | |
| Examiner | : Bipin H. Shalwala | |
| Docket No. | : 69657/S1437 | |

**INFORMATION DISCLOSURE STATEMENT**
**37 CFR § 1.97(b)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
December 9, 2013

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is FORM PTO/SB/08A/B listing the references that are known to applicant. Copies of each of the listed non-U.S. references are enclosed. This filing is timely because it is made during one of the periods described in 37 CFR § 1.97(b).

It is respectfully requested that the listed references be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of FORM PTO/SB/08A/B be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

**Application No.: 13/614,197**

The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
CHRISTIE, PARKER & HALE, LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/dg
Enclosures: PTO/SB/08A/B, w/references

DLG PAS1271491.1-*-12/9/13 10:05 AM



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별첨 사본은 아래 출원의 원본과 동일함을 증명함.

This is to certify that the following application annexed hereto is a true copy from the records of the Korean Intellectual Property Office

출 원 번 호 : 10-2012-0022967
Application Number

출 원 년 월 일 : 2012년 03월 06일
Filling Date 3월 . 06, 2012

출 원 인 : 삼성디스플레이 주식회사
Applicant(s) Samsung Display Co., Ltd.

2013년 10월 08일

특 허 청
COMMISSIONER

제출 일자 : 2012-03-06

【서지사항】

| | |
|---|---|
| 【서류명】 | 특허출원서 |
| 【참조번호】 | 6767 |
| 【출원구분】 | 특허출원 |
| 【출원인】 | |
| 【명칭】 | 삼성모바일디스플레이주식회사 |
| 【출원인코드】 | 1-2008-040752-7 |
| 【대리인】 | |
| 【명칭】 | 팬코리아특허법인 |
| 【대리인코드】 | 9-2007-100081-9 |
| 【지정된변리사】 | 김재만 |
| 【포괄위임등록번호】 | 2008-081420-6 |
| 【발명의 국문명칭】 | 유기 발광 표시 장치의 화소 배열 구조 |
| 【발명의 영문명칭】 | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| 【발명자】 | |
| 【성명】 | 이상신 |
| 【성명의 영문표기】 | LEE, SANG SHIN |
| 【주민등록번호】 | 770602-1XXXXXX |
| 【우편번호】 | 445-738 |
| 【주소】 | 경기 화성시 반월동 두산위브아파트 205동 603호 |
| 【국적】 | KR |
| 【심사청구】 | 청구 |



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제출 일자 : 2012-03-06

【취지】 위와 같이 특허청장에게 제출합니다.

대리인 팬코리아특허법인 (서명 또는 인)

【수수료】

| | | | |
|---|---|---|---|
| 【출원료】 | 0 | 면 | 38,000 원 |
| 【가산출원료】 | 23 | 면 | 0 원 |
| 【우선권주장료】 | 0 | 건 | 0 원 |
| 【심사청구료】 | 14 | 항 | 690,000 원 |
| 【합계】 | 728,000 원 | | |

【수수료 자동납부번호】 064-094949-04-013



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제출 일자 : 2012-03-06

# 【명세서】

## 【발명의 명칭】

유기 발광 표시 장치의 화소 배열 구조{PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE}

## 【기술분야】

<1> 본 발명은 유기 발광 표시 장치의 화소 배열 구조에 관한 것으로서, 보다 상세하게는 복수의 화소가 발광하여 이미지(image)를 표시하는 유기 발광 표시 장치의 화소 배열 구조에 관한 것이다.

## 【배경기술】

<2> 표시 장치는 이미지를 표시하는 장치로서, 최근 유기 발광 표시 장치(organic light emitting diode display)가 주목 받고 있다.

<3> 유기 발광 표시 장치는 자체 발광 특성을 가지며, 액정 표시 장치(liquid crystal display device)와 달리 별도의 광원을 필요로 하지 않으므로 두께와 무게를 줄일 수 있다. 또한, 유기 발광 표시 장치는 낮은 소비 전력, 높은 휘도 및 높은 반응 속도 등의 고품위 특성을 나타낸다.

<4> 일반적으로 유기 발광 표시 장치는 각각이 서로 다른 색의 빛을 발광하는 복수의 화소들을 포함하며, 이 복수의 화소들이 발광하여 이미지(image)를 표시한다.

<5> 여기서, 화소란 이미지를 표시하는 최소 단위를 의미하며, 이웃하는 화소 사이에는 각 화소를 구동하기 위한 게이트 라인, 데이터 라인, 구동 전원 라인 등의



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전원 라인 및 각 화소의 면적 또는 형태 등을 정의하기 위한 화소 정의막 등의 절연층 등이 위치할 수 있다.

<6> 종래의 유기 발광 표시 장치의 화소를 구성하는 유기 발광층은 파인메탈마스크(fine metal mask, FMM) 등의 마스크를 이용하여 증착 형성하였는데, 화소의 개구율 확보를 위해 이웃하는 화소 간의 갭(gap)을 짧게 형성할 경우 증착 신뢰도가 저하되는 문제점이 있었으며, 증착 신뢰도 향상을 위해 화소 간의 갭을 멀게 형성할 경우 화소의 개구율이 저하되는 문제점이 있었다.

【발명의 내용】

【해결하려는 과제】

<7> 본 발명의 일 실시예는 상술한 문제점을 해결하기 위한 것으로서, 화소의 개구율이 향상되는 동시에 화소 간의 갭이 효율적으로 설정된 유기 발광 표시 장치의 화소 배열 구조를 제공하고자 한다.

【과제의 해결 수단】

<8> 상술한 기술적 과제를 달성하기 위한 본 발명의 일 측면은 유기 발광 표시 장치의 화소 배열 구조에 있어서, 제1 화소, 상기 제1 화소와 이격되어 있으며, 상기 제1 화소의 중심점을 정사각형의 중심점으로 하는 가상의 정사각형의 제1 꼭지점에 중심점이 위치하는 제2 화소, 및 상기 제2 화소와 이격되어 있으며, 상기 가상의 정사각형의 상기 제1 꼭지점과 이웃하는 제2 꼭지점에 중심점이 위치하는 제3 화소를 포함하는 유기 발광 표시 장치의 화소 배열 구조를 제공한다.



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<9> 상기 제2 화소는 복수개이며, 상기 복수개의 제2 화소는 상기 제1 화소를 사이에 두고 상호 이격되어 있을 수 있다.

<10> 상기 제3 화소는 복수개이며, 상기 복수개의 제3 화소는 상기 제1 화소를 사이에 두고 상호 이격되어 있을 수 있다.

<11> 상기 복수개의 제2 화소 및 상기 복수개의 제3 화소 각각은 상기 제1 화소를 둘러싸도록 가상의 직선 상에서 상호 교호적으로 배열될 수 있다.

<12> 상기 제1 화소, 상기 제2 화소 및 상기 제3 화소 각각은 다각형 형태를 가지며, 상기 제2 화소 및 상기 제3 화소는 상기 제1 화소 대비 큰 면적을 가질 수 있다.

<13> 상기 제1 화소는 사각형 형태를 가지며, 상기 제2 화소 및 상기 제3 화소 각각은 팔각형 형태를 가질 수 있다.

<14> 상기 제1 화소는 복수개이며, 상기 복수개의 제1 화소 각각은 동일한 사각형 형태를 가질 수 있다.

<15> 상기 제2 화소와 상기 제3 화소 각각은 서로 동일한 면적을 가지며, 상기 제1 화소, 상기 제2 화소 및 상기 제3 화소 각각 사이의 거리는 동일한 제1 길이를 가지며, 이웃하는 상기 제1 화소 간의 거리는 상기 제1 길이 대비 긴 제2 길이를 가질 수 있다.

<16> 상기 제2 화소는 상기 제3 화소 대비 큰 면적을 가지며, 상기 제2 화소와 상기 제3 화소 사이의 거리는 제3 길이를 가지며, 상기 제1 화소와 상기 제2 화소 사



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이의 거리 및 상기 제1 화소와 상기 제3 화소 사이의 거리 각각은 동일한 제4 길이를 가지며, 이웃하는 상기 제1 화소 간의 거리는 상기 제3 길이 및 상기 제4 길이 대비 긴 제5 길이를 가질 수 있다.

<17> 상기 제1 화소는 복수개이며, 상기 복수개의 제1 화소 중 이웃하는 제1 화소 각각은 서로 대칭인 사각형 형태를 가질 수 있다.

<18> 상기 제2 화소는 상기 제3 화소 대비 큰 면적을 가질 수 있다.

<19> 상기 제3 화소는 상기 제2 화소 대비 큰 면적을 가질 수 있다.

<20> 상기 제1 화소, 상기 제2 화소 및 상기 제3 화소 각각은 서로 다른 색의 빛을 발광할 수 있다.

<21> 상기 제1 화소, 상기 제2 화소 및 상기 제3 화소 각각은 녹색, 청색 및 적색 각각의 빛을 발광할 수 있다.

【발명의 효과】

<22> 상술한 본 발명의 과제 해결 수단의 일부 실시예 중 하나에 의하면, 화소의 개구율이 향상되는 동시에 화소 간의 갭이 효율적으로 설정된 유기 발광 표시 장치의 화소 배열 구조가 제공된다.

【도면의 간단한 설명】

<23> 도 1은 본 발명의 제1 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조를 나타낸 도면이다.

도 2는 본 발명의 제2 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조



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를 나타낸 도면이다.

도 3은 본 발명의 제3 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조를 나타낸 도면이다.

도 4는 본 발명의 제4 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조를 나타낸 도면이다.

【발명을 실시하기 위한 구체적인 내용】

<24> 이하, 첨부한 도면을 참고로 하여 본 발명의 여러 실시예들에 대하여 본 발명이 속하는 기술 분야에서 통상의 지식을 가진 자가 용이하게 실시할 수 있도록 상세히 설명한다. 본 발명은 여러 가지 상이한 형태로 구현될 수 있으며 여기에서 설명하는 실시예들에 한정되지 않는다.

<25> 본 발명을 명확하게 설명하기 위해서 설명과 관계없는 부분은 생략하였으며, 명세서 전체를 통하여 동일 또는 유사한 구성요소에 대해서는 동일한 참조 부호를 붙이도록 한다.

<26> 또한, 여러 실시예들에 있어서, 동일한 구성을 가지는 구성요소에 대해서는 동일한 부호를 사용하여 대표적으로 제1 실시예에서 설명하고, 그 외의 실시예에서는 제1 실시예와 다른 구성에 대해서만 설명하기로 한다.

<27> 또한, 도면에서 나타난 각 구성의 크기 및 두께는 설명의 편의를 위해 임의로 나타내었으므로, 본 발명이 반드시 도시된 바에 한정되지 않는다.

<28> 또한, 명세서 전체에서, 어떤 부분이 어떤 구성요소를 "포함" 한다고 할 때,



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이는 특별히 반대되는 기재가 없는 한 다른 구성요소를 제외하는 것이 아니라 다른 구성요소를 더 포함할 수 있는 것을 의미한다.

<29> 이하, 도 1을 참조하여 본 발명의 제1 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조를 설명한다. 도 1은 유기 발광 표시 장치를 구성하는 화소들의 일부분을 개략적으로 나타낸 도면이다.

<30> 도 1은 본 발명의 제1 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조를 나타낸 도면이다.

<31> 도 1에 도시된 바와 같이, 본 발명이 제1 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조는 복수의 제1 화소(100), 복수의 제2 화소(200) 및 복수의 제3 화소(300)를 포함한다.

<32> 여기서, 화소(pixel)란 이미지를 표시하는 최소 단위를 의미한다.

<33> 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 사이에는 각 화소를 구동하기 위한 게이트 라인, 데이터 라인, 구동 전원 라인 등의 전원 라인 및 각 화소를 정의하기 위한 화소 정의막 등의 절연층 등이 위치할 수 있으며, 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 각각에 대응하여 애노드 전극, 유기 발광층 및 캐소드 전극을 포함하는 유기 발광 소자(organic light emitting diode)가 위치할 수 있다. 상기한 구성들은 종래에 공지된 기술들이므로 설명의 편의상 설명하지 않으며, 각 화소의 형태는 전원 라인들, 화소 정의막 또는 애노드 전극 등에 의해 정의될 수 있으나, 이에 한정되지는 않는다.



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<34> 제1 화소(100)는 이웃한 제2 화소(200) 및 제3 화소 대비 작은 면적을 가지고 있으며, 다각형의 형태 중 사각형의 형태를 가지고 있다. 제1 화소(100)는 복수개이며, 복수개의 제1 화소(100)는 서로 동일한 사각형 형태를 가지고 있다. 복수개의 제1 화소(100)는 상호 이격되어 가상의 제1 직선(VL1) 상에 배열되어 있다. 제1 화소(100)는 녹색의 빛을 발광하며, 녹색의 빛을 발광하는 유기 발광층을 포함할 수 있다.

<35> 제1 화소(100)의 중심점을 정사각형의 중심점으로 하는 가상의 정사각형(VS)의 제1 꼭지점(P1)에 제2 화소(200)가 위치하고 있으며, 가상의 정사각형(VS)의 제2 꼭지점(P2)에 제3 화소(300)가 위치하고 있다.

<36> 제2 화소(200)는 제1 화소(100)와 이격되어 있으며, 가상의 정사각형(VS)의 제1 꼭지점(P1)에 중심점이 위치하고 있다. 제2 화소(200)는 이웃하는 제1 화소(100) 대비 더 큰 면적을 가지고 있으며, 다각형의 형태 중 팔각형의 형태를 가지고 있다. 제2 화소(200)는 복수개이며, 복수개의 제2 화소(200)는 서로 동일한 팔각형의 형태를 가지고 있다. 복수개의 제2 화소(200)는 제1 화소(100)를 두고 상호 이격되어 있다. 제2 화소(200)는 청색의 빛을 발광하며, 청색의 빛을 발광하는 유기 발광층을 포함할 수 있다.

<37> 제3 화소(300)는 제1 화소(100) 및 제2 화소(200)와 이격되어 있으며, 가상의 정사각형(VS)의 제1 꼭지점(P1)과 이웃하는 제2 꼭지점(P2)에 중심점이 위치하고 있다. 제3 화소(300)는 이웃하는 제1 화소(100) 대비 더 큰 면적을 가지고 있는 동시에 제2 화소(200)와 동일한 면적을 가지고 있으며, 다각형의 형태 중 팔각



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형의 형태를 가지고 있다. 제3 화소(300)는 복수개이며, 복수개의 제3 화소(300)는 서로 동일한 팔각형의 형태를 가지고 있다. 복수개의 제3 화소(300)는 제1 화소(100)를 두고 상호 이격되어 있다. 제3 화소(300)는 적색의 빛을 발광하며, 적색의 빛을 발광하는 유기 발광층을 포함할 수 있다.

<38> 복수개의 제3 화소(300) 및 복수개의 제2 화소(200) 각각은 가상의 제2 직선(VL2) 상에서 상호 교호적으로 배열되며, 이로 인해 제1 꼭지점(P1)에 중심점이 위치하는 복수개의 제2 화소(200) 및 제2 꼭지점(P2)에 중심점이 위치하는 복수개의 제3 화소(300) 각각은 제1 화소(100)를 둘러싸고 있다.

<39> 이와 같이, 제1 화소(100)의 중심점을 정사각형의 중심점으로 하는 가상의 정사각형(VS)의 제1 꼭지점(P1)에 제2 화소(200)의 중심점이 위치하고, 제2 꼭지점(P2)에 제3 화소(300)의 중심점이 위치하며, 제2 화소(200) 및 제3 화소(300)가 동일한 면적을 가짐으로써, 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 각각 사이의 거리는 동일한 제1 길이(L1)를 가지며, 이웃하는 제1 화소(100) 간의 거리는 제1 길이(L1) 대비 긴 제2 길이(L2)를 가지게 된다.

<40> 이로 인해, 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 각각의 사이에는 제1 길이(L1)의 갭(gap)이 형성되는 동시에, 이웃하는 제1 화소(100) 사이에는 제1 길이(L1) 대비 긴 제2 길이(L2)의 갭이 형성됨으로써, 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 각각에 포함된 녹색의 유기 발광층, 청색의 유기 발광층 및 적색의 유기 발광층 각각을 형성하는 파인메탈마스크를 이용한 증착 공정 시 증착 신뢰도가 향상된다. 또한, 복수의 제2 화소(200) 및 복수의 제3 화소(300) 각



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각이 제1 화소(100)를 둘러싸도록 배열됨으로써, 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 각각의 개구율을 향상시킬 수 있다. 이는 전체적인 유기 발광 표시 장치의 제조 시간 및 제조 비용을 절감하는 동시에 유기 발광 표시 장치가 표시하는 이미지의 품질을 향상시키는 요인으로서 작용된다.

<41> 상술한 바와 같이, 본 발명의 제1 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조는 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 각각이 단순히 다각형의 형태를 가지는 것이 아니라, 유기 발광 표시 장치의 고유의 제조 특성인 유기 발광층의 증착 공정을 고려하여, 파인메탈마스크를 이용한 증착 공정시 유기 발광층의 증착 신뢰도를 향상시키는 동시에 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 각각의 개구율을 향상시키기 위해, 가상의 정사각형(VS)의 중심점에 제1 화소(100)의 중심점을 위치시키고, 제1 꼭지점(P1)에 제2 화소(200)의 중심점을 위치시키고, 제2 꼭지점(P2)에 제3 화소(300)의 중심점을 위치시키는 것이다.

<42> 한편, 본 발명의 제1 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조에서 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 각각은 녹색, 청색 및 적색 각각의 색을 발광하나, 본 발명의 다른 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조에서는 이에 한정되지 않고, 제1 화소, 제2 화소 및 제3 화소 각각이 서로 다른 색의 빛을 발광할 수 있다. 일례로, 제2 화소 및 제3 화소 중 하나 이상의 화소가 백색 등의 빛을 발광할 수 있다.

<43> 이하, 도 2를 참조하여 본 발명의 제2 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조에 대하여 설명한다.



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<44> 이하, 제1 실시예와 구별되는 특징적인 부분만 발췌하여 설명하며, 설명이 생략된 부분은 제1 실시예에 따른다. 그리고, 본 발명의 제2 실시예에서는 설명의 편의를 위하여 동일한 구성요소에 대하여는 본 발명의 제1 실시예와 동일한 참조번호를 사용하여 설명한다.

<45> 도 2는 본 발명의 제2 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조를 나타낸 도면이다.

<46> 도 2에 도시된 바와 같이, 본 발명이 제2 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조는 복수의 제1 화소(100), 복수의 제2 화소(200) 및 복수의 제3 화소(300)를 포함한다.

<47> 복수개의 제1 화소(100)는 서로 동일한 사각형 형태를 가지고 있다.

<48> 제2 화소(200) 및 제3 화소 각각은 서로 다른 면적을 가지고 있으며, 제2 화소(200)가 제3 화소(300) 대비 큰 면적을 가지고 있다.

<49> 이와 같이, 제1 화소(100)의 중심점을 정사각형의 중심점으로 하는 가상의 정사각형(VS)의 제1 꼭지점(P1)에 제2 화소(200)의 중심점이 위치하고, 제2 꼭지점(P2)에 제3 화소(300)의 중심점이 위치하며, 제2 화소(200)가 제3 화소(300) 대비 큰 면적을 가짐으로써, 제2 화소(200)와 제3 화소(300) 사이의 거리는 제3 길이(L3)를 가지고, 제1 화소(100)와 제2 화소(200) 사이의 거리 및 제1 화소(100)와 제3 화소(300) 사이의 거리 각각은 동일한 제4 길이(L4)를 가지며, 이웃하는 제1 화소(100) 간의 거리는 제2 길이(L2) 및 제4 길이(L4) 대비 긴 제5 길이(L5)를 가



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진다.

<50> 이로 인해, 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 각각의 사이에는 제3 길이(L3) 또는 제4 길이(L4)의 갭(gap)이 형성되는 동시에, 이웃하는 제1 화소(100) 사이에는 제3 길이(L3) 및 제4 길이(L4) 대비 긴 제5 길이(L5)의 갭이 형성됨으로써, 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 각각에 포함된 녹색의 유기 발광층, 청색의 유기 발광층 및 적색의 유기 발광층 각각을 형성하는 파인메탈마스크를 이용한 증착 공정 시 증착 신뢰도가 향상된다. 또한, 복수의 제2 화소(200) 및 복수의 제3 화소(300) 각각이 제1 화소(100)를 둘러싸도록 배열됨으로써, 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 각각의 개구율을 향상시킬 수 있다. 이는 전체적인 유기 발광 표시 장치의 제조 시간 및 제조 비용을 절감하는 동시에 유기 발광 표시 장치가 표시하는 이미지의 품질을 향상시키는 요인으로서 작용된다.

<51> 또한, 본 발명의 제2 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조는 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 중 다른 화소 대비 수명이 짧은 청색의 빛을 발광하는 제2 화소(200)가 제3 화소(300) 대비 큰 면적을 가짐으로써, 전체적인 유기 발광 표시 장치의 수명이 저하되는 것이 억제된다. 즉, 수명이 향상된 유기 발광 표시 장치의 화소 배열 구조가 제공된다.

<52> 이하, 도 3을 참조하여 본 발명의 제3 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조에 대하여 설명한다.

<53> 이하, 제1 실시예와 구별되는 특징적인 부분만 발췌하여 설명하며, 설명이



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생략된 부분은 제1 실시예에 따른다. 그리고, 본 발명의 제3 실시예에서는 설명의 편의를 위하여 동일한 구성요소에 대하여는 본 발명의 제1 실시예와 동일한 참조번호를 사용하여 설명한다.

<54> 도 3은 본 발명의 제3 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조를 나타낸 도면이다.

<55> 도 3에 도시된 바와 같이, 본 발명이 제3 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조는 복수의 제1 화소(100), 복수의 제2 화소(200) 및 복수의 제3 화소(300)를 포함한다.

<56> 복수개의 제1 화소(100) 중 이웃하는 제1 화소(100) 각각은 서로 대칭인 사각형 형태를 가지고 있다.

<57> 제2 화소(200) 및 제3 화소 각각은 서로 다른 면적을 가지고 있으며, 제2 화소(200)가 제3 화소(300) 대비 큰 면적을 가지고 있다.

<58> 이와 같이, 제1 화소(100)의 중심점을 정사각형의 중심점으로 하는 가상의 정사각형(VS)의 제1 꼭지점(P1)에 제2 화소(200)의 중심점이 위치하고, 제2 꼭지점(P2)에 제3 화소(300)의 중심점이 위치하며, 이웃하는 제1 화소(100) 각각이 서로 대칭인 사각형 형태를 가지는 동시에 제2 화소(200)가 제3 화소(300) 대비 큰 면적을 가짐으로써, 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 각각에 포함된 녹색의 유기 발광층, 청색의 유기 발광층 및 적색의 유기 발광층 각각을 형성하는 파인메탈마스크를 이용한 증착 공정 시 증착 신뢰도가 향상된다. 또한, 복수의 제2



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화소(200) 및 복수의 제3 화소(300) 각각이 제1 화소(100)를 둘러싸도록 배열됨으로써, 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 각각의 개구율을 향상시킬 수 있다. 이는 전체적인 유기 발광 표시 장치의 제조 시간 및 제조 비용을 절감하는 동시에 유기 발광 표시 장치가 표시하는 이미지의 품질을 향상시키는 요인으로서 작용된다.

<59> 또한, 본 발명의 제3 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조는 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 중 다른 화소 대비 수명이 짧은 청색의 빛을 발광하는 제2 화소(200)가 제3 화소(300) 대비 큰 면적을 가짐으로써, 전체적인 유기 발광 표시 장치의 수명이 저하되는 것이 억제된다. 즉, 수명이 향상된 유기 발광 표시 장치의 화소 배열 구조가 제공된다.

<60> 이하, 도 4를 참조하여 본 발명의 제4 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조에 대하여 설명한다.

<61> 이하, 제1 실시예와 구별되는 특징적인 부분만 발췌하여 설명하며, 설명이 생략된 부분은 제1 실시예에 따른다. 그리고, 본 발명의 제4 실시예에서는 설명의 편의를 위하여 동일한 구성요소에 대하여는 본 발명의 제1 실시예와 동일한 참조번호를 사용하여 설명한다.

<62> 도 4는 본 발명의 제4 실시예에 따른 유기 발광 표시 장치의 화소 배열 구조를 나타낸 도면이다.

<63> 도 4에 도시된 바와 같이, 본 발명이 제4 실시예에 따른 유기 발광 표시 장



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치의 화소 배열 구조는 복수의 제1 화소(100), 복수의 제2 화소(200) 및 복수의 제3 화소(300)를 포함한다.

<64> 복수개의 제1 화소(100) 중 이웃하는 제1 화소(100) 각각은 서로 대칭인 사각형 형태를 가지고 있다.

<65> 제2 화소(200) 및 제3 화소 각각은 서로 다른 면적을 가지고 있으며, 제3 화소(300)가 제2 화소(200) 대비 큰 면적을 가지고 있다.

<66> 이와 같이, 제1 화소(100)의 중심점을 정사각형의 중심점으로 하는 가상의 정사각형(VS)의 제1 꼭지점(P1)에 제2 화소(200)의 중심점이 위치하고, 제2 꼭지점(P2)에 제3 화소(300)의 중심점이 위치하며, 이웃하는 제1 화소(100) 각각이 서로 대칭인 사각형 형태를 가지는 동시에 제3 화소(300)가 제2 화소(200) 대비 큰 면적을 가짐으로써, 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 각각에 포함된 녹색의 유기 발광층, 청색의 유기 발광층 및 적색의 유기 발광층 각각을 형성하는 파인메탈마스크를 이용한 증착 공정 시 증착 신뢰도가 향상된다. 또한, 복수의 제2 화소(200) 및 복수의 제3 화소(300) 각각이 제1 화소(100)를 둘러싸도록 배열됨으로써, 제1 화소(100), 제2 화소(200) 및 제3 화소(300) 각각의 개구율을 향상시킬 수 있다. 이는 전체적인 유기 발광 표시 장치의 제조 시간 및 제조 비용을 절감하는 동시에 유기 발광 표시 장치가 표시하는 이미지의 품질을 향상시키는 요인으로서 작용된다.

<67> 본 발명을 앞서 기재한 바에 따라 바람직한 실시예를 통해 설명하였지만, 본 발명은 이에 한정되지 않으며 다음에 기재하는 특허청구범위의 개념과 범위를 벗어



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나지 않는 한, 다양한 수정 및 변형이 가능하다는 것을 본 발명이 속하는 기술 분야에 종사하는 자들은 쉽게 이해할 것이다.

【부호의 설명】

<68> 제1 화소(100), 제2 화소(200), 제3 화소(300)



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【특허청구범위】

【청구항 1】

유기 발광 표시 장치의 화소 배열 구조에 있어서,

제1 화소;

상기 제1 화소와 이격되어 있으며, 상기 제1 화소의 중심점을 정사각형의 중심점으로 하는 가상의 정사각형의 제1 꼭지점에 중심점이 위치하는 제2 화소; 및

상기 제2 화소와 이격되어 있으며, 상기 가상의 정사각형의 상기 제1 꼭지점과 이웃하는 제2 꼭지점에 중심점이 위치하는 제3 화소

를 포함하는 유기 발광 표시 장치의 화소 배열 구조.

【청구항 2】

제1항에서,

상기 제2 화소는 복수개이며,

상기 복수개의 제2 화소는 상기 제1 화소를 사이에 두고 상호 이격되어 있는 유기 발광 표시 장치의 화소 배열 구조.

【청구항 3】

제2항에서,

상기 제3 화소는 복수개이며,

상기 복수개의 제3 화소는 상기 제1 화소를 사이에 두고 상호 이격되어 있는 유기 발광 표시 장치의 화소 배열 구조.



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【청구항 4】

제3항에서,

상기 복수개의 제2 화소 및 상기 복수개의 제3 화소 각각은 상기 제1 화소를 둘러싸도록 가상의 직선 상에서 상호 교호적으로 배열되는 유기 발광 표시 장치의 화소 배열 구조.

【청구항 5】

제4항에서,

상기 제1 화소, 상기 제2 화소 및 상기 제3 화소 각각은 다각형 형태를 가지며,

상기 제2 화소 및 상기 제3 화소는 상기 제1 화소 대비 큰 면적을 가지는 유기 발광 표시 장치의 화소 배열 구조.

【청구항 6】

제5항에서,

상기 제1 화소는 사각형 형태를 가지며,

상기 제2 화소 및 상기 제3 화소 각각은 팔각형 형태를 가지는 유기 발광 표시 장치의 화소 배열 구조.

【청구항 7】

제6항에서,

상기 제1 화소는 복수개이며,



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상기 복수개의 제1 화소 각각은 동일한 사각형 형태를 가지는 유기 발광 표시 장치의 화소 배열 구조.

【청구항 8】

제7항에서,

상기 제2 화소와 상기 제3 화소 각각은 서로 동일한 면적을 가지며,

상기 제1 화소, 상기 제2 화소 및 상기 제3 화소 각각 사이의 거리는 동일한 제1 길이를 가지며,

이웃하는 상기 제1 화소 간의 거리는 상기 제1 길이 대비 긴 제2 길이를 가지는 유기 발광 표시 장치의 화소 배열 구조.

【청구항 9】

제7항에서,

상기 제2 화소는 상기 제3 화소 대비 큰 면적을 가지며,

상기 제2 화소와 상기 제3 화소 사이의 거리는 제3 길이를 가지며,

상기 제1 화소와 상기 제2 화소 사이의 거리 및 상기 제1 화소와 상기 제3 화소 사이의 거리 각각은 동일한 제4 길이를 가지며,

이웃하는 상기 제1 화소 간의 거리는 상기 제3 길이 및 상기 제4 길이 대비 긴 제5 길이를 가지는 유기 발광 표시 장치의 화소 배열 구조.

【청구항 10】

제6항에서,



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상기 제1 화소는 복수개이며,

상기 복수개의 제1 화소 중 이웃하는 제1 화소 각각은 서로 대칭인 사각형 형태를 가지는 유기 발광 표시 장치의 화소 배열 구조.

【청구항 11】

제10항에서,

상기 제2 화소는 상기 제3 화소 대비 큰 면적을 가지는 유기 발광 표시 장치의 화소 배열 구조.

【청구항 12】

제10항에서,

상기 제3 화소는 상기 제2 화소 대비 큰 면적을 가지는 유기 발광 표시 장치의 화소 배열 구조.

【청구항 13】

제1항 내지 제12항 중 어느 한 항에서,

상기 제1 화소, 상기 제2 화소 및 상기 제3 화소 각각은 서로 다른 색의 빛을 발광하는 유기 발광 표시 장치의 화소 배열 구조.

【청구항 14】

제13항에서,

상기 제1 화소, 상기 제2 화소 및 상기 제3 화소 각각은 녹색, 청색 및 적색 각각의 빛을 발광하는 유기 발광 표시 장치의 화소 배열 구조.



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제출 일자 : 2012-03-06

【요약서】

【요약】

유기 발광 표시 장치의 화소 배열 구조는 제1 화소, 상기 제1 화소와 이격되어 있으며 상기 제1 화소의 중심점을 정사각형의 중심점으로 하는 가상의 정사각형의 제1 꼭지점에 중심점이 위치하는 제2 화소, 및 상기 제2 화소와 이격되어 있으며 상기 가상의 정사각형의 상기 제1 꼭지점과 이웃하는 제2 꼭지점에 중심점이 위치하는 제3 화소를 포함한다.

【대표도】

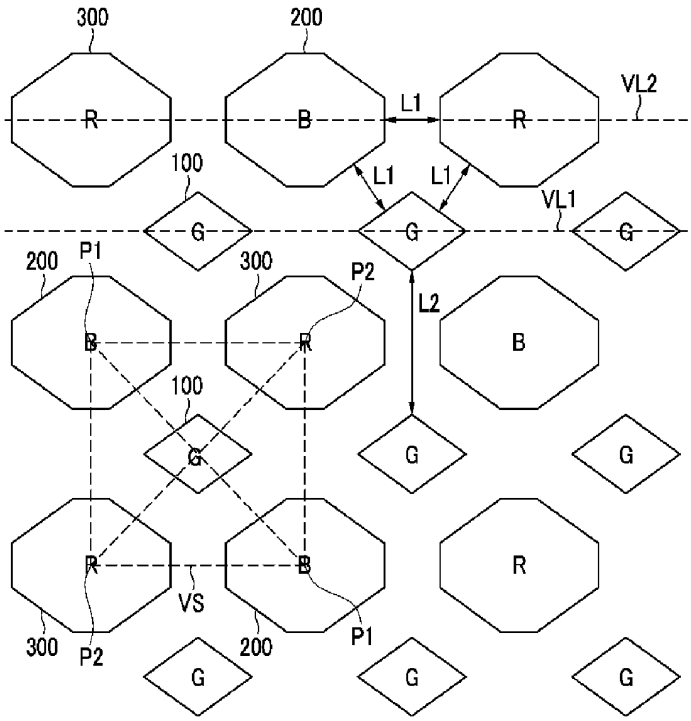
도 1



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【도면】

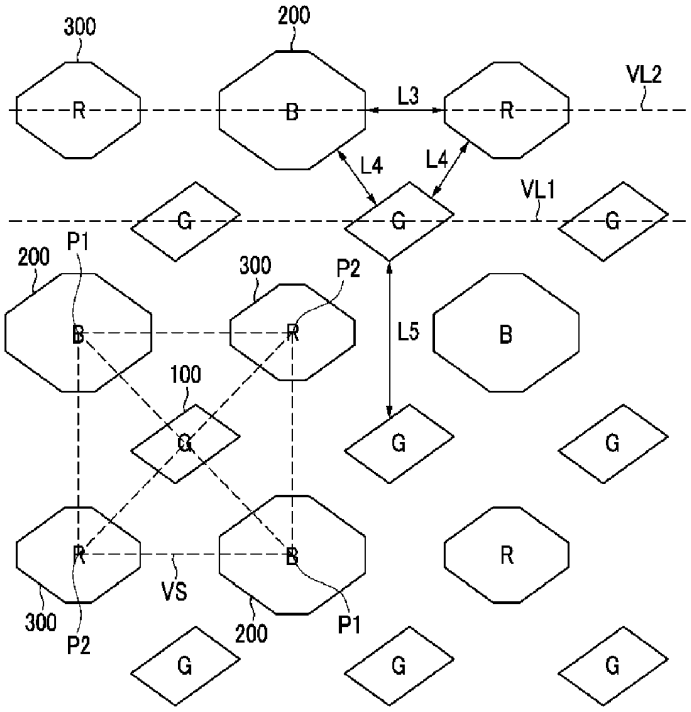
【도 1】






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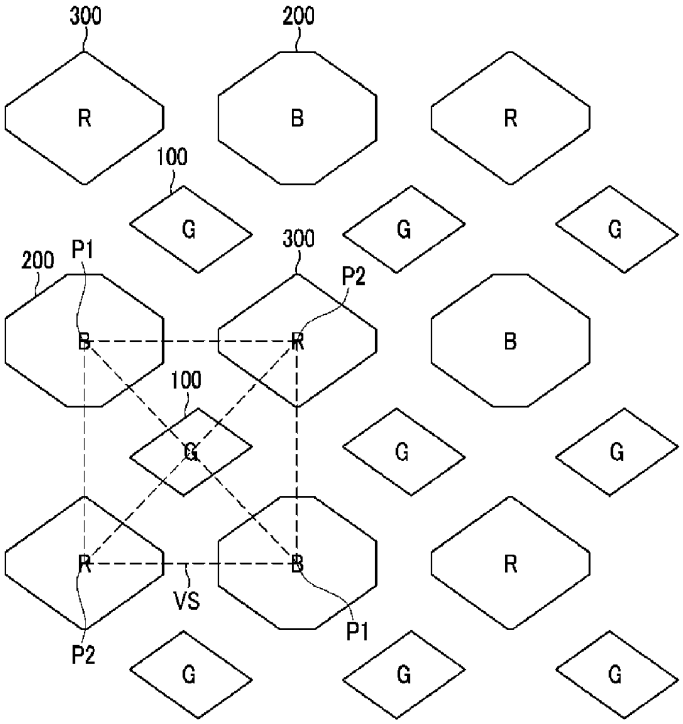
【도 2】






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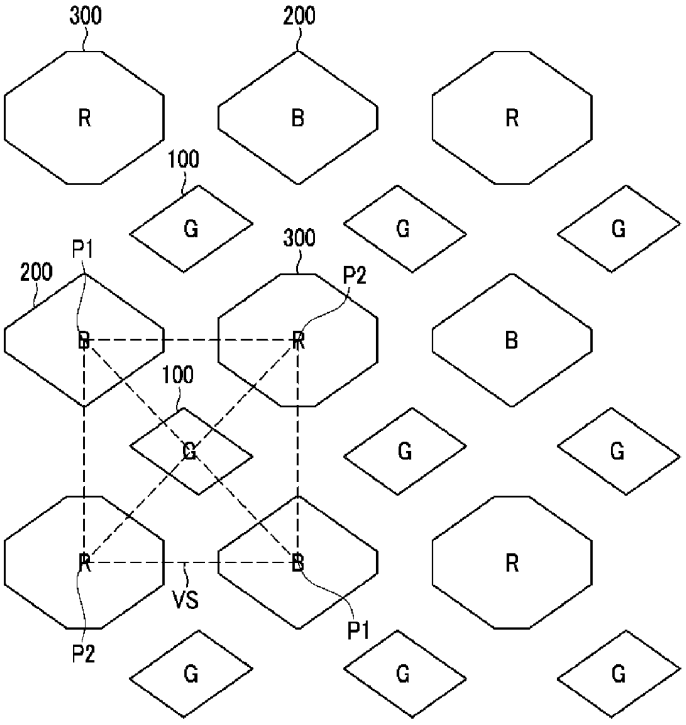
【도 3】






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【도 4】






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PO BOX 29001
Glendale, CA 91209-9001

**PUBLICATION NOTICE**

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**Title:**PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

**Publication No.**US-2013-0234917-A1
**Publication Date:**09/12/2013

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| FORM PTO/SB/08A/B (10-01)<br>Substitute for PTO-1449A/B<br><br>**INFORMATION DISCLOSURE**<br><br>**STATEMENT BY APPLICANT**<br><br>(use as many sheets as necessary) | | |
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| | **Attorney Docket Number** | 69657/S1437 |
| | **Application Number** | 13/614,197 |
| | **Filing Date** | September 13, 2012 |
| | **Inventor(s)** | Sang-Shin Lee |
| | **Group Art Unit** | 2691 |
| | **Examiner Name** | Amr A. Awad |

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| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER<br>Number - Kind Code[2] (If Known) | PUBLICATION DATE<br>MM-DD-YYYY | NAME OF PATENTEE |
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| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document<br>Country Code[3] - Number[4] - Kind Code[5]<br>(If Known) | Publication Date<br>MM-DD-YYYY | Name of Patentee or<br>Applicant of Cited Document | T[6]<br>(✓) |
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| | | EPO Search Report dated July 8, 2013, for corresponding European Patent application 13157562.3, (6 pages) |
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BOE et al. v. Samsung, IPR2023-00988

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(51) INT CL:
***G09G 3/36*** (2006.01) ***G09F 9/302*** (2006.01)

(52) UK CL (Edition X ):
**G5C** CA342 CA350 CHE

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UK CL (Edition X ) **G5C**
INT CL **G02F, G09F, G09G**
Other: **ONLINE DATABASE: EPODOC, WPI**

(54) Abstract Title: **Optoelectronic display and method of manufacturing the same**

(57) An optoelectronic display comprising a plurality of pixels (2), each pixel comprising a plurality of sub-pixel (4,6,8) wherein the optoelectronic display comprises a colour-forming layer which is patterned providing a plurality of discrete colour-forming regions in a two-dimensional array, and wherein an addressing array is provided for addressing the discrete colour-forming regions, at least some of the discrete colour-forming regions having portions which are separately addressable by the addressing array, each portion defining a sub-pixel of the optoelectronic display.

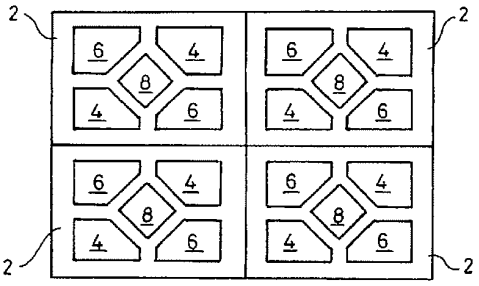



*Fig. 2*

GB 2 437 110 A

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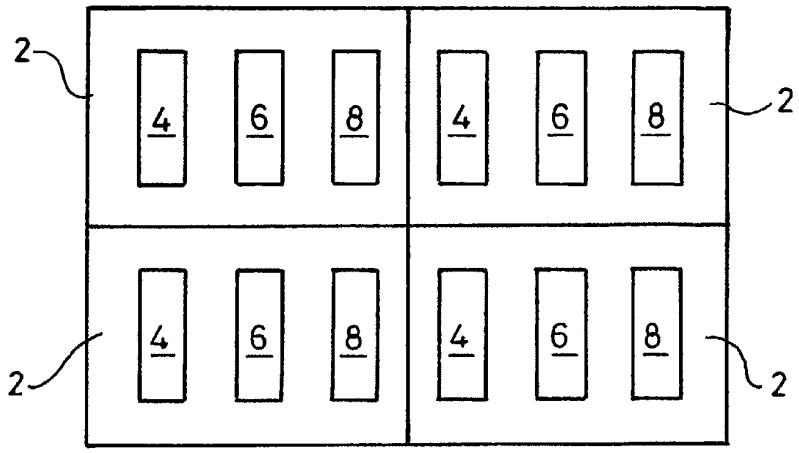



Fig. 1

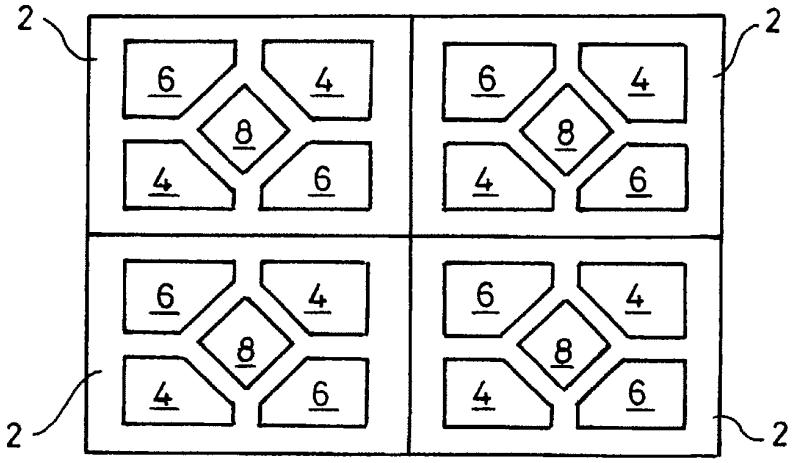



Fig. 2

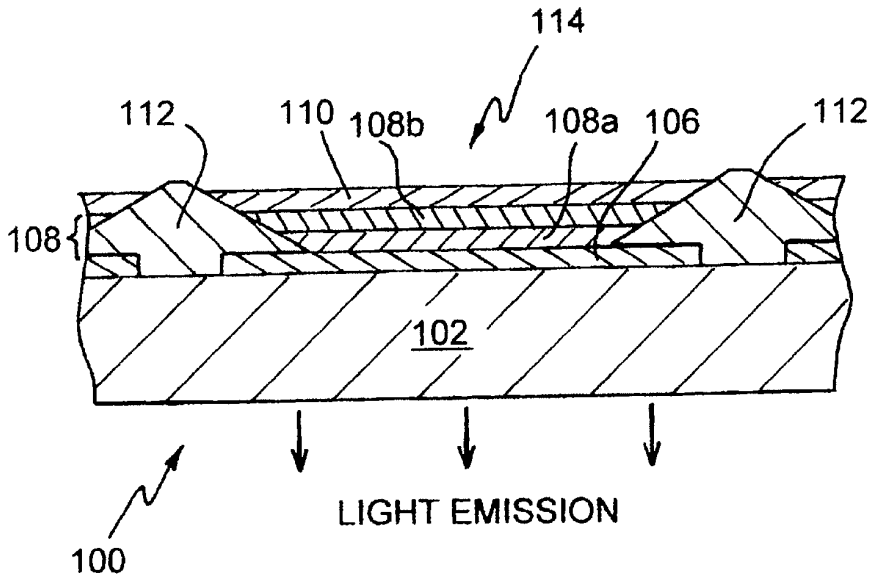

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Fig. 3

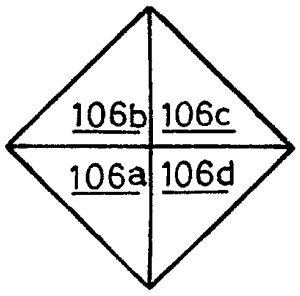

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Fig. 4

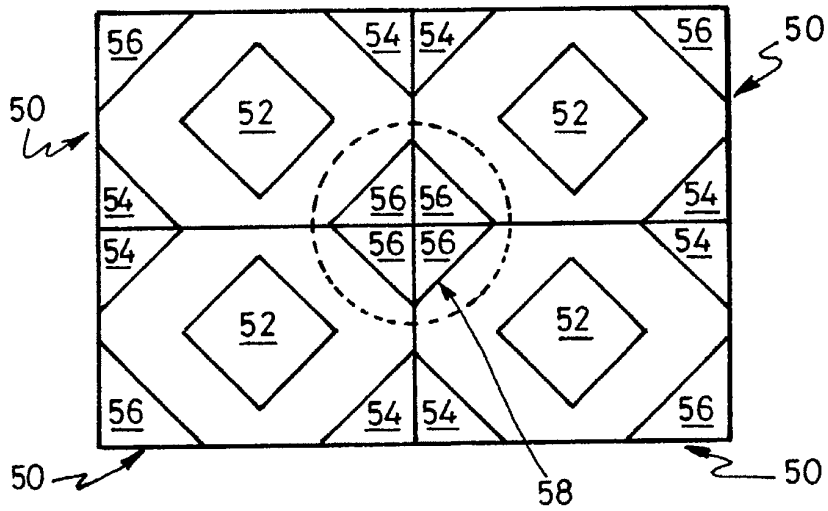

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Fig. 5

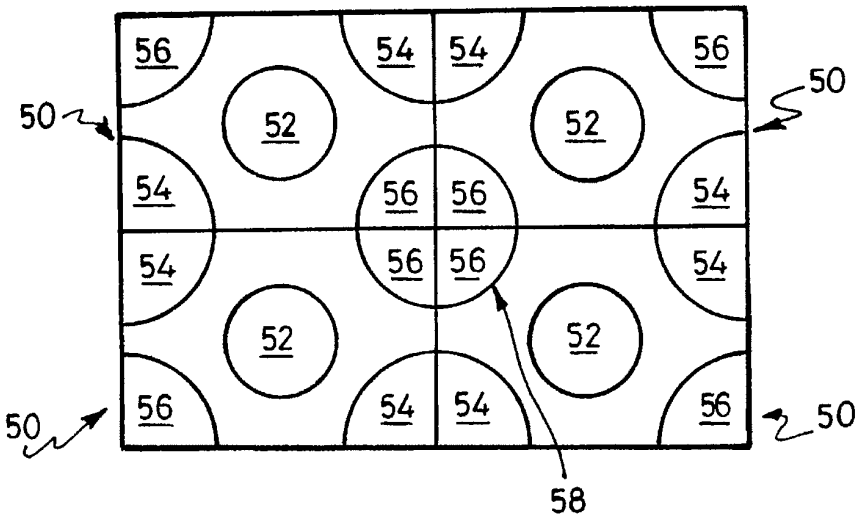

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Fig. 6

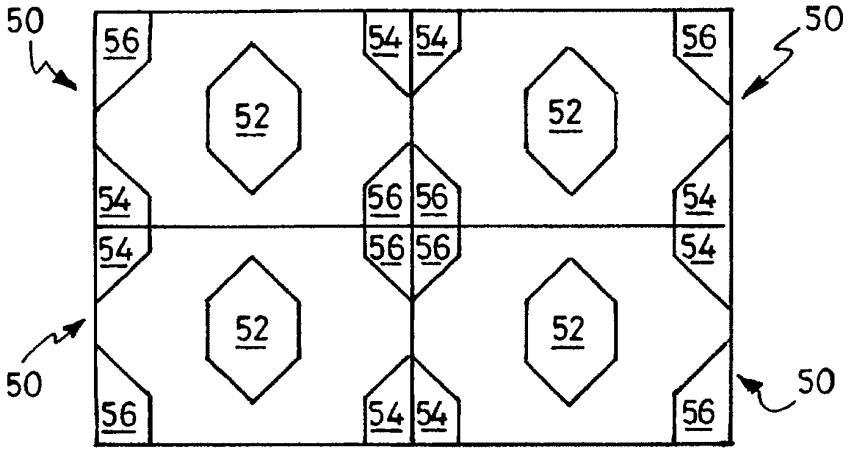

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Fig. 7

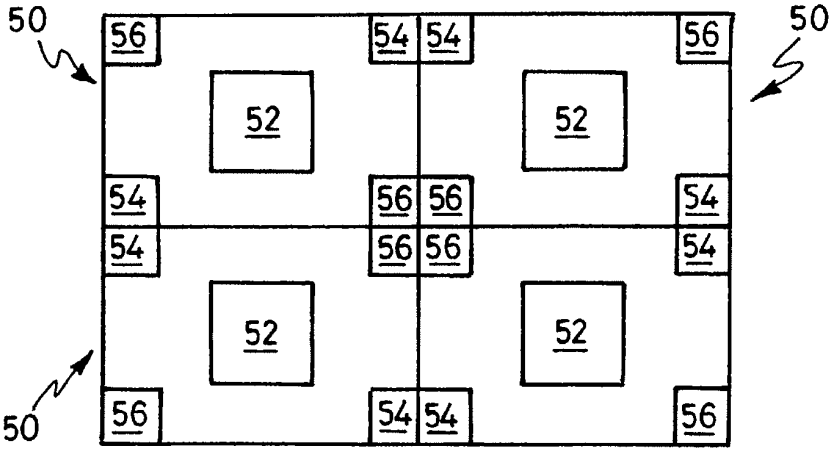

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Fig. 8

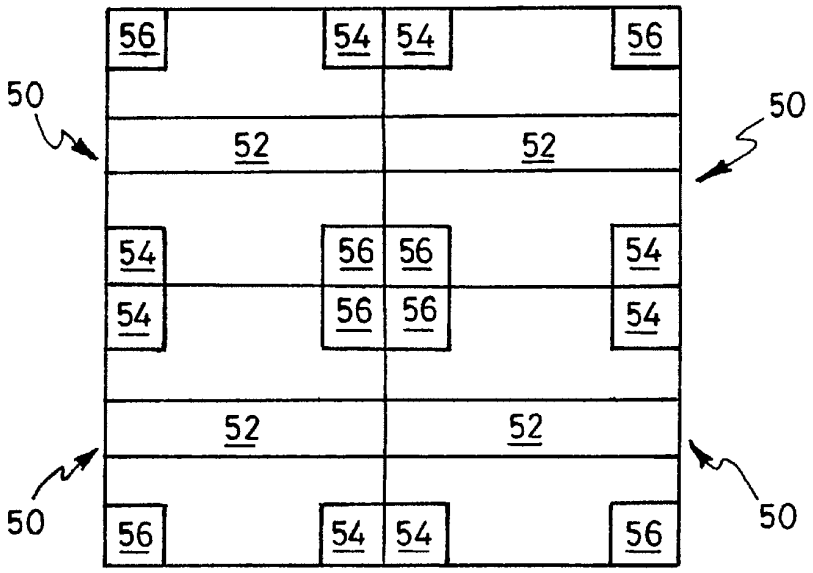

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Fig. 9

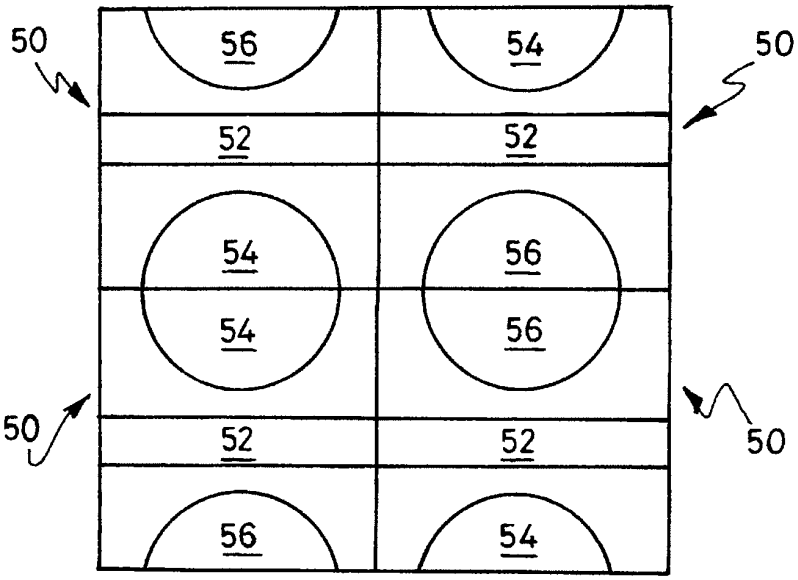

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Fig. 10

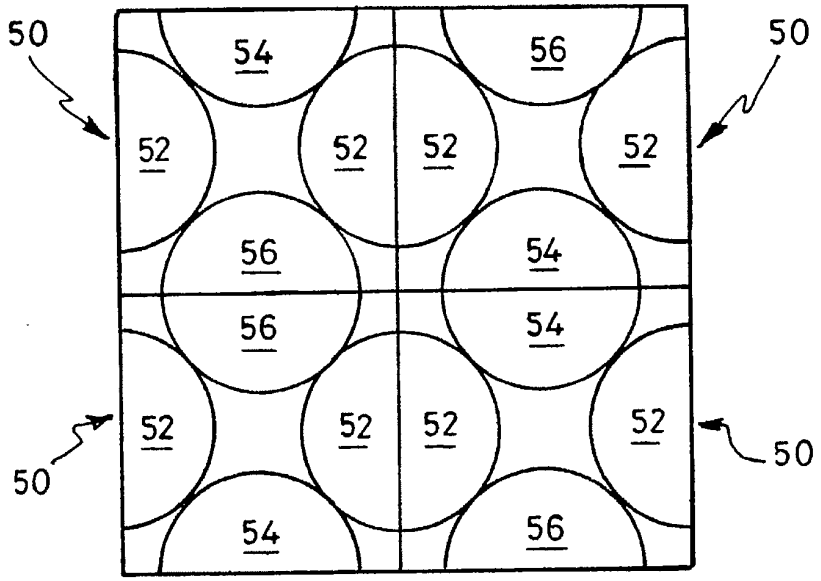

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Fig. 11

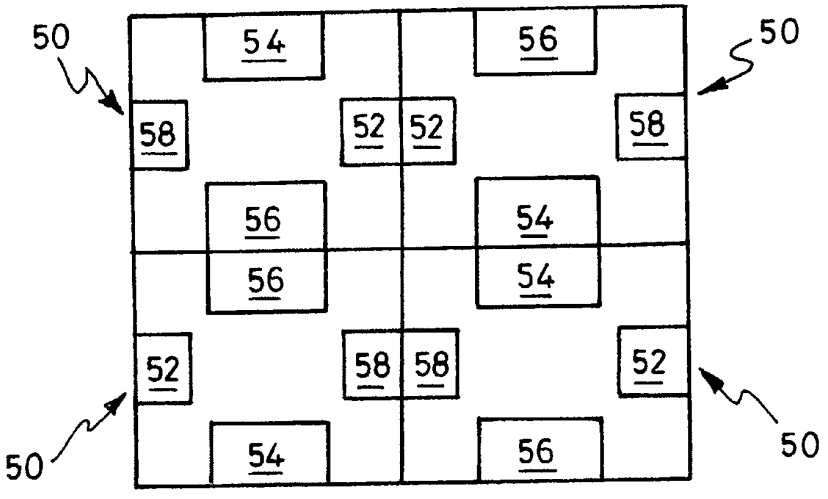

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Fig. 12

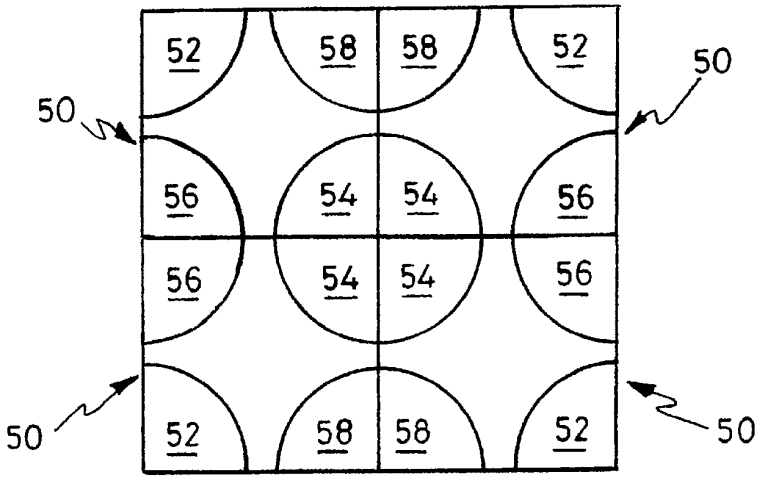



Fig. 13

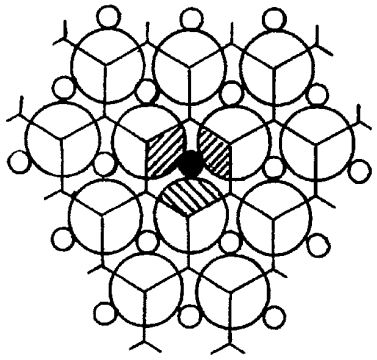


Fig. 14

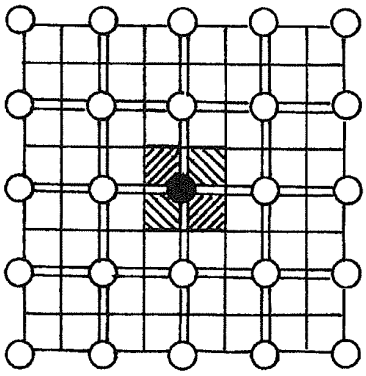


Fig. 15

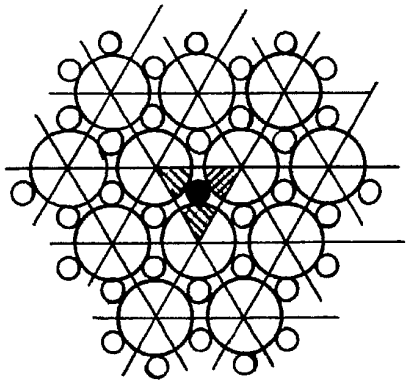


Fig. 16

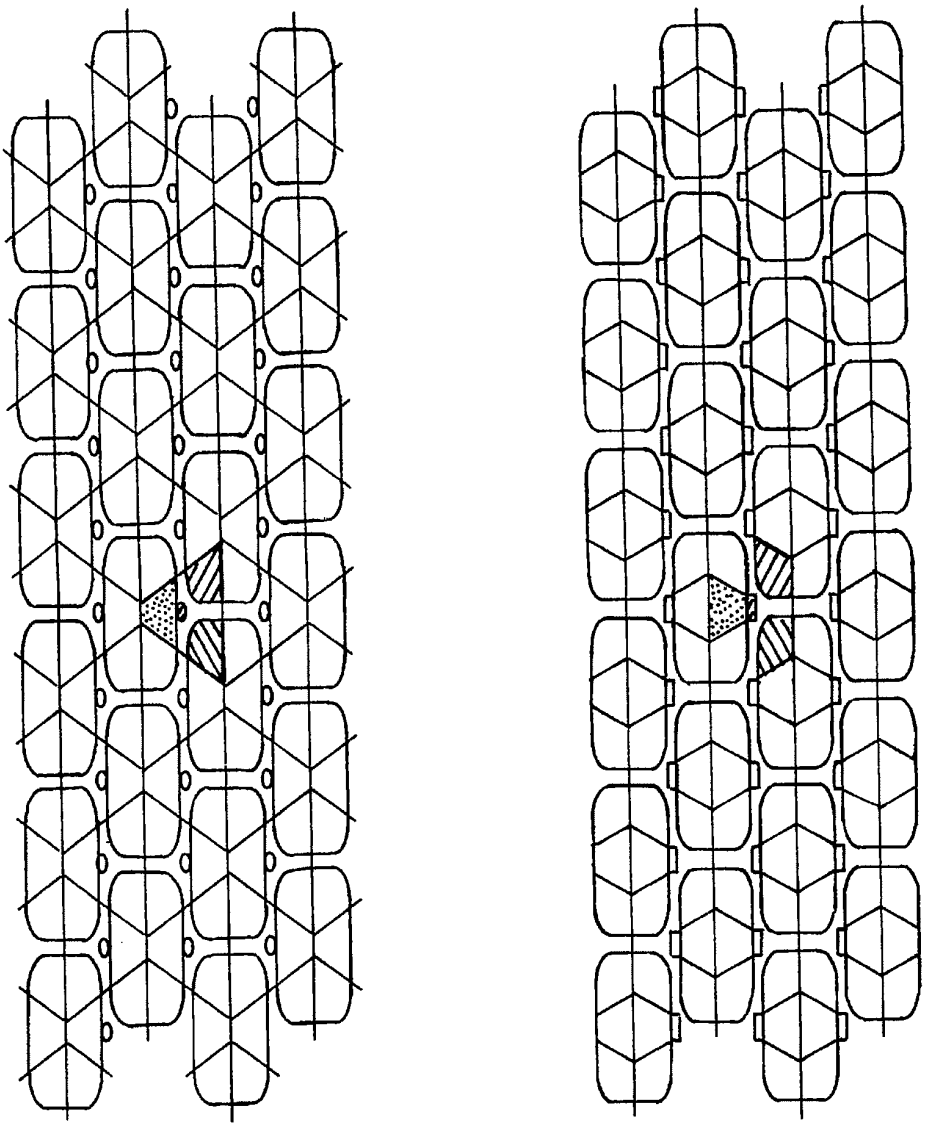


Fig. 17

# OPTOELECTRONIC DISPLAY AND METHOD OF MANUFACTURING THE SAME

**Field of Invention**

This invention relates to an optoelectronic display and a method of manufacturing the same.

**Background of Invention**

Various types of optoelectronic displays are known in the art. These include, for example, Liquid Crystal Displays (LCDs), ElectroLuminescent (EL) displays, and Plasma Displays (PDs).

Multicoloured displays typically comprise a plurality of pixels, each pixel comprising a plurality of sub-pixels. In a full colour display, red, green, and blue sub-pixels are provided. The sub-pixels are defined by a colour-forming layer. The colour-forming layer may be a light-emissive layer comprising a plurality of discrete light-emissive regions of different light-emissive material defining the sub-pixels. For example, an EL display has such a light-emissive layer disposed between electrodes which are patterned so as to be able to address the individual sub-pixels which correspond to the discrete light-emissive regions of the light-emissive layer.

Alternatively, the colour-forming layer may be a colour filter comprising a plurality of discrete regions of different colour defining the sub-pixels. For example, an LCD may have such a filter with a white backlight and a liquid crystal arrangement for addressing the individual sub-pixels that correspond to the discrete coloured regions of the filter.

Various different arrangements for the pixels and the sub-pixels of a light-emissive display have been proposed in the prior art. Figure 1 shows a standard pixel

arrangement in which each pixel 2 comprises a single red sub-pixel 4, a single green sub-pixel 6 and a single blue sub-pixel 8, all of which are the same size.

Improvements over the basic arrangement shown in Figure 1 have been suggested, such as the arrangements disclosed in US 2003/0117423, WO 03/060870 and 2004/0080479. These "checkerboard" arrangements are adapted to provide better visual performance when compared to the standard arrangement shown in Figure 1. An example is shown in Figure 2 of the present application, each pixel 2 comprising a central blue sub-pixel 8, with red sub-pixels 4 in one pair of diagonally opposing corners, and green sub-pixels 6 in the other pair of diagonally opposing corners. The sub-pixels are arranged so that around a junction between four adjacent pixels, the sub-pixels alternate between red and green.

A problem with the aforementioned arrangements is that it is difficult to provide an intricately patterned colour-forming layer. Furthermore, depending on the materials and the patterning techniques used, there will be a lower limit to the size of discrete colour-forming regions that can be reliably formed.

Embodiments of the present invention seek to solve the aforementioned problems in the prior art by providing a pixel/sub-pixel arrangement that is easier to manufacture and has good visual performance.

**Summary of the present invention**

According to a first aspect of the present invention there is provided an optoelectronic display comprising a plurality of pixels, each pixel comprising a plurality of sub-pixels, wherein the optoelectronic display comprises a colour-forming layer which is patterned providing a plurality of discrete colour-forming regions in a two-dimensional array, and wherein an addressing array is provided for addressing the discrete colour-forming regions, at least some of the discrete colour-forming regions having portions which are separately addressable by the addressing array, each portion defining a sub-pixel of the optoelectronic display.



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By two-dimensional array, we mean an array comprising a plurality of point-like discrete colour-forming regions. The point-like colour-forming regions may have various shapes including circular, oval, rectangular, square and hexagonal.

By "discrete colour forming region" we mean a continuous region of colour-forming material rather than a plurality of colour-forming regions. By continuous region, we mean continuous in the plane of the display. A discrete colour-forming region may comprise a number of layers, one on top of the other, in a direction perpendicular to the plane of the display. However, if such layers are continuous in the plane of the display then they would constitute a discrete colour-forming region.

The present invention solves the problems previously outlined with regard to the prior art "checkerboard" arrangements in that each sub-pixel does not have to be defined by a corresponding discrete colour-forming region. At least some of the discrete colour-forming regions provide a plurality of sub-pixels which are individually addressable by the addressing array. This simplifies the patterning process for the colour-forming layer while not significantly reducing visual performance of the display. Furthermore, an increase in resolution can be achieved with no change in the pattern of the colour-forming layer.

Preferably, each separately addressable portion defines a sub-pixel of a different pixel in the optoelectronic display. The discrete colour-forming regions may have any number of separately addressable portions. However, in preferred arrangements discrete colour forming regions have 2, 3, 4 or 6 separately addressable portions.

According to some embodiments of the present invention, the colour-forming layer is emissive. Alternatively, the colour-forming layer is a colour filter layer, a phosphor layer or a colour changing media such as a fluorescent dye. An example is an optoelectronic display which comprises: a substrate; a first electrode layer disposed over the substrate; a light-emissive layer disposed over the first electrode layer; and a second electrode layer disposed over the light-emissive layer. The light emissive layer constitutes the colour-forming layer which is patterned providing a plurality of discrete light-emissive regions in a two-dimensional array. The electrode layers constitute the addressing array with the first electrode layer and/or the second



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electrode layer comprising a plurality of electrodes, each electrode comprising at least two sub-electrodes drivably associated with each discrete light-emissive region.

The provision of at least two sub-electrodes associated with each discrete light-emissive region allows areas of the discrete light-emissive region to be differentially driven. Accordingly, a discrete light-emissive region can contribute to a plurality of different sub-pixels.

In a preferred embodiment the light-emissive layer is patterned by providing a bank structure disposed over the first electrode layer defining a plurality of wells, each well containing one of the discrete light-emissive regions, whereby at least two of the sub-electrodes are associated with each well.

Preferably, the first electrode layer comprises said plurality of electrodes with at least two of the sub-electrodes being associated with each discrete light-emissive region. Preferably, the first electrode is the anode. The anode may be any suitable material but is preferably ITO.

One class of optoelectronic displays is that using an organic material for light emission. The basic structure of these devices is a light emissive organic layer, for instance a film of a poly (p-phenylenevinylene) ("PPV") or polyfluorene, sandwiched between a cathode for injecting negative charge carriers (electrons) and an anode for injecting positive charge carriers (holes) into the organic layer. The electrons and holes combine in the organic layer generating photons. In WO90/13148 the organic light- emissive material is a polymer. In US 4,539,507 the organic light-emissive material is of the class known as small molecule materials, such as (8-hydroxyquinoline) aluminium ("Alq3"). In a practical device one of the electrodes is transparent, to allow the photons to escape the device.

A typical organic light-emissive display (OLED) is fabricated on a glass or plastic substrate coated with a transparent anode such as indium-tin-oxide ("ITO"). A layer of a thin film of at least one electroluminescent organic material covers the first electrode. Finally, a cathode covers the layer of electroluminescent organic material.



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The cathode is typically a metal or alloy and may comprise a single layer, such as aluminium, or a plurality of layers such as calcium and aluminium.

In operation, holes are injected into the device through the anode and electrons are injected into the device through the cathode. The holes and electrons combine in the organic electroluminescent layer to form excitons which then undergo radiative decay to give light (in light detecting devices this process essentially runs in reverse).

Organic light-emissive displays can provide a particularly advantageous form of electro-optic display. They are bright, colourful, fast-switching, provide a wide viewing angle and are easy and cheap to fabricate on a variety of substrates. Organic (which here includes organometallic) light-emissive displays may be fabricated using either polymers or small molecules in a range of colours (or in multi-coloured displays), depending upon the materials used.

Organic light-emissive displays may be deposited on a substrate in a matrix of pixels to form a single or multi-colour pixellated display. A multicoloured display may be constructed using groups of red, green, and blue emitting pixels. So-called active matrix displays have a memory element, typically a storage capacitor and a transistor, associated with each pixel whilst passive matrix displays have no such memory element and instead are repetitively scanned to give the impression of a steady image.

Preferably, a conductive polymer layer is disposed between the first electrode layer and the light-emissive layer. This layer may be any suitable material but is preferably PEDOT-PSS.

Preferably, at least one of the conductive polymer layer and the light-emissive layer is deposited by ink jet printing.

If the material of the sub-electrodes is of a low enough conductivity so as to make lateral conduction negligible, then no gap need be provided between the sub-electrodes. For example, sub-electrodes could be made of a thin layer of material in order to increase lateral resistance and reduce lateral conduction thus negating the requirement for a gap between the sub-electrodes. However, in this case, additional



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conductive connecting lines will usually be required, particularly for a passive matrix display, as otherwise the resistance across the display will generally be too high. This is not such a problem for active matrix displays in which each discrete light-emissive region will have its own driver.

For example, in passive matrix displays an ITO anode of typically 150nm thickness is used in standard devices. A thinner layer may be used in accordance with embodiments of the present invention in order to avoid lateral conduction between sub-electrodes, e.g. ½ or ¼ of this thickness. In this case, a more conductive connecting line may be provided. In active matrix displays, an ITO anode of this lower thickness can be utilized as the distance between the drivers and the pixels is small.

In embodiments of the present invention, the sub-electrodes are connected to a conductive connecting line via a resistive connection which may be provided by, for example, a thin portion of the electrode material. Providing a resistant connection between the common conductor line and the sub-electrodes gives a "soft" electrical connection so if there is a short the whole line of pixels in the display will not be lost.

Alternatively, a gap may be provided between the sub-electrodes. This gap may be filed with an insulating material in order to planarize the upper surface of the anode. Examples of suitable planarizing, insulating materials include dielectrics such as silicon dioxide or a photoresist. It is advantageous for the planarizing, insulating material to have similar wetting properties to the material of the sub-electrodes for the material deposited thereover. Furthermore, it is advantageous to select a planarizing, insulating material which is not etched away when patterning the bank material. As an alternative to providing a planarizing, insulating material, the gap between sub-electrodes may be made sufficiently small that the material deposited thereover can span the gap. If the electrode layer is thin then there is less or no need to planarize the layer.

It is advantageous for the electrode layer to have a constant thickness in order to prevent non-uniformities in the overlying layers.



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In one arrangement, the electrode layer comprising the sub-electrodes comprises two layers, a patterned conductive contact layer defining the sub-electrodes with a uniform layer of charge injecting material thereover. For example, a patterned metal contact layer may be provided with a uniform layer of ITO deposited thereover. The charge injecting material must be of low enough conductance so as to prevent lateral conduction. This may be achieved, for example, by providing a relatively thin layer of ITO as the charge injecting layer.

The electrode layer may be patterned by standard photolithography. However, any patterning techniques can be used including, for example, laser ablation, e-beam ablation, dry etching, and wet etching. Furthermore, the patterning method need not be subtractive and direct writing techniques can be employed such as ink jet printing.

According to another aspect of the present invention there is provided a method of manufacturing a light-emissive display according to the first aspect of the invention, wherein the colour-forming layer is deposited by ink-jet printing.

Ink jet printing is particularly useful due to its scalability and adaptability. The former allows arbitrarily large sized substrates to be patterned and the latter should mean that there are negligible tooling costs associated with changing from one product to another since the image of dots printed on a substrate is defined by software.

However, there are some problems with ink jet printing. There is a limit to how small the individual sub-pixels can be made using ink jet printing. Furthermore, the ink does not wet into tight corners of complex well shapes. These problems can be alleviated by the present invention which allows a high resolution display to be produce without unduly increase the complexity of the sub-pixels or unduly decreasing their size. Primarily, embodiments of the present invention are useful for ink jet printed displays because of the problems involved in achieving flat films for large areas and difficulties in reliably printing very small areas. However, it is envisaged that embodiments of the present invention may also be useful when using other deposition techniques.



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If the colour-forming layer is deposited by vacuum deposition of small molecules then a shadow mask is typically used to provide the required resolution. A limit exists in the resolution of the shadow mask and therefore embodiments of the present invention can provide a higher resolution display without unduly increasing the complexity of the sub-pixels or unduly decreasing their size.

**Brief Summary of the Drawings**

Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows a standard sub-pixel arrangement of a full colour light-emissive display;

Figure 2 shows an improved prior art sub-pixel arrangement of a full colour light-emissive display;

Figure 3 shows a vertical cross section through an example of an OLED device;

Figure 4 shows a plan view of an electrode comprising four sub-electrodes in accordance with an embodiment of the present invention;

Figure 5 shows a sub-pixel arrangement according to an embodiment of the present invention.

Figure 6 shows a sub-pixel arrangement according to another embodiment of the present invention;

Figure 7 shows a sub-pixel arrangement according to another embodiment of the present invention;

Figure 8 shows a sub-pixel arrangement according to another embodiment of the present invention;



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Figure 9 shows a sub-pixel arrangement according to another embodiment of the present invention;

Figure 10 shows a sub-pixel arrangement according to another embodiment of the present invention;

Figure 11 shows a sub-pixel arrangement according to another embodiment of the present invention;

Figure 12 shows a sub-pixel arrangement according to another embodiment of the present invention;

Figure 13 shows a sub-pixel arrangement according to another embodiment of the present invention;

Figure 14 shows an arrangement in which the pixels are hexagonal;

Figure 15 shows an arrangement in which the pixels are square;

Figure 16 shows an arrangement in which the discrete light-emissive regions are circular and the pixels are triangular; and

Figure 17 shows two arrangements in which the discrete light-emissive regions are substantially rectangular and the pixels are substantially triangular.

**Detailed Description of Preferred Embodiments**

Figure 3 shows a vertical cross section through an example of an OLED device 100. The structure of the device is somewhat simplified for the purposes of illustration.

The OLED 100 comprises a substrate 102, typically 0.7 mm or 1.1 mm glass but optionally clear plastic, on which an anode layer 106 is deposited comprising four separately drivable sub-anodes (shown in Figure 4). The anode layer typically comprises around 150 nm thickness of ITO (indium tin oxide), over which is provided



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a metal contact layer, typically around 500nm of aluminium, sometimes referred to as anode metal. Glass substrates coated with ITO and contact metal may be purchased from Corning, USA. The contact metal (and optionally the ITO) is patterned as desired so that it does not obscure the display, by a conventional process of photolithography followed by etching.

A substantially transparent hole conducting layer 108a is provided over the anode metal, followed by an electroluminescent layer 108b. Banks 112 may be formed on the substrate, for example from positive or negative photoresist material, to define wells 114 into which these active organic layers may be selectively deposited, for example by a droplet deposition or inkjet printing technique. The wells thus define light emitting areas or pixels of the display.

A cathode layer 110 is then applied by, say, physical vapour deposition. The cathode layer typically comprises a low work function metal such as calcium or barium covered with a thicker, capping layer of aluminium and optionally including an additional layer immediately adjacent the electroluminescent layer, such as a layer of lithium fluoride, for improved electron energy level matching. Mutual electrical isolation of cathode lines may achieved through the use of cathode separators. Typically a number of displays are fabricated on a single substrate and at the end of the fabrication process the substrate is scribed, and the displays separated. An encapsulant such as a glass sheet or a metal can is utilized to inhibit oxidation and moisture ingress.

Organic LEDs of this general type may be fabricated using a range of materials including polymers, dendrimers, and so-called small molecules, to emit over a range of wavelengths at varying drive voltages and efficiencies. Examples of polymer-based OLED materials are described in WO90/13148, WO95/06400 and WO99/48160; examples of dendrimer-based materials are described in WO 99/21935 and WO 02/067343; and examples of small molecule OLED materials are described in US 4,539,507. The aforementioned polymers, dendrimers and small molecules emit light by radiative decay of singlet excitons (fluorescence). However, up to 75% of excitons are triplet excitons which normally undergo non-radiative decay. Electroluminescence by radiative decay of triplet excitons (phosphorescence) is



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disclosed in, for example, "Very high-efficiency green organic light-emitting devices based on electrophosphorescence" M.A. Baldo, S. Lamansky, P.E. Burrows, M.E. Thompson, and S.R. Forrest *Applied Physics Letters*, Vol. 75(1) pp.4-6, July 5, 1999". In the case of a polymer-based OLED, layers 108 comprise a hole conducting layer 108a and a light emitting polymer (LEP) electroluminescent layer 108b. The electroluminescent layer may comprise, for example, around 70nm (dry) thickness of PPV (poly(p-phenylenevinylene)) and the hole conducting layer, which helps match the hole energy levels of the anode layer and of the electroluminescent layer, may comprise a conductive organic material, for example, around 50-200 nm, preferably around 150 nm (dry) thickness of PEDOT:PSS (polystyrene-sulphonate-doped polyethylene-dioxythiophene).

Figure 4 shows a plan view of the anode 106 comprising four sub-anodes 106a, 106b, 106c, 106d in accordance with an embodiment of the present invention.

Figure 5 shows a sub-pixel arrangement according to an embodiment of the present invention which utilizes electrodes of the type shown in figure 4. Each pixel 50, comprises a central blue sub-pixel 52, with red sub-pixels 54 in one pair of diagonally opposing corners, and green sub-pixels 56 in the other pair of diagonally opposing corners as in the prior art arrangement shown in Figure 2. However, unlike the arrangement in Figure 2, the sub-pixels at a junction between four adjacent pixels are the same colour and are formed by a single discrete colour-forming region 58. The discrete colour-forming region 58 has four separately addressable portions, each portion contributing a sub-pixel to one of the four pixels shown. The portions are separately addressable by utilizing an electrode of the type shown in Figure 4 having four sub-electrodes.

Such an arrangement simplifies the prior art arrangement shown in Figure 2. Less discrete colour-forming regions are required and the discrete colour-forming regions can be made larger and less complex in shape while still providing a display having excellent visual characteristics.

Other arrangements which utilize the present invention are also envisaged. For example, the relative sizes and shape of the discrete colour-forming regions can be



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varied. For organic light-emissive materials it is often the case that the lifetime of the blue emissive material is the limiting factor on the lifetime of the device. In this case, it is advantageous to provide blue colour-forming regions that have a larger area than the red and green colour-forming regions. By providing the blue colour-forming regions with a larger area, they can be driven at a lower voltage thus increasing the lifetime of the blue colour-forming material in the device. It is to be understood that any of the blue, green and/or red colour-forming regions may have different sizes according to the performance characteristics of the materials and the desired performance characteristics of the display.

Figure 6 shows a similar arrangement to that of Figure 5 which utilizes round discrete colour-forming regions rather than square. This arrangement may have a lower aperture ratio than that of Figure 5 but it is advantageous in that the round colour forming regions are more readily ink jet printed. The discrete colour-forming region 58 has four portions which are separately addressable by utilizing an electrode similar to that shown in Figure 4 but circular in shape having four segments.

Figure 7 shows a similar arrangement to that of Figure 5 which utilizes hexagonal discrete colour-forming regions rather than square. This arrangement provides a good aperture ratio while having corners that have a greater angle than in the square arrangement such that ink can readily wet the whole of each discrete colour-forming region.

Figure 8 shows a similar arrangement to that of Figure 5 but with the square discrete colour-forming regions in a slightly different orientation.

Figure 9 shows a similar arrangement to that of Figure 5 but with the central sub-pixels of adjacent pixels being merged into a continuous strip.

Figure 10 shows an arrangement similar to that of Figure 9 but with circular discrete-colour forming regions disposed between the continuous strips, the circular regions having two portions which are individually addressable by utilizing an electrode similar to that shown in Figure 4 but circular in shape having two segments.



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Figure 11 shows an arrangement in which all the discrete colour-forming regions comprise two portions that are individually addressable.

Figure 12 shows an arrangement which further comprises white colour-forming regions 58.

Figure 13 shows a similar arrangement to that illustrated in Figure 11 but further including white colour-forming regions 58.

The previously illustrated arrangements comprise square pixels. However, the present invention is not so limited. The pixels may, for example, have a hexagonal, square or triangular shape as shown in Figures 14 to 16.

Figure 17 shows two further arrangements in which the discrete light-emissive regions are substantially rectangular or square and the pixels are substantially triangular. These arrangements may have the most pixels per discrete light-emissive region for a "square-tile" type arrangement. The top layout is optimised for a smooth macro-pixel outline. However, in this arrangement the centroids of the macro-pixels do not lie exactly on the square tile points of the square-tile arrangement. The bottom layout does not have a smooth macro-pixel outline. However, in this arrangement the centroids of the macro-pixels lie on the square tile points. Other considerations include the area of ink lost to drying effects, and in this case the top layout is more immune to these effects as each sub-pixel has approximately the same proportion of well edge and well centre area.

It is to be noted that by providing an addressing array that can separately address a number of portions of the colour-forming regions, the resolution of the display is increased without changing the pattern of the colour-forming layer. For example, in the arrangements illustrated in Figures 14 to 16, the resolution has been increased by a factor of 3, 4 and 6 respectively with no change in the pattern of the colour-forming layer when compared with analogous arrangements in which the discrete colour-forming regions do not comprise individually addressable portions.



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The arrangements provide enhanced resolution and may be most effective where pixel sizes are on the edge of the eye's spatial resolution. In particular, blocks of primary colours on a screen may appear dithered as, in effect, with this technique there are clusters of one sub-pixel colour rather than an even distribution. However the resolution of the eye to luminance variation is twice that of its red-green colour resolution, which is itself twice the blue-yellow colour resolution. Thus, for very fine resolutions where the macro-pixel spacing is equal to the eye's ability to resolve neighbouring pixels, this clustering will not be evident.

This technique could also be utilized to achieve the increased resolution required for 3D displays without requiring smaller ink-wells. For 3-D displays, where different macro-pixels are projected in different directions to produce multiple views, it could be arranged such that only similar sub-pixel groupings are projected in any given direction thus removing the visual effect of sub-pixels clustering.

Although preferred embodiments of the present invention have been described with reference to an organic light-emissive display, it is to be understood that other types of display such as LCDs and Plasma Displays, as well as other EL displays such as inorganic EL displays, can utilize the present invention.



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**Claims**

1. An optoelectronic display comprising a plurality of pixels, each pixel comprising a plurality of sub-pixels, wherein the optoelectronic display comprises a colour-forming layer which is patterned providing a plurality of discrete colour-forming regions in a two-dimensional array, and wherein an addressing array is provided for addressing the discrete colour-forming regions, at least some of the discrete colour-forming regions having portions which are separately addressable by the addressing array, each portion defining a sub-pixel of the optoelectronic display.

2. A display according to claim 1, wherein each separately addressable portion defines a sub-pixel of a different pixel in the optoelectronic display.

3. A display according to claim 1 or 2, wherein the discrete colour-forming regions comprise 2, 3, 4 or 6 separately addressable portions.

4. A display according to any preceding claim, wherein the pixels are square, rectangular, triangular or hexagonal in shape.

5. A display according to any preceding claim, wherein the discrete colour-forming regions are one or more of square, rectangular, circular, oval, and hexagonal in shape.

6. A display according any preceding claim, wherein the optoelectronic display is a multicolour display.

7. A display according to any preceding claim, wherein the colour-forming layer is a light-emissive layer.

8. A display according to claim 7, the optoelectronic display comprising: a substrate; a first electrode layer disposed over the substrate; the light-emissive layer disposed over the first electrode layer; and a second electrode layer disposed over the



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light-emissive layer, the light emissive layer being patterned to provide a plurality of discrete light-emissive regions in a two-dimensional array, the first electrode layer and/or the second electrode layer comprising a plurality of electrodes, each electrode comprising at least two sub-electrodes associated with each discrete light-emissive region.

9. A display according to claim 8, wherein the optoelectronic display further comprises drive circuitry capable of driving each sub-electrode at a different voltage.

10. A display according to claim 9, wherein the display is an active matrix display, each sub-pixel having an active switching component associated therewith in order to provide different drive voltages to each sub-electrode.

11. A display according to any one of claims 8 to 10, wherein a gap is provided between said sub-electrodes for preventing lateral conduction between the sub-electrodes.

12. A display according to claim 11, wherein said gap is filled with an insulating material in order to planarize an upper surface of the electrodes.

13. A display according to claim 12, wherein said insulating material is an inorganic dielectric material or an organic photoresist material.

14. A display according to any one of claims 8 to 13, wherein said sub-electrodes comprise a patterned layer of conductive material and an unpatterned layer of conductive material, said unpatterned layer being less conductive than said patterned layer for preventing lateral conduction between the sub-electrodes.

15. A display according to claim 14, wherein the patterned layer comprises a patterned conductive contact layer defining the sub-electrodes and the unpatterned layer comprises a uniform layer of charge injecting material.

16. A display according to any one of claims 8 to 15, wherein the light-emissive layer is patterned by providing a bank structure disposed over the first electrode layer



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defining a plurality of wells, each well containing one of the discrete light-emissive regions, whereby at least two sub-electrodes are associated with each well.

17. A display according to any one of claims 8 to 16, wherein the first electrode layer comprises the sub-electrodes.

18. A display according to any one of claims 8 to 17, wherein the sub-electrodes are anodes.

19. A display according to any one of claims 8 to 18, wherein the light-emissive layer comprises an organic light-emissive material.

20. A display according to claim 19, wherein the light-emissive layer comprises a polymer light-emissive material.

21. A display according to any one of claims 8 to 20, wherein a conductive polymer layer is disposed between one of the electrode layers and the light-emissive layer.

22. A method of manufacturing an optoelectronic display according to any preceding claim, wherein the colour-forming layer is deposited from solution.

23. A method according to claim 22, wherein the colour-forming layer is deposited by ink-jet printing or spin coating.

24. A method according to claim 22 or 23, the method comprising: providing a substrate; depositing a first electrode layer over the substrate; depositing a light-emissive layer as the colour-forming layer over the first electrode layer; and depositing a second electrode layer over the light-emissive layer, wherein the light-emissive layer is patterned providing a two-dimensional array of discrete light-emissive regions, and wherein the first electrode layer and/or the second electrode layer comprises a plurality of electrodes, each electrode comprising at least two sub-electrodes associated with each discrete light-emissive region.



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25. A method according to claim 24, wherein the light-emissive layer is patterned by depositing a bank structure disposed over the first electrode layer defining a plurality of wells prior to depositing the light-emissive layer, the light-emissive layer being subsequently deposited such that each well contains one of the discrete light-emissive regions, whereby at least two sub-electrodes are associated with each well.

26. A method according to claim 24 or 25, wherein the sub-electrodes are patterned by laser ablation, e-beam ablation, dry etching, wet etching, or direct writing.



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For Innovation

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|---|---|---|---|
| **Application No:** | GB0607369.6 | **Examiner:** | Helen Edwards |
| **Claims searched:** | All | **Date of search:** | 25 July 2006 |

## Patents Act 1977: Search Report under Section 17

**Documents considered to be relevant:**

| Category | Relevant to claims | Identity of document and passage or figure of particular relevance |
|---|---|---|
| X | 1, 3, 4, 5, 6 | US5899550 A (CANNON KABUSHIKI KAISHA) See figures and column 3 line 60 to column 4 line 35. |
| X | 1, 3, 4, 5, 6 | EP0671648 A2 (CANNON INFORMATION SYSTEMS RESEARCH) See figures and page 5 line 44 to page 6 line 40 |

Categories:

| | | | |
|---|---|---|---|
| X | Document indicating lack of novelty or inventive step | A | Document indicating technological background and/or state of the art |
| Y | Document indicating lack of inventive step if combined with one or more other documents of same category | P | Document published on or after the declared priority date but before the filing date of this invention |
| & | Member of the same patent family | E | Patent document published on or after, but with priority date earlier than, the filing date of this application |

**Field of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC$^{X}$ :

G5C

Worldwide search of patent documents classified in the following areas of the IPC

G02F; G09F; G09G

The following online and other databases have been used in the preparation of this search report

EPODOC, WPI



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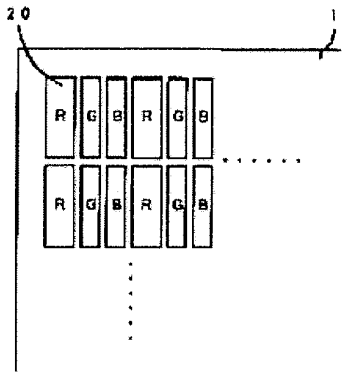
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## (54) ORGANIC ELECTROLUMINESCENT DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To form a light emitting layer having excellent color balance while equalizing durability of each color by including a light emitting area having a different area in plural light emitting areas formed on a board.
SOLUTION: In the case where a pitch of one picture element in the simple matrix stripe arrangement on a board 1 is 300 m and a gap between each light emitting area 20 is 30 μm, for example, width of a red light emitting area 20 is set at 90 μm, and width of a green light emitting area and a blue light emitting area are set at 60 μm so that the R light emitting area 20 becomes 1.5 times of the G and B light emitting areas 20. Current density equal to each other can be obtained by forming the R light emitting area 20 at 1.5 times of the G and the B light emitting areas 20, and since an occupation factor of one light emitting area is large, practical light emitting intensity is improved. Durability (lifetime) of the R light emission is thereby improved. Area of each light emitting area 20 can be adjusted for setting on the basis of the durability of the light emitting material to be used.






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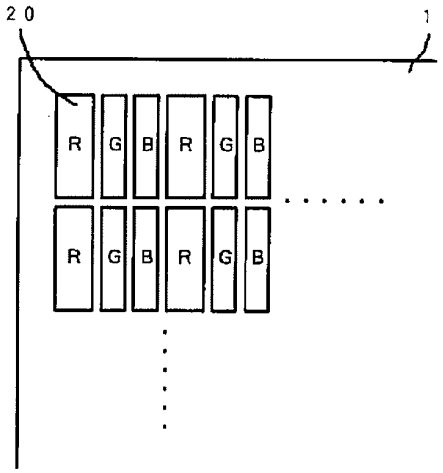
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(54)【発明の名称】　有機電界発光装置

(57)【要約】
【課題】カラーディスプレイの形成において、発光層材料の特性を考慮して、各色の耐久性を同等にし、色バランスに優れた発光層構成を有する有機電界発光装置を提供する。
【解決手段】基板上に形成された第一電極と、前記第一電極上に形成された少なくとも有機化合物からなる発光層を含む薄膜層と、前記薄膜層上に形成された第二電極とを含み、前記基板上に複数の発光領域が形成された有機電界発光装置であって、異なる面積もしくは異なる形状を有する発光領域が存在する。

図1




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【特許請求の範囲】

【請求項１】基板上に形成された第一電極と、前記第一電極上に形成された少なくとも有機化合物からなる発光層を含む薄膜層と、前記薄膜層上に形成された第二電極とを含み、前記基板上に複数の発光領域が形成された有機電界発光装置であって、異なる面積を有する発光領域が存在することを特徴とする有機電界発光装置。

【請求項２】パターニングされた発光層に対応して複数の色で発光する発光領域が存在し、少なくとも１つの色の発光領域の面積が他の色の発光領域の面積と異なることを特徴とする請求項１記載の有機電界発光装置。

【請求項３】パターニングされた発光層に対応して赤、緑、青の３色に発光する発光領域が存在し、赤色の発光領域の面積が緑色もしくは青色の発光領域の面積より大きいことを特徴とする請求項１記載の有機電界発光装置。

【請求項４】互いに交差する複数の第一電極と第二電極との交点に発光領域が存在することを特徴とする請求項１記載の有機電界発光装置。

【請求項５】異なる面積を有する発光領域がマトリクス状に配列されていることを特徴とする請求項１記載の有機電界発光装置。

【請求項６】１つの画素が、同色で発光し、かつ、互いに異なる面積を有する複数の発光領域を含むことを特徴とする請求項１記載の有機電界発光装置。

【請求項７】同色で発光し、かつ、互いに異なる面積を有する複数の発光領域の発光状態を制御することで、階調制御を行うことを特徴とする請求項６記載の有機電界発光装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、表示装置、フラットパネルディスプレイ、バックライト、照明、インテリア、標識、看板、電子写真機などの分野に利用可能な、電気エネルギーを光に変換できる有機電界発光装置に関する。

【０００２】

【従来の技術】陰極から注入された電子と陽極から注入された正孔とが、両極に挟まれた有機蛍光体内で再結合して発光するという有機電界発光装置の研究が近年活発に行われるようになってきた。この装置は、薄型、低駆動電圧下での高輝度発光、蛍光材料を選ぶことによる多色発光が特徴であり注目を集めている。

【０００３】有機電界発光装置が低電圧で高輝度に発光することは、イーストマン・コダック社のC.W.Tangらによって初めて示された(Appl.Phys.Lett.,51(12)913(1987).)。ここに示された有機電界発光装置の代表的な構成は、ＩＴＯ透明電極膜が形成されたガラス基板上に、蒸着法によって正孔輸送性のジアミン化合物、発光層である８－ヒドロキシキノリンアルミニウム、そして陰極としてＭｇ：Ａｇを順次設けたものであり、１０Ｖ程度の駆動電圧で１０００ｃｄ／$m^2$の緑色発光が可能であった。現在の有機電界発光装置は、上記の素子構成要素の他に電子輸送層を設けるなど構成を変えているものもあるが、基本的にはC.W.Tangらの構成を踏襲している。

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【０００４】高輝度および多色発光が可能であるこれらの有機電界発光装置を表示素子などに利用する検討も盛んである。フルカラーディスプレイの場合では、所定の位置に赤(Ｒ)、緑(Ｇ)、青(Ｂ)の発光領域を３つ並べて１つの画素を構成する方法が一般的に採用される。これを実現する手段として、色変換方式、カラーフィルター方式、ＲＧＢ独立画素方式などが提案されている。

【０００５】色変換方式では青色で発光するモノクロディスプレイの前方に青色光を吸収して別の色で発光する色変換層を設置することで、また、カラーフィルター方式では白色で発光するモノクロディスプレイの前方にカラーフィルターを設置することで、間接的にＲＧＢ発光を実現する。いずれの方式でも、見かけの発光色に関わらず、実際に発光を司る部分はモノクロの有機電界発光装置であり、そこでは１つの発光材料のみが用いられる。したがって、輝度低下速度が見かけの発光色に関わらず一定になるなどの長所があるが、最終的な発光効率が低下し、また、色変換層やカラーフィルターの形成が製造コストの増大を招くという問題があった。

【０００６】一方、ＲＧＢ独立画素方式では発光層をパターニングすることで直接的にＲＧＢ発光を実現する。有機電界発光装置がＲＧＢにそれぞれ独立した素子からなる発光領域を有するので、最終的な発光効率が最も高く、また、構造も簡単なので製造コストも安いという長所がある。

【０００７】しかしながら、用いられる発光層材料がＲ、Ｇ、Ｂそれぞれに同等の能力を有する成分が開発されているわけではない。現状ではＧの発光効率が高く、Ｒは低いことから、発光領域の面積を同じにした場合、Ｇでは電流密度が小さく、Ｒでは電流密度が大きくなる。従来の有機電界発光装置においては、Ｒ、Ｇ、Ｂの発光領域の面積は同一に設定されていたので、それぞれの発光領域において必要輝度に対する効率が異なると、効率の劣る発光領域に対してより高い電流密度で電流を流すことになり、電流密度に反比例する耐久性がより低下するという問題があった。

【０００８】さらに、Ｒ、Ｇ、Ｂ各発光領域の面積が同一であると、配線抵抗が同じなので必要輝度に対する効率の高い、例えばＧでは配線抵抗による電圧降下が小さく、効率の低い、例えばＲでは電圧降下が大きくなる。したがって、定電圧駆動回路では発光色によって電圧降下の値が異なり、輝度にばらつきが生じるという問題がある。また、定電流駆動回路では前期電圧降下を補償するために出力電圧のばらつきが大きくなり、駆動回路への負担が大きくなるという問題があった。

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【０００９】
【発明が解決しようとする課題】カラーディスプレイの形成において、発光層材料の特性を考慮して、各色の耐久性を同等にし、色バランスに優れた発光層構成を有する有機電界発光装置が求められる。
【００１０】
【課題を解決するための手段】本発明は、基板上に形成された第一電極と、前記第一電極上に形成された少なくとも有機化合物からなる発光層を含む薄膜層と、前記薄膜層上に形成された第二電極とを含み、前記基板上に複数の発光領域が形成された有機電界発光装置であって、異なる面積を有する発光領域が存在することを特徴とする有機電界発光装置である。
【００１１】
【発明の実施の形態】本発明における有機電界発光装置とは、陽極と陰極との間に少なくとも有機化合物からなる発光層が存在し、電気エネルギーにより発光する装置である。
【００１２】この有機電界発光装置における発光領域とは、好ましい一例として示すと、一定の間隔をあけて配置された複数のパターニングされた第一電極（陽極）と、一定の間隔をあけて配置された複数のパターニングされた第二電極（陰極）とが交差し、その重なる部分である。従って、発光層はマトリクス状に区分された領域である。
【００１３】本発明の第一の特徴は、複数の発光領域が形成された有機電界発光装置であって、異なる面積の発光領域が存在することである。すなわち、発光色が１つのモノクロ発光装置において、例えば発光領域の面積Ａの領域と面積Ｂの領域を配置した場合、面積Ａの領域を発光した場合と面積Ｂの領域を発光した場合、さらにこれら２つの領域を同時に発光した場合とで、発光強度が１、２、３の３つの階調をスイッチング動作のみで得ることが可能となり、モノクロではあるが階調表示が可能になり、情報量を増加することができる。このことはカラー発光装置にも適用可能であり、例えば１画素がそれぞれ２つずつのＲＧＢ発光領域からなり、それら同色の２つの発光領域の面積が異なる場合にも、上記モノクロ発光装置と同様に階調表示を容易に行うことが可能になる。さらに、色調変化も容易になる。このように、面積比の選択や面積の異なる発光領域設定数により種々の目的に適合した有機電界発光装置を作製することが可能になる。
【００１４】本発明の第二の特徴は、複数の色で発光する発光領域が存在し、ある色の発光領域の面積が他の色の発光領域の面積と異なることである。例えば２色の発光色を選択した場合、Ｘ色とＹ色がありそれぞれの必要輝度に対する発光効率が１．５：１の場合には、Ｘ色の発光領域の面積を１とし、Ｙ色の発光領域の面積を１．５として、それぞれの発光色の実効的な発光強度を同一レベルとして、色のバランスをとり、両者の耐久性を均等化させることで発光装置自身の耐久性を良好に保持することができる。また、２色同時発光状態での混合色をそれぞれの発光面積の大きさを調整して種々に設定することが可能になる。
【００１５】本発明の第三の特徴は、フルカラーディスプレイで用いられるＲ、Ｇ、Ｂの３色で発光する発光領域が存在する有機電界発光装置において、ある発光領域の面積が他の２つの発光領域の面積より大きいことである。例えば、Ｒの発光領域の面積が、ＧもしくはＢの発光領域の面積より大きい場合や、Ｇ発光領域の面積が最も小さい場合である。
【００１６】発光層に用いられる有機化合物として多くの物質が開発されているが、現実にはＧに発光する物質に比べてＢもしくはＲに発光する物質の必要輝度に対する効率が十分でないという課題がある。本発明の異なる面積の発光領域を有する有機電界発光装置の考え方に基づくならば、本発明の第三の特徴のようにＢもしくはＲの発光領域の面積をＧの発光領域の面積より大きくすることで、好ましくはＲの発光領域の面積をＧもしくはＢの発光領域の面積より大きくすることで、現実の課題を解決し、各色の発光強度のバランスを取ることが可能になる。例えば、ＧおよびＢの発光領域の面積を１とした場合、Ｒの発光領域の面積を２とすることで、各色発光強度の問題を改善し、ひいては有機電界発光装置の全体としての発光寿命を向上させることが可能になる。
【００１７】Ｒ、Ｇ、Ｂの発光領域の面積が同じであり、それぞれの必要輝度に対する効率がＲの場合のみ悪く、例えばそれを１／２と仮定した時、Ｒの領域にはＧおよびＢの領域の２倍の電流を流さなければならないので、Ｒの領域では電流密度が２倍になる。発光層の耐久性は、電流密度に反比例するので、Ｒの耐久性が悪くなる。これに対して、Ｒの必要輝度に対する効率がＧもしくはＢに対して、例えば１／２と仮定して、Ｒの発光領域の面積をＧ、Ｂの２倍とした場合には、Ｒの領域にＧ、Ｂより２倍の電流を流しても電流密度を同一することができる。Ｒ、Ｇ、Ｂ３色とも面積が同じ場合に比べてＲに掛かる電流密度は小さくなり、Ｇ、Ｂと同等となるので、各色の発光強度と耐久性のバランスが良くなってくる。
【００１８】すでに記述したように発光領域は第一電極と第二電極が交差してできる部分であり、マトリクス配置で得られるものであるが、本発明が好ましく適用できる単純マトリクス型の発光領域の配置は、図１に示すストライプ配列と図２に示すデルタ配列である。しかし、本発明の面積の異なる発光領域を設定する方法は、単純マトリクス型の場合だけでなく、アクティブマトリクス型やセグメント型においても有効である。
【００１９】単純マトリクス型ストライプ配列での１画素のピッチが３００μｍ、各発光領域間のギャップが３

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０μｍである場合、例えば、Ｒ発光領域の幅が９０μｍとし、ＧとＢは６０μｍであれば、Ｒの発光領域はＧとＢの発光領域の１．５倍となる。このようにＲの発光領域をＧとＢの発光領域の１．５倍とすることで、電流密度を同じになるようにし、１つの発光領域の占有率が大きいので実効的な発光強度が向上するため、Ｒの発光の耐久性（寿命）を改善することができるようになる。用いる発光材料の耐久性をもとにそれぞれの発光色に対する発光領域の面積を調整して設定することも可能である。カラーディスプレイにおいてはＲ、Ｇ、Ｂ３色の発光領域をセットとして１つの画素を構成するが、Ｒ、Ｇ、Ｂ３色の発光効率に対応した発光領域を設定することで全体としての発光強度を調整することができるので色バランスが向上し、鮮明な画像表示が可能となるメリットが得られる。

【００２０】それぞれの発光領域の面積は第一電極と第二電極の交差する重なりの大きさに相当するので、発光領域の面積の配分は電極のパターニングによって決められる。

【００２１】必要輝度に対する効率が低く、発光面積のより大きい発光領域には多くの電流が流れるので、電流密度を他の発光領域と同じにするために電極幅を大きくすることになる。このようにして電圧降下の値の各色によるばらつきを小さくすることができる。このために、駆動回路に要求される性能の範囲を小さくまとめることができ、駆動ＩＣのサイズの減少やコストの削減につながる。

【００２２】本発明では異なる形状の発光領域が存在してもよい。このような場合、形状の違いによる電極エッジ長さの相違や放熱速度の相違などを利用して、発光領域の耐久性のバランスを向上させることができる。また、各電極の実効的な抵抗値を変化させることも可能であるので、既に説明したように電極による電圧降下のばらつきを減少させることもできる。また、ドーナツ状の発光領域を同心円的に配置したり、三角形や六角形などの多角形の発光領域を形成したり、キャラクター的、記号的、図形的な意味をもつ形状の発光領域を形成するなどすれば、視覚的な表示効果を高める効果も期待できる。これらは、モノクロ、カラーに限定されず任意の形態の表示装置に適用可能である。

【００２３】発光層の形成は、電極のパターニングに合わせて行われる。製造工程上、先に形成されるパターニングされた第一電極（陽極）となる透明電極の上に、発光層が形成され、第一電極と交差して形成される第二電極がその上に形成されて発光領域となる。従って、単純マトリクス型のストライプ配列とデルタ配列は、電極のパターニングにより発光領域の面積が決められる。デルタ配列の場合にはガイド電極が設置されることが多い。

【００２４】第一電極として酸化錫インジュウム（ＩＴＯ）透明電極膜を形成したガラス基板を用い、通常、フォトリソグラフィ法で第一電極をパターニングすることができる。本発明の有機電界発光装置を得るためには、第一電極のパターニングに用いるフォトマスクの設計において、電極線幅に目的とする発光領域の面積の差に対応した差異をつけておくことが必要である。このような差異を第一電極のパターニングの際に付与するか、第二電極のパターニングの際に付与するかは、限定されるものではない。

【００２５】第一電極上には必要に応じてスペーサーを形成することができる。このスペーサーは第一電極のエッジを保護したり発光領域を規定するための絶縁層として機能させることができる。また、マスク蒸着法におけるマスク傷の防止や隔壁法による隔壁として機能させてもよいが、この場合にはスペーサーは薄膜層の厚さより高いことが好ましい。なお、これらのスペーサーを黒色化して光反射防止機能を付加することもできる。

【００２６】第一電極の上に形成される少なくとも有機化合物からなる発光層を含む薄膜層は、１）正孔輸送層／発光層、２）正孔輸送層／発光層／電子輸送層、３）発光層／電子輸送層、そして４）以上の組合せ物質を一層に混合した形態の発光層のいずれであってもよい。すなわち、素子構成として有機化合物からなる発光層が存在していれば、上記１）～３）の多層積層構造の他に４）のような発光材料単独または発光材料と正孔輸送材料や電子輸送材料を発光層を一層設けるだけでも良い。

【００２７】正孔輸送層は正孔輸送性物質単独で、あるいは正孔輸送性物質と高分子結着剤により形成される。正孔輸送性物質としては、Ｎ，Ｎ’－ジフェニル－Ｎ，Ｎ’－ジ（３－メチルフェニル）－１，１’－ジフェニル－４，４’－ジアミン（ＴＰＤ）やＮ，Ｎ’－ジフェニル－Ｎ，Ｎ’－ジナフチル－１，１’－ジフェニル－４，４’－ジアミン（ＮＰＤ）などに代表されるトリフェニルアミン類、Ｎ－イソプロピルカルバゾール、ビスカルバゾール誘導体、ピラゾリン誘導体、スチルベン系化合物、ヒドラゾン系化合物、オキサジアゾール誘導体やフタロシアニン誘導体に代表される複素環化合物、ポリマー系では前記単量体を側鎖に有するポリカーボネートやポリスチレン誘導体、ポリビニルカルバゾール、ポリシラン、ポリフェニレンビニレンなどが好ましいが、特に限定されるものではない。

【００２８】第一電極上にパターニングして形成される発光層の材料は、アントラセンやピレン、そして８－ヒドロキシキノリンアルミニウムの他には、例えば、ビススチリルアントラセン誘導体、テトラフェニルブタジエン誘導体、クマリン誘導体、オキサジアゾール誘導体、ジスチリルベンゼン誘導体、ピロロピリジン誘導体、ペリノン誘導体、シクロペンタジエン誘導体、チアジアゾロピリジン誘導体、ポリマー系では、ポリフェニレンビニレン誘導体、ポリパラフェニレン誘導体、そしてポリチオフェン誘導体などが使用できる。また、発光層に添

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加するドーパントとしては、ルブレン、キナクリドン誘導体、フェノキサゾン６６０、ＤＣＭ１、ペリノン、ペリレン、クマリン５４０、ジアザインダセン誘導体などがそのまま使用できる。

【００２９】電子輸送性物質としては、電界を与えられた電極間において陰極からの電子を効率よく輸送することが必要で、電子注入効率が高く、注入された電子を効率よく輸送することが望ましい。そのためには電子親和性が大きく、しかも電子移動度が大きく、さらに安定性に優れ、トラップとなる不純物が製造時および使用時に発生しにくい物質であることが要求される。このような条件を満たす物質として８－ヒドロキシキノリンアルミニウム、ヒドロキシベンゾキノリンベリリウム、２－（４－ビフェニル）－５－（４－ｔ－ブチルフェニル）－１，３，４－オキサジアゾール（ｔ－ＢｕＰＢＤ）などのオキサジアゾール系誘導体、薄膜安定性を向上させたオキサジアゾール二量体系誘導体の１，３－ビス（４－ｔ－ブチルフェニル－１，３，４－オキサジゾリル）ビフェニレン（ＯＸＤ－１）、１，３－ビス（４－ｔ－ブチルフェニル－１，３，４－オキサジゾリル）フェニレン（ＯＸＤ－７）、トリアゾール系誘導体、フェナントロリン系誘導体などがある。

【００３０】以上の正孔輸送層、発光層、電子輸送層に用いられる材料は単独で各層を形成することができるが、高分子結着剤としてポリ塩化ビニル、ポリカーボネート、ポリスチレン、ポリ（Ｎ－ビニルカルバゾール）、ポリメチルメタクリレート、ポリブチルメタクリレート、ポリエステル、ポリスルホン、ポリフェニレンエーテル、ポリブタジエン、炭化水素樹脂、ケトン樹脂、フェノキシ樹脂、ポリウレタン樹脂などの溶剤可溶性樹脂や、フェノール樹脂、キシレン樹脂、石油樹脂、ユリア樹脂、メラミン樹脂、不飽和ポリエステル樹脂、アルキド樹脂、エポキシ樹脂、シリコーン樹脂などの硬化性樹脂などに分散させて用いることも可能である。

【００３１】上記正孔輸送層、発光層、電子輸送層などの有機層の形成方法は、抵抗加熱蒸着、電子ビーム蒸着、スパッタリング法などがある。特に限定されるものではないが、通常は、抵抗加熱蒸着、電子ビーム蒸着などの蒸着法が特性面で好ましい。

【００３２】これらのうちパターニングが必要な層の形成にはシャドーマスクを用いたマスク蒸着法を用いることが好ましいが、隔壁法などの公知の技術を利用することもできる。

【００３３】第二電極となる陰極は、電子を本素子の発光層に効率よく注入できる物質であれば特に限定されない。従って、アルカリ金属などの低仕事関数金属の使用も可能であるが、電極の安定性を考えると、白金、金、銀、銅、鉄、錫、アルミニウム、マグネシウム、インジウムなどの金属、またはこれら金属と低仕事関数金属との合金などが好ましい例として挙げられる。また、あらかじめ有機層に低仕事関数金属を微量ドーピングしておき、その後に比較的安定な金属を陰極として成膜することで、電極注入効率を高く保ちながら安定な電極を得ることもできる。これらの電極の作成法も抵抗加熱蒸着、電子ビーム蒸着、スパッタリング、イオンプレーティング法などのドライプロセスが好ましく、隔壁法、マスク蒸着法、レーザーアブレーション法などの公知技術が利用できるが、なかでも広い電極形成条件に対応できるマスク蒸着法が好ましい。

【００３４】マスク蒸着法に用いるシャドーマスクとして、発光層または第二電極などパターニングする目的の機能を損なわないことを前提として、シャドーマスクの開口部に補強線を存在させたシャドーマスクを用いることが好ましい。このようなシャドーマスクを活用し、マスク蒸着を１回で行うこともできるが、マスク強度の向上が可能な開口部数を減らしたシャドーマスクを用いて、２回以上の複数回蒸着を繰り返す方法を用いることもできる。また、シャドーマスクと基板とを１対１に対応する方法で複数枚の基板を同時にマスク蒸着して装置作製の効率を上げることや、障子タイプの集合マスクを利用して複数枚の基板を同時にパターニング処理することなども可能である。

【００３５】有機電界発光装置は、必要に応じて第二電極のパターニング工程後に、公知技術を用いて保護層の形成や発光領域の封止を行う。

【００３６】

【実施例】以下、実施例および比較例をあげて本発明を説明するが、本発明はこれらの例によって限定されるものではない。

【００３７】実施例１

４６ｍｍ×３８ｍｍの大きさに切断したＩＴＯ基板（ジオマテック社製）のＩＴＯ膜をフォトリソグラフィ法でパターニングし、その長手方向の中央部に５ｍｍ×１０ｍｍと２．５ｍｍ×１０ｍｍのパターン化されたＩＴＯ膜(第一電極となる）を２ｍｍの間隔をあけて形成した。

【００３８】発光層用シャドーマスクは、厚さ０．２ｍｍのステンレス鋼製板にサイズ１５ｍｍ×１５ｍｍの開口部をマスク中心に配置したもので、幅２ｍｍのステンレス鋼製フレームを有する。

【００３９】第二電極用シャドーマスクは、厚さ０．２ｍｍのステンレス鋼製板にサイズ５ｍｍ×２５ｍｍの開口部をマスク中心に配置したもので、幅２ｍｍのステンレス鋼製フレームを有する。

【００４０】パターン化されたＩＴＯ基板を蒸着機内にセットし、真空度を$2\times10^{-4}$ Ｐａ以下にして、基板前面に該発光層用シャドーマスクを配置し、密着させた。この状態で、銅フタロシアニン１０ｎｍ、Ｎ，Ｎ’－ジフェニル－Ｎ，Ｎ’－ジナフチル－１，１’－ジフェニル－４，４’－ジアミン（ＮＰＤ）５０ｎｍおよびＡｌ

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$q_3$５０ｎｍを蒸着した。その後、薄膜層をリチウム蒸気に曝してドーピング（膜厚換算量０．５ｎｍ）した。

【００４１】次に、該第二電極用シャドーマスクに交換して、真空度３×１０$^{-4}$ Ｐａ以下でアルミニウムを１２０ｎｍの厚さに蒸着して、第二電極をパターニングした。

【００４２】これにより、基板上の第一電極と第二電極との交点に緑色発光領域２つを有する素子が作製された。

【００４３】面積の小さい方の発光領域を発光させた場合には、１の強度の緑色光が観察され、面積の大きい方の発光領域を発光させた場合には、２の強度の緑色光が観察された。両方を同時に発光させると３の強度になるので、この装置により、定電圧のスイッチングという簡単な回路動作によっても、少なくとも３段階の階調表示が可能となった。

【００４４】実施例２

発光層パターニング用として、図３に示したようにマスク部分と補強線とが同一平面内に形成されたシャドーマスクを作製した。Ｒ発光層用は、シャドーマスクの外形１２０×８４ｍｍ、マスク部分３１の厚さは２５μｍであり、長さ６４ｍｍ、幅１２０μｍのストライプ状開口部３２がピッチ３００μｍで２７２本配置されている。ＧおよびＢ発光層用は、シャドーマスクの外形は１２０×８４ｍｍ、マスク部分３１の厚さは２５μｍであり、長さ６４ｍｍ、幅９０μｍのストライプ状開口部３２がピッチ３００μｍで２７２本配置されている。各ストライプ状開口部には、開口部と直交する幅２０μｍ、厚さ２５μｍの補強線３３が１．８ｍｍ間隔に形成されている。それぞれのシャドーマスクは外形が等しい幅４ｍｍのステンレス鋼製フレーム３４に固定されている。

【００４５】第二電極パターニング用として、図４および図５に示すようにマスク部分３１の一方の面３５と補強線３３との間に隙間３６が存在する構造の同一のシャドーマスクを用意した。シャドーマスクの外形は１２０×８４ｍｍ、マスク部分の厚さは１００μｍであり、長さ１００ｍｍ、幅２５０μｍのストライプ状開口部３２がピッチ３００μｍで２００本配置されている。マスク部分の上には、幅４０μｍ、厚さ３５μｍ、対向する二辺の間隔が２００μｍの正六角形構造からなるメッシュ状の補強線が形成されている。隙間の高さはマスク部分の厚さと等しく１００μｍである。各々のシャドーマスクは発光層用シャドーマスクと同様のステンレス鋼製のフレームに固定して用いられる。

【００４６】第一電極は以下の通りパターニングした。厚さ１．１ｍｍの無アルカリガラス基板表面にスパッタリング蒸着法によって厚さ１３０ｎｍのＩＴＯ透明電極膜が形成されたＩＴＯガラス基板（ジオマテック社製）を１２０×１００ｍｍの大きさに切断した。ＩＴＯ基板上にフォトレジストを塗布して、通常のフォトリソグラフィ法による露光、現像によってフォトレジストをパターニングした。ＩＴＯの不要部分をエッチングして除去した後、フォトレジストを除去し、ＩＴＯ電極をパターニングした。得られたＩＴＯパターンは、線幅９０μｍ１本と線幅６０μｍ２本のストライプ状パターンがそれぞれ間隔を３０μｍとり、これらの３本のストライプ状パターンを１セットとするパターンが３００μｍピッチで２７２セット（ストライプ状パターンとして８１６本）並んだものである。

【００４７】薄膜層より少なくとも厚みが大きく、シャドーマスクを支える部分として機能するスペーサーは以下のように形成した。ポリイミド系の感光性コーティング剤(東レ社製、ＵＲ－３１００）をスピンコート法により前記第一電極を形成した基板上に塗布して、クリーンオーブンによる窒素雰囲気下で８０℃、１時間プリベーキングした。この塗布膜にフォトマスクを介してパターン露光を行う。現像には東レ社製ＤＶ－５０５を用い、その後、クリーンオーブン中で１８０℃、３０分間、さらに２５０℃、３０分間ベーキングして、第一電極に直交するスペーサーを形成した。このスペーサーは、長さ９０ｍｍ、幅５０μｍ、高さ４μｍであり、３００μｍピッチで２０１本配置されている。このスペーサーの電気絶縁性は良好であった。

【００４８】前記第一電極パターニングを行いスペーサーを形成した基板を洗浄した後、真空蒸着機内にセットした。本蒸着機では、真空中においてそれぞれ１０μｍ程度の精度で基板とマスクの位置合わせができ、マスクを交換することが可能である。

【００４９】発光層を含む薄膜層は、抵抗線加熱方式による真空蒸着法によって以下のように形成した。なお、蒸着時の真空度は２×１０$^{-4}$ Ｐａ以下であり、蒸着中は蒸着源に対して基板を回転させた。

【００５０】まず、図６に示すような配置において、銅フタロシアニンを１５ｎｍ、ビス（Ｎ－エチルカルバゾール）を６０ｎｍ基板全面に蒸着して正孔輸送層５を形成した。

【００５１】次に、Ｇ発光層用マスクを、それぞれの第一電極とスペーサーが形成された基板前方に配置して両者を密着させ、基板後方にはフェライト系板磁石（日立金属社製、ＹＢＭ－１Ｂ）を配置した。この際、図７および図８に示したように、ストライプ状第一電極２がシャドーマスクのストライプ状開口部３２の中心に位置し、補強線３３がスペーサー４の位置と一致し、かつ補強線とスペーサーが接触するように、配置される。この状態で、０．３ｗｔ％の１，３，５，７，８－ペンタメチル－４，４－ジフロロ－４－ボラ－３ａ，４ａ－ジアザ－ｓ－インダセン（ＰＭ５４６）をドーピングした８－ヒドロキシキノリン－アルミニウム錯体（$Alq_3$）を２１ｎｍ蒸着し、緑色発光層をパターニングした。

【００５２】次に、前記緑色発光層のパターニングと同

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様にして、シャドーマスクを交換して、Ｒ発光層用マスクを取り付け、位置をずらしＲ発光層用の幅広いＲ用の第一電極パターンに位置合わせして、１ｗｔ％の４－（ジシアノメチレン）－２－メチル－６－（ジュロリジルスチリル）ピラン（ＤＣＪＴ）をドーピングしたＡｌ$q_3$を２０ｎｍ蒸着して、赤色発光層をパターニングした。

【００５３】さらに、シャドーマスクを交換し、Ｂ発光層用シャドーマスクを取り付け、さらに位置をずらしてＢ発光層の第一電極パターンに位置合わせして、４，４’－ビス（２，２’－ジフェニルビニル）ジフェニル（ＤＰＶＢｉ）を２０ｎｍ蒸着して、青色発光層をパターニングした。緑色、赤色、青色それぞれの発光層は、ストライプ状第一電極の３本ごとに配置され、第一電極の露出部分を完全に覆っている。

【００５４】次に、図９に示したような配置において、ＤＰＶＢｉを３５ｎｍ、Ａｌ$q_3$を１０ｎｍ基板全面に蒸着した。この後に、薄膜層をリチウム蒸気に曝してドーピング（膜厚換算量０．５ｎｍ）した。

【００５５】第二電極は抵抗線加熱方式による真空蒸着法によって以下のように形成した。なお、蒸着時の真空度は$3\times10^{-4}$ Ｐａ以下であり、蒸着中は２つの蒸着源に対して基板を回転させた。

【００５６】前記発光層のパターニングと同様に、第二電極用マスクを薄膜層までが形成された基板前方に配置して両者を密着させ、基板後方には磁石を配置した。この際、図１０および図１１に示すように、スペーサー４がマスク部分=３１の位置と一致するように両者は配置される。この状態でアルミニウムを２４０ｎｍの厚さに蒸着して第二電極８をパターニングした。第二電極は、間隔をあけて配置された複数のストライプ状にパターニングされている第一電極と直交する配置で、間隔をあけて配置された複数のストライプ状にパターニングされている。

【００５７】最後に、図９に示したような配置において、一酸化珪素を１２０ｎｍ電子ビーム蒸着法によって基板全面に蒸着して、保護層を形成した。

【００５８】図１２および図１３に示すように、本数８１６本のＩＴＯストライプ状第一電極上に、パターニングされた緑色発光層、赤色発光層および青色発光層が形成され、第一電極と直交するように幅２５０μｍ、ピッチ３００μｍのストライプ状第二電極が２００本配置された単純マトリクス型ストライプ配列のフルカラー有機電界発光装置が作製できた。赤、緑、青の３つの発光領域が１画素を形成するので、本発光装置は３００μｍピッチで２７２×２００画素を有している。

【００５９】得られた有機電界発光装置は、Ｒ発光層の発光領域の面積が、Ｇ、Ｂ発光層の発光領域の面積の１．５倍あった。これによりＲ発光層の耐久性が向上するとともに３色の色バランスがより優れた表示が可能になった。

【００６０】比較例

８１６本のストライプ状パターンの線幅がすべて７０μｍ（間隔３０μｍ）となるようにＩＴＯをパターニングしたこと以外は実施例２と同様にして有機電界発光装置を作製した。Ｒ、Ｇ、Ｂ各画素の大きさが等しいために、実施例２と同等の色バランスを得るためにＲ画素の電流密度を１．５倍にする必要が生じた。そのため、実施例２に比べてＲ画素の輝度低下が早かった。

【００６１】実施例３

実施例２と同様にして第一電極をパターニングした。得られたＩＴＯパターンは、線幅がそれぞれ３０、６０、１２０μｍのストライプ状パターンがそれぞれ間隔を３０μｍとり、これらの３本のストライプ状パターンを１セットとするパターンが３００μｍピッチで２７２セット（ストライプ状パターンとして８１６本）並んだものである。

【００６２】その後、実施例２と同様にしてスペーサーを形成し、基板を洗浄した後、真空蒸着機内にセットした。

【００６３】銅フタロシアニンを１０ｎｍ、ＮＰＤを５０ｎｍ、Ａｌ$q_3$を５０ｎｍ、順に基板全面に蒸着した。その後、薄膜層をリチウム蒸気に曝してドーピング（膜厚換算量０．５ｎｍ）し、実施例２と同様に第二電極をパターニングした。

【００６４】このようにして、本数８１６本のＩＴＯストライプ状第一電極上に、全面蒸着された緑色発光層が存在し、第一電極と直交するように幅２５０μｍ、ピッチ３００μｍのストライプ状第二電極が２００本配置された単純マトリクス型ストライプ配列のモノクロ有機電界発光装置が作製できた。幅がそれぞれ３０、６０、１２０μｍ、長さは２５０μｍと等しい、同色３つの発光領域が１画素を形成するので、本発光装置は３００μｍピッチで２７２×２００画素を有している。

【００６５】１画素を構成する３つの発光領域の面積は１：２：４の関係にあるので、それぞれの発光領域の単純なオン・オフの組み合わせにより、相対強度比が０：１：２：３：４：５：６：７の８階調表示が実現できた。従来の階調表示方法は、振幅変調やパルス幅変調あるいはそれらの組み合わせにより達成されるが、それに比べて、本実施例の階調表示方法は駆動回路の構成が簡易である。

【００６６】

【発明の効果】本発明によって、Ｒ、Ｇ、Ｂそれぞれの発光領域の電流密度を同等にし、電流密度に反比例する発光層の耐久性を均等化させることにより、全体として耐久性能を向上し、表示色の色特性を向上させることができる。

【図面の簡単な説明】

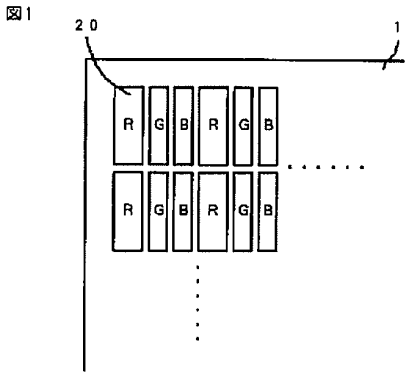
【図１】画素の単純マトリクス型ストライプ配列を示す

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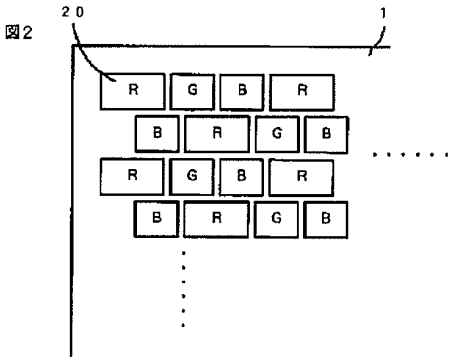
模式図。
【図２】画素の単純マトリクス型デルタ配列を示す模式図。
【図３】発光層パターニング用シャドーマスクの一例を示す平面図。
【図４】第二電極パターニング用シャドーマスクの一例を示す平面図。
【図５】図４のＸＸ’断面図。
【図６】正孔輸送層の形成方法の一例を説明するＸＸ’断面図。
【図７】本発明の発光層パターニング方法の一例を説明するＸＸ’断面図。
【図８】本発明の発光層パターニング方法の一例を説明するＹＹ’断面図。
【図９】電子輸送層の形成方法の一例を説明するＸＸ’断面図。
【図１０】第二電極パターニング方法の一例を説明するＸＸ’断面図。
【図１１】第二電極パターニング方法の一例を説明するＹＹ’断面図。
【図１２】本発明の有機電界発光装置の一例を示す平面図。
＊【図１３】図１２のＸＸ’断面図。

【符号の説明】
1　基板
2　第一電極
4　スペーサー
5　正孔輸送層
6　発光層
7　電子輸送層
8　第二電極
10　１０　薄膜層
１１　正孔輸送材料
１２　発光材料
１３　電子輸送材料
１４　第二電極材料
２０　発光領域
３０　シャドーマスク
３１　マスク部分
３２　開口部
３３　補強線
３４　フレーム
３５　マスク部分の一方の面
３６　隙間

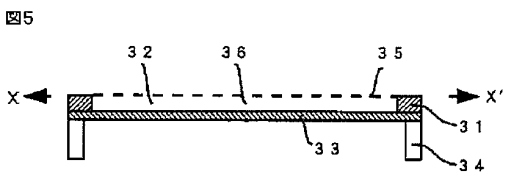
【図１】



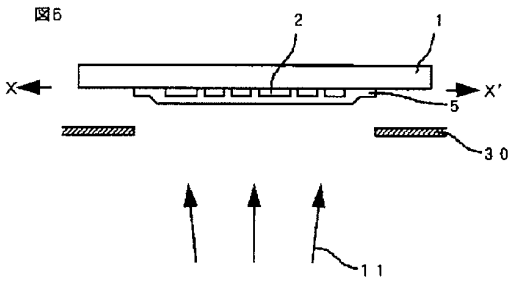

【図２】




【図５】

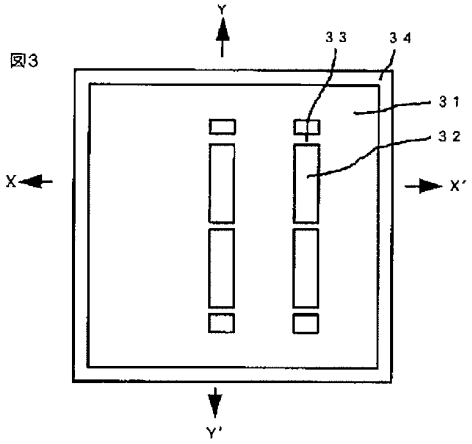



【図６】

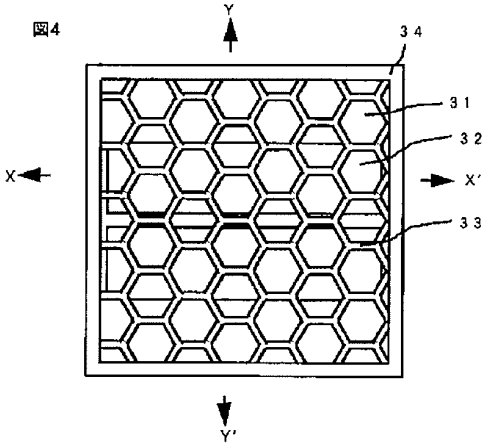



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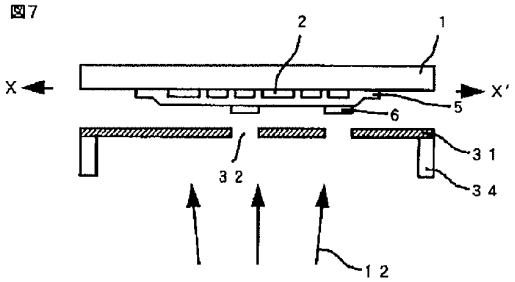
【図３】



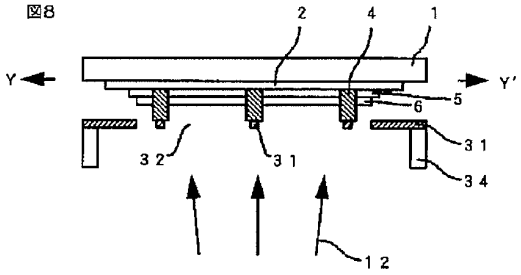

【図４】



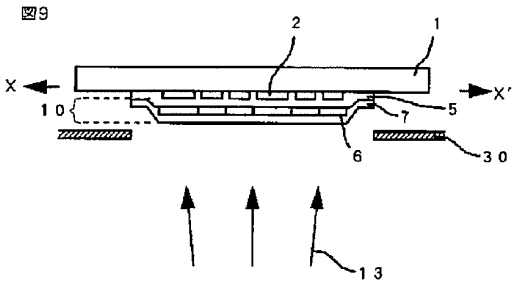

【図７】



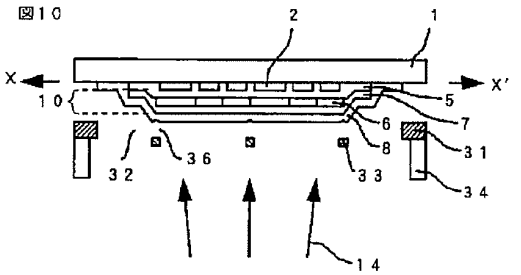

【図８】



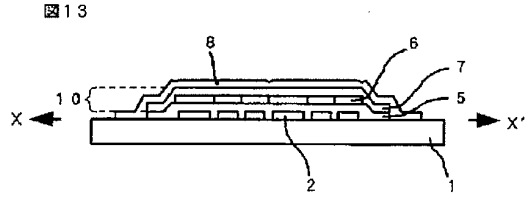

【図９】




【図１０】



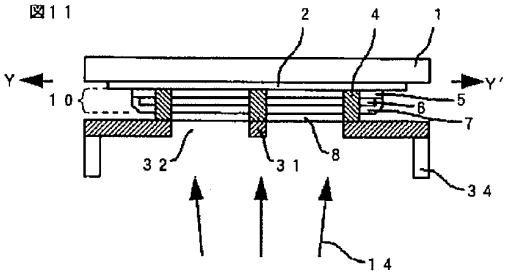

【図１３】




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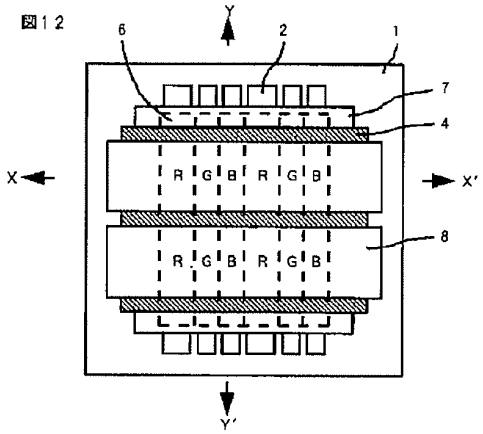
【図１１】

図１１




【図１２】

図１２




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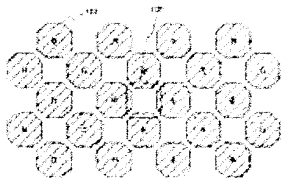
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(72)Inventor : **KOYAMA JUN**
**MIYAKE HIROYUKI**
**YAMAZAKI SHUNPEI**

(30)Priority
Priority number : **2005104455** Priority date : **31.03.2005** Priority country : **JP**

## (54) DISPLAY AND ELECTRONIC EQUIPMENT USING THE SAME

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a display which is made smaller in parasitic resistance and parasitic capacity and is hardly increased in delay time even if a delta array is used and a plurality of elements, such as static memories, are arranged within a pixel, and electronic equipment using the same.
SOLUTION: In the delta array, pixel electrodes are arrayed by forming their shapes to a polygonal shape in the case of a large number of the elements, such as the static elements, or in the case of the large area of the elements required to be included in the pixel.





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(33)優先権主張国　日本国(JP)

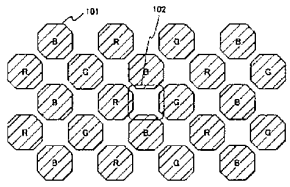
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株式会社半導体エネルギー研究所
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神奈川県厚木市長谷３９８番地　株式会社半導体エネルギー研究所内

Fターム(参考)　2H092 GA11 JA24 JB21 JB22 JB31 NA25 PA01 PA06 PA13

最終頁に続く

(54)【発明の名称】表示装置、およびそれを用いた電子機器

(57)【要約】
【課題】デルタ配列を用いた表示装置において、画素毎にスタティックメモリなどの素子数の多い回路を配置する場合、配線が複雑になり配線遅延を招いていた。
【解決手段】デルタ配置において、スタティックメモリなどの素子数が多い場合、または画素に含ませることが必要な素子の面積が大きい場合に画素電極の形状を多角形として配列させる。画素電極の形状を多角形にすることによって、画素形状に沿った配線が使用可能になり、素子数の多い画素になっても、配線の寄生抵抗、寄生容量を低減でき、配線遅延を解決することができる。
【選択図】図1



【特許請求の範囲】
【請求項１】
基板上にデルタ配列された複数の発光素子と、
前記発光素子の各に配置された画素駆動素子とを有し、
前記発光素子の画素電極の形状は八角形であることを特徴とする表示装置。
【請求項２】
請求項１において、
前記画素駆動素子に信号または電力を供給する配線として、前記画素電極に沿った斜め配線を有することを特徴とする表示装置。
【請求項３】
基板上にデルタ配列された複数の発光素子と、
前記発光素子の各に配置された画素駆動素子と、
前記発光素子の各に配置されたスタティックメモリとを有し、
前記発光素子の画素電極の形状は八角形であることを特徴とする表示装置。
【請求項４】
請求項３において、
前記画素駆動素子または前記スタティックメモリに信号または電力を供給する配線として、前記画素電極に沿った斜め配線を有することを特徴とする表示装置。
【請求項５】
請求項１乃至請求項４のいずれか一項において、
前記表示装置は高階調を表示する第１の表示モードと、
低階調を表示する第２のモードとを有することを特徴とする表示装置。
【請求項６】
請求項５において、
前記第１の表示モードは６４階調以上の階調表示が可能であり、
前記第２の表示モードは２階調の表示が可能であることを特徴とする表示装置。
【請求項７】
請求項１乃至請求項６のいずれか一項において、
前記八角形状の画素電極の角部の少なくとも一つは、丸みを帯びていることを特徴とする表示装置。
【請求項８】
デルタ配列された複数の発光素子と、
前記発光素子の各に配置された画素駆動素子とを有し、
前記発光素子を構成する電極の一方の形状が八角形であることを特徴とする表示装置。
【請求項９】
請求項８において、
前記画素駆動素子に信号または電力を供給する配線として、前記八角形状の電極に沿った斜め配線を有することを特徴とする表示装置。
【請求項１０】
請求項８または請求項９において、
前記八角形状の電極の角部の少なくとも一つは、丸みを帯びていることを特徴とする表示装置。
【請求項１１】
請求項１乃至請求項１０のいずれか一項に記載の表示装置を用いた電子機器。
【請求項１２】
請求項１１において、
前記電子機器は、コンピュータ、カメラ、携帯情報端末装置、画像再生装置、時計、携帯電話機のいずれかであることを特徴とする電子機器。
【発明の詳細な説明】
【技術分野】

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【０００１】
本発明は、表示装置に関し、特に発光素子を有する表示装置に関する。また、発光素子を有する表示装置を含んだ電子機器に関する。
【背景技術】
【０００２】
近年、通信技術の進歩に伴って、携帯電話が普及している。今後は更に動画の伝送やより多くの情報伝達が予想される。一方、パーソナルコンピュータ（ＰＣ）もその軽量化によって、モバイル対応の製品が生産されている。電子手帳に始まったＰＤＡと呼ばれる情報端末も多数生産され普及しつつある。また、表示装置の発展により、それらの携帯情報機器のほとんどにはフラットパネルディスプレイが装備されている。
【０００３】
また、アクティブマトリクス型の表示装置の中でも、近年、低温ポリシリコン薄膜トランジスタ（以下薄膜トランジスタをＴＦＴと表記する）を用いた表示装置の製品化が進められている。低温ポリシリコンでは画素だけでなく、画素部の周囲に信号線駆動回路を一体形成することが可能であるため、表示装置の小型化や、高精細化が可能であり、今後はさらに普及が見込まれる。
【０００４】
このようなモバイル機器用の表示装置においては、電子ブックなどの表示をおこなう場合が考えられる。そのような場合においては、画面を静止させ、そのときには、表示装置を駆動するためのコントローラ、ドライバを停止することによって、消費電力の低減をはかることが考えられてきた。そのための１つとして画素領域にスタティックメモリ（通常はＳＲＡＭであるがＳＲＡＭでなくとも良い）を配置し、そのスタティックメモリに静止画の情報を記憶することによって、静止画を表示し続けるものがあった。その例を以下の特許文献１に示す。
【０００５】
また、携帯情報機器には小型液晶テレビ、デジタルスチルカメラ、ビデオカメラ等も含まれる。このような自然画を表示する携帯情報機器のディスプレイにはデルタ配列のディスプレイが使用されることが多い。デルタ配列とは図２に示すように１行ごとに画素をずらして配列する方法である。デルタ配列は自然画を表示することにおいて、過去からよく使用される配列であった。
【特許文献１】特開２００１－２２２２５６号公報
【発明の開示】
【発明が解決しようとする課題】
【０００６】
前述した従来の表示装置には以下に示すような不具合があった。スタティックメモリを構成するためには通常６個の素子が必要であり、１つの画素の中に、６個以上の素子を配置しなければならなかった。
【０００７】
図２に従来のデルタ配列をおこなった画素の図を示す。図２において、画素部分は画素電極２０１とそれを駆動する回路素子２０２によって構成される。
【０００８】
デルタ配列は主としてＡＶ機器に用いられ、自然画を少ない画素数で表示しやすいという特徴があるが、画素を１列おきに、半分ずつずらして配置するため、画素の素子に信号または電源を供給するための配線が複雑となり、画素電極間面積を多く必要とし、配線の寄生抵抗、寄生容量が増加させていた。これは図２において、回路素子２０２の周囲には並行配線が多数配置されることからも容易に想定できることである。
【０００９】
特に、前述した様にスタティックメモリを内蔵する場合はさらにこの効果が顕著となり、寄生抵抗や寄生容量が増大し、信号の遅延時間を増加させる原因となっていた。また、素子数は多くなくとも、容量素子などで多くの面積を必要とする場合においても同様に、

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遅延時間を増加させる原因になっていた。

【００１０】

以上のような問題を鑑み本発明ではデルタ配列を用い、且つ、画素内部にスタティックメモリなど複数の素子を配置しても、寄生抵抗や寄生容量を小さくし、遅延時間の増大しにくい表示装置、およびそれらを用いた電子機器を提供することを課題とする。

【課題を解決するための手段】

【００１１】

以上のような問題を解決するため、本発明は、デルタ配置において、スタティックメモリなどの素子数が多い場合、または画素に含ませることが必要な素子の面積が大きい場合に画素電極の形状を多角形として配列させることを特徴としている。

【００１２】

本発明の一は、基板上にデルタ配列された複数の発光素子と、発光素子の各に配置された画素駆動素子とを有している表示装置である。この表示装置において、発光素子の少なくとも一方の電極形状は、多角形としている。

【００１３】

本発明の一は、基板上にデルタ配列された複数の発光素子と、発光素子の各に配置された画素駆動素子とを有している表示装置である。この表示装置において、発光素子の各に対応して配置されたスタティックメモリを有し、該発光素子の少なくとも一方の電極形状は、多角形としている。

【００１４】

この場合において、画素駆動素子またはスタティックメモリに信号または電力を供給する配線は、多角形の画素電極に沿った斜め配線で配設されている。

【００１５】

また、八辺を有し、ある一辺と、隣の一辺の長さの差が、ある一辺の長さの２０％以下、好ましくは１０％以下となる辺により構成された多角形の形状を有する画素電極とすることが好ましい。すなわち、八角形若しくはそれに近い多角形とすることが好ましい。なお、八角形若しくはそれに近い多角形が有する角部のうち、少なくとも一つの角部が丸みを帯びていても良い。

【００１６】

本発明の一は、上記発明の構成において、高階調を表示する第１の表示モードと、低階調を表示する第２の表示モードとを有し、当該複数の表示モードを切替可能とする表示装置である。この場合において、第１の表示モードは６４階調以上の階調表示を可能とし、第２の表示モードは２階調の表示を可能とする構成であってもよい。

【発明の効果】

【００１７】

以上に示したように、本発明は、画素電極の形状を八角形にすることによって、デルタ配列を行いながら、素子の配列を有効におこない、スタティックメモリなどを１つの画素に１つ以上配置したとしても、配線の寄生抵抗や配線の寄生容量を低減でき、遅延時間の増加を抑えることができる。また素子、配線の配置が容易となる。

【発明を実施するための最良の形態】

【００１８】

以下、本発明の実施の態様について、図面を参照して説明する。但し、本発明は多くの異なる態様で実施することが可能であり、本発明の趣旨及びその範囲から逸脱することなくその形態及び詳細をさまざまに変更し得ることは当業者であれば容易に理解される。従って、本実施の形態の記載内容に限定して解釈されるものではない。

【００１９】

図１に八角形の画素電極を持つ画素の例を示す。１０１が１つの画素を表し、１０２が画素を駆動する回路を配置する場所を表す。図１に示すように回路を配置する領域１０２を都合良く得ることが可能になり、前述した従来の正方形または長方形の画素に比べて効率的な配置が可能になる。

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【００２０】
図３に図１の画素を拡大した場合の構成例を示す。図３は図１の領域１０２を表している。図３の３１０は画素電極を表し、３１１が画素電極３１０の電位を制御する回路を表している。３０２は３１１に接続されるデータ線、３０７は他の画素電極を制御する回路につながるデータ線、３０４は第１の走査線、３０５は第２の走査線である。また、３０８、３０９は他の画素を制御する走査線である。３０３は電源供給線、３０６は他の画素の電源供給線である。３０１は配線を含めた画素回路を表している。また、３１２は低電位側電源線である。
【００２１】
ここで、データ線３０２、３０７、走査線３０４、３０５、３０８、３０９、低電位側電源線３１２は図３にあるように八角形の画素の斜めの辺に沿った形で形成されている。このような形状をとることによって、配線クロスによる不要な寄生容量の発生や、配線長の増加による寄生抵抗の増加を防ぐことが可能になる。また素子、配線の配置を容易にすることが可能になる。
【００２２】
以上、本実施の形態では、八角形の画素電極を持つ画素の例について説明したが、本発明はこれに限定されず多角形の画素電極を適用することができる。特に、八辺を有し、ある一辺と、隣の一辺の長さの差が、ある一辺の長さの２０％以下、好ましくは１０％以下となる辺により構成された多角形の形状を有する画素電極とすることが好ましい。すなわち、八角形若しくはそれに近い多角形とすることが好ましい。
【実施例１】
【００２３】
図４に図３の３０１の回路構成例を示す。図４の４０１が図３の３１１に対応する。図４の４０２はデータ線、４２１は第１の走査線、４０４は第２の走査線、４０３は電源供給線、４０５はスイッチングＴＦＴ、４０９は駆動ＴＦＴ、４１５は発光素子、４１７は発光素子の第１の電極、４１６は発光素子の第２の電極を表す。また４１０から４１３のＴＦＴはスタティックメモリを構成している。４０６はスタティックメモリに書き込みをおこないやすくするためのスイッチＴＦＴで、スイッチングＴＦＴ４０５と逆極性のＴＦＴを用いる。また、４０７はスタティックメモリの出力を駆動ＴＦＴ４０９のゲートに入力するためのスイッチＴＦＴである。スイッチＴＦＴ４０８は駆動ＴＦＴ４０９のゲートを電源供給線４０３に接続するもので、駆動ＴＦＴ４０９をオフするために用いる。４１４はスタティックメモリの低電位側電源である。
【００２４】
図４では、第１の走査線４２１の信号によりスイッチングＴＦＴ４０５をオンまたはオフすることで、データ線４０２のデータをスタティックメモリに記憶させるかどうかが決まる。このスタティックメモリに記憶されたデータと第２の走査線４０４の信号によって駆動ＴＦＴ４０９がオンまたはオフするかが決まり、オンの時には発光素子が発光する。
【００２５】
以下において、本実施形態における動作について説明をおこなう。
まず、発光素子を点灯させるデータを書き込む場合について説明する。データ線４０２にはロウ電位の信号が入力される。次に、第１の走査線４２１がハイになるとスイッチングＴＦＴ４０５がオンして、データ線のロウ電位がＴＦＴ４１０、ＴＦＴ４１１で構成されるインバータに入力され、ＴＦＴ４１０、４１１で構成されるインバータの出力はハイになる。このインバータ出力はＴＦＴ４１２、ＴＦＴ４１３で構成されるインバータに入力される。ＴＦＴ４１２、４１３で構成されるインバータの出力はロウであり、スイッチＴＦＴ４０７を介して、駆動ＴＦＴ４０９のゲートに入力される。
スイッチＴＦＴ４０６は第１の走査線がハイである間はオフとなっている。図４において駆動ＴＦＴ４０９はＰ型ＴＦＴであるので、ロウ電位がゲートに入力されるとオンし、発光素子の第１の電極４１７と電源供給線４０３は電気的に接続（短絡）し、発光素子に電流が流れ、発光がおこなわれる。このとき、第２の走査線４０４はハイであるものとす

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る。

【００２６】

次に、発光素子を点灯させないデータを書き込む場合について説明する。データ線４０２にはハイ電位の信号が入力される。次に、第１の走査線４２１がハイになるとスイッチングＴＦＴ４０５がオンして、データ線のハイ電位がＴＦＴ４１０、ＴＦＴ４１１で構成されるインバータに入力され、ＴＦＴ４１０、４１１で構成されるインバータの出力はロウになる。このインバータ出力はＴＦＴ４１２、ＴＦＴ４１３で構成されるインバータに入力される。ＴＦＴ４１２、４１３で構成されるインバータの出力はハイであり、スイッチＴＦＴ４０７を介して、駆動ＴＦＴ４０９のゲートに入力される。

スイッチＴＦＴ４０６は第１の走査線４２１がハイである間はオフとなっている。図４において、駆動ＴＦＴ４０９はＰ型ＴＦＴであるので、ハイ電位がゲートに入力されるとオフし、発光素子の第１の電極４１７と電源供給線４０３は電気的に接続（短絡）せず、発光素子に電流が流れず、発光がおこなわれない。このとき、第２の走査線４０４はハイであるものとする。

【００２７】

次に、発光素子を消灯させる場合について説明する。消灯時には第１の走査線４２１はロウであるので、スイッチングＴＦＴ４０５はオフし、データ線４０２の電位は画素には書き込まれない。スイッチＴＦＴ４０６がオンし、データはすでに書き込まれたものが保持されている。第２の走査線４０４がロウとなり、スイッチＴＦＴ４０７はオフとなり、駆動ＴＦＴ４０９とスタティックメモリは遮断される。スイッチＴＦＴ４０８を介して、電源供給線４０３の電位が駆動ＴＦＴ４０９のゲートに入力される。

駆動ＴＦＴ４０９はＰ型ＴＦＴであるので、電源供給線４０３の電位がゲートに入力されるとオフし、発光素子の第１の電極４１７と電源供給線４０３は電気的に接続（短絡）接続せず、発光素子に電流が流れず、消灯される。

以上のように本実施例は動作する。尚、スタティックメモリを用いた回路構成は本実施例に記載したものに限定されず他の構成をとったものでも良い。

また、スタティックメモリは電源を切断しない限り、記憶状態を保持できるためドライバや後述するコントローラなどをすべて停止させることが可能となり、静止画を表示する場合には低消費電力化をはかることが可能である。

【実施例２】

【００２８】

スタティックメモリを用いた表示は、スタティックメモリの出力値が０または１を表すデジタル値であるから、アナログ的な表示はできない。従って階調表示をおこなうときは時間階調を用いる。時間階調の原理について説明をおこなう。

【００２９】

時間階調はある一定の輝度で発光する素子の点灯時間を変化させて、階調を表示するものである。たとえば、１フレーム期間中すべて点灯すれば点灯率は１００％となる。また１フレーム期間中の半分の期間点灯すれば点灯率は５０％となる。フレーム周波数がある程度高ければ、一般的には６０Ｈｚ以上であれば、人間の目では点滅が認識できず、中間調として認識される。このようにして、点灯率を変化させることによって、階調を表現することが可能である。

【００３０】

図５（Ａ）は横軸に時間をとり、縦軸に表示画面の画素の縦軸をとったものである。この例では、表示画面は上から順に書き込みをおこなっており、そのため、表示が遅れることになる。この実施例では上から順に書き込みをおこなっているが、これには限定されない。以下４ビットを例にとり説明をおこなうが本発明は４ビットに限定されるものではない。

【００３１】

図５（Ａ）では、１フレームを４つのサブフレーム（Ｔｓ１、Ｔｓ２、Ｔｓ３、Ｔｓ４）に分けている。それぞれのサブフレームの期間の長さの比は、Ｔｓ１：Ｔｓ２：Ｔｓ３

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：Ｔｓ４＝８：４：２：１となっている。これらのサブフレームを組み合わせることによって、点灯期間の長さを０～１５までのいずれかに設定することが可能である。このように１フレームを２のべき乗のサブフレームに区切って階調を表現できる。

【００３２】

また、Ｔｓ４では点灯期間が短いため、画面の下半分の書き込みが終了する前に、上半分を消灯する必要があり、書き込みと消去を並行しておこなっている。

【００３３】

図５（Ｂ）は図５（Ａ）と異なる時間区分で階調表現をおこなったものである。図５（Ａ）の階調表現手段では上位ビットが変化したときに、疑似輪郭と呼ばれる不具合が発生する。これは人間の目が、例えば７階調目と８階調目を交互に見たときに映像が本来の階調とは異なって見えるように錯覚をする、というものである。

【００３４】

従って、図５（Ｂ）では上位ビットを分割し、上述した疑似輪郭現象を軽減しているものである。具体的には、最上位ビット（ここではＴｓ１）を４つに分割し、１フレーム内部に配置している。また、第２ビット（ここではＴｓ２）を２分割し、１フレーム内部に配置している。このようにして、時間的に長いビットを分割し、疑似輪郭の軽減をおこなっている。

【００３５】

図６（Ａ）は疑似輪郭が発生しないように、サブフレームを２のべき乗ではなく等間隔で区分したものである。この方式では大きなビットの区切りがないので、疑似輪郭は発生しないが、階調自体は荒くなる。すなわち、階調がサブフレームの倍数で表現されてしまうため、サブフレームの倍数以外の階調をうまく表示できない。従って、ＦＲＣ（フレームレートコントロール）またはディザなどを用いて、階調補完をおこなう必要がある。

【００３６】

図６（Ｂ）は２値表示のみをおこなう場合のものである。この場合は１フレーム中に１サブフレームのみ存在するので、書き換え回数も１フレームに１回となり、コントローラ、ドライバの消費電力を低減することが可能になる。

自然画を表示しない場合には、階調数は多くなくても良いので、消費電力を優先した表示が可能となる。このような表示と前述した図５（Ａ）、図５（Ｂ）、図６（Ａ）などを組み合わせることによって、大きな階調数が必要な場合と、少ない階調で十分な場合を使い分けて、消費電力の削減が可能になる。

【００３７】

図６（Ｃ）は４階調を表現するもので１フレーム期間に３回の書き込みをおこなって表示をおこなう。これは図６（Ｂ）よりは階調数が多く必要であるが、図６（Ａ）ほど多くを必要としない場合などに適応される。

【００３８】

このようにサブフレームの構成方法は多数あり、ここに記載されている方法には限定されない。時間階調方式ではコントローラから入力する信号で上記の方式が設定できるのでディスプレイが多くの切り替え機能を持たなくとも、上記のいずれかから選択が可能になる。

【００３９】

本実施例は、発明を実施するための最良の形態、及び、実施例１と自由に組み合わせることが可能である。

【実施例３】

【００４０】

時間階調方式の駆動方法を行うための信号を、ディスプレイのソース信号線駆動回路及びゲート信号線駆動回路に供給する回路について、図７及び図８を用いて説明する。

【００４１】

本明細書中では、表示装置に入力される映像信号を、デジタルビデオ信号と呼ぶことにする。なおここでは、４ビットのデジタルビデオ信号を入力して、画像を表示する表示装

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置を例に説明する。ただし、本発明は４ビットに限定されるものではない。

【００４２】

信号制御回路７０１にデジタルビデオ信号が読み込まれ、ディスプレイ７００にデジタル映像信号（ＶＤ）を出力する。また、本明細書中では、信号制御回路においてデジタルビデオ信号を編集し、ディスプレイに入力する信号に変換したものを、デジタル映像信号と呼ぶ。ディスプレイ７００の、ソース信号線駆動回路７０７及びゲート信号線駆動回路７０８を駆動するための信号は、ディスプレイコントローラ７０２によって入力されている。

【００４３】

信号制御回路７０１及びディスプレイコントローラ７０２の構成について説明する。なお、ディスプレイ７００のソース信号線駆動回路７０７は、シフトレジスタ７１０、ＬＡＴ（Ａ）７１１、ＬＡＴ（Ｂ）７１２によって構成される。他に、図示していないが、レベルシフタやバッファ等を設けてもよい。また、本発明はこのような構成に限定するものではない。

【００４４】

信号制御回路７０１は、ＣＰＵ７０４、メモリ７０５、メモリ７０６及びメモリコントローラ７０３によって構成されている。信号制御回路７０１の詳細は図８に示す。

【００４５】

信号制御回路７０１に入力されたデジタルビデオ信号は、メモリコントローラ７０３によって制御されるスイッチ７１３を介してメモリ７０５に入力される。ここで、メモリ７０５は、ディスプレイ７００の画素部７０９の全画素分の４ビットのデジタルビデオ信号を、記憶可能な容量を有する。メモリ７０５に１フレーム期間分の信号が記憶されると、メモリコントローラ７０３によって、各ビットの信号が順に読み出される。デジタル映像信号ＶＤはスイッチ７１４を介して、ディスプレイ７００に入力される。

【００４６】

メモリ７０５に記憶された信号の読み出しが始まると、今度は、メモリ７０６に、スイッチ７１３を介して、次のフレーム期間に対応するデジタルビデオ信号が入力され、記憶され始める。メモリ７０６もメモリ７０５と同様に、表示装置の全画素分の４ビットのデジタルビデオ信号を記憶可能な容量を有するとする。メモリ７０６に１フレーム期間分の信号が記憶されると、メモリコントローラ７０３によって、各ビットの信号が順に読み出される。デジタル映像信号ＶＤはスイッチ７１４を介して、ディスプレイ７００に入力される。メモリ７０６に記憶された信号の読み出しが始まると、メモリ７０５には次の書き込みがはじまる。これを繰り返すことによって、ディスプレイに信号を供給する。

【００４７】

このように、信号制御回路７０１は、それぞれ１フレーム期間分ずつの４ビットのデジタルビデオ信号を記憶することができるメモリ７０５及びメモリ７０６を有し、このメモリ７０５とメモリ７０６とを交互に用いて、デジタルビデオ信号をディスプレイ７００に供給する。

【００４８】

ここでは、２つのメモリ７０５及びメモリ７０６を、交互に用いて信号を記憶する信号制御回路７０１について示したが、一般に、複数フレーム分の情報を記憶することができるメモリを有し、これらのメモリを交互に用いることで時間階調表示に必要な信号を得ることが可能である。

【００４９】

本実施例は、発明を実施するための最良の形態、実施例１、及び、実施例２と自由に組み合わせることが可能である。

【実施例４】

【００５０】

携帯電話ではＱＶＧＡのフォーマットが広く使用されている。従ってＱＶＧＡのフォーマットが使用できれば、ＱＶＧＡ対応のソフトウエアがそのまま使用できるので、新たな

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ソフト開発が不要となり、開発費の低減が可能になる。また、ユーザーも普段使用している携帯電話と同様な機能を得ることが可能になり、利便性が向上する。

【００５１】

従って、本発明では、ＱＶＧＡのソフトで画像信号を処理し、その後、フォーマット変換を用いて、ＱＶＧＡのデータをＨＶＧＡ（ハーフＶＧＡ）またはＶＧＡ、ＳＶＧＡなどの高解像モードに展開することによって、高解像ディスプレイを用いて、ＱＶＧＡの画像を得ることが可能になる。

【００５２】

図１０にセットのブロック図を示す。各ブロックはアンテナ１００１、ＲＦ回路１００２、ベースバンド回路１００３、コントローラ１００４、ディスプレイ１００７によって構成される。ベースバンド部をＱＶＧＡ対応のものとすることによって、携帯電話のシステムをそのまま使用することが可能になる。

コントローラの内部にはフォーマット変換回路１００５、クロック制御信号発生回路１００６を有し、ベースバンド回路１００３から送られる信号をＱＶＧＡから、その他の信号に変換する。

【００５３】

フォーマット変換の実施例として図１１のようなものがあげられる。図１１はメモリ１１０１、メモリ１１０２、メモリ制御回路１１０３より構成される。ベースバンド回路から送られた信号はまずメモリ１１０１に記憶される。次に配列を変えてメモリ１１０２にデータを転送する。メモリ制御回路１１０３はこれらメモリ１１０１、メモリ１１０２のタイミングを制御する。

【００５４】

次に図１２に示すような変換をおこなうための動作について説明する。ＱＶＧＡからＶＧＡに変換を行うためには、ＱＶＧＡの画素数が２４０×３２０であり、ＶＧＡの画素数が４８０×６４０であるため、縦横とも２倍にする必要がある。その変換動作としては縦横に対して、メモリ１１０１より同じデータを２回読み出し、メモリ１１０２に書き込むことでフォーマット変換が可能になる。

【００５５】

ＱＶＧＡの画面を図１２（Ａ）に示すような２画素×２画素の単位に分割する。それをメモリ１１０１からメモリ１１０２に送る際には、それぞれの画素データを４回ずつ読み出し、図１２（Ｂ）に示すように４×４のデータを作製する。このようにして縦横とも２倍のデータをもつ表示に用いる画像データを構成することが可能である。

【００５６】

次にＱＶＧＡからＳＶＧＡに変換を行う場合、ＱＶＧＡの画素数が２４０×３２０であり、ＳＶＧＡの画素数が６００×８００であるため、縦横とも２．５倍にする必要がある。この場合は単純に読み出し回数を増やした場合では整数倍しかできないため、以下の方法をおこなう。

【００５７】

ＱＶＧＡの画面を図１３（Ａ）に示すような２画素×２画素の単位に分割する。それをメモリ１１０１からメモリ１１０２に送る際には、フレームによって画素ごとの読み出し回数を変えることで２．５倍を実現する。

【００５８】

まず、第１のフレームにおいては図１３（Ｂ）に示すようにメモリ１１０１から画素Ａのデータを９回、画素Ｂのデータを６回、画素Ｃのデータを６回、画素Ｄのデータを４回読み出し、メモリ１１０２に記憶する。

【００５９】

次に第２のフレームにおいては図１３（Ｃ）に示すようにメモリ１１０１から画素Ａのデータを６回、画素Ｂのデータを９回、画素Ｃのデータを４回、画素Ｄのデータを６回読み出し、メモリ１１０２に記憶する。

【００６０】

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次に第３のフレームにおいては図１３（Ｄ）に示すようにメモリ１１０１から画素Ａのデータを６回、画素Ｂのデータを４回、画素Ｃのデータを９回、画素Ｄのデータを６回読み出し、メモリ１１０２に記憶する。

【００６１】

次に第４のフレームにおいては図１３（Ｅ）に示すようにメモリ１１０１から画素Ａのデータを４回、画素Ｂのデータを６回、画素Ｃのデータを６回、画素Ｄのデータを９回読み出し、メモリ１１０２に記憶する。

【００６２】

これによって、第１フレーム～第４フレーム間において、どの画素も合計２５回の読み出しがおこなわれ、平均６．２５回の読み出しがおこなわれる。縦横に関しては２．５倍になっていることになる。このようにして縦横とも２．５倍のデータをもつ表示に用いる画像データを構成することが可能である。

【００６３】

次にＱＶＧＡからＨＶＧＡに変換を行う場合、ＱＶＧＡの画素数が２４０×３２０であり、ＨＶＧＡの画素数が３２０×４８０であるため、縦横とも１．３３３倍以上にする必要がある。この場合は単純に読み出し回数を増やした場合では整数倍しかできないため、以下の方法をおこなう。また、ＨＶＧＡは画面アスペクト比が３：４でないため、一部表示がおこなえない領域があるがこの場合はその部分を黒表示にするなどして対応する。

【００６４】

ＱＶＧＡの画面を図１４（Ａ）に示すような３画素×３画素の単位に分割する。それをメモリ１１０１からメモリ１１０２に送る際には、フレームによって画素ごとに読み出し回数を変えることで１．３３３倍を実現する。

【００６５】

まず、第１のフレームにおいては図１４（Ｂ）に示すようにメモリ１１０１から画素Ａのデータを４回、画素Ｂのデータを２回、画素Ｃのデータを２回、画素Ｄのデータを２回、画素Ｅのデータを１回、画素Ｆのデータを１回、画素Ｇのデータを２回、画素Ｈのデータを１回、画素Ｉのデータを１回読み出し、メモリ１１０２に記憶する。

【００６６】

次に、第２のフレームにおいては図１４（Ｃ）に示すようにメモリ１１０１から画素Ａのデータを２回、画素Ｂのデータを４回、画素Ｃのデータを２回、画素Ｄのデータを１回、画素Ｅのデータを２回、画素Ｆのデータを１回、画素Ｇのデータを１回、画素Ｈのデータを２回、画素Ｉのデータを１回読み出し、メモリ１１０２に記憶する。

【００６７】

次に、第３のフレームにおいては図１４（Ｄ）に示すようにメモリ１１０１から画素Ａのデータを２回、画素Ｂのデータを２回、画素Ｃのデータを４回、画素Ｄのデータを１回、画素Ｅのデータを１回、画素Ｆのデータを２回、画素Ｇのデータを１回、画素Ｈのデータを１回、画素Ｉのデータを２回読み出し、メモリ１１０２に記憶する。

【００６８】

次に、第４のフレームにおいては図１４（Ｅ）に示すようにメモリ１１０１から画素Ａのデータを２回、画素Ｂのデータを１回、画素Ｃのデータを１回、画素Ｄのデータを４回、画素Ｅのデータを２回、画素Ｆのデータを２回、画素Ｇのデータを２回、画素Ｈのデータを１回、画素Ｉのデータを１回読み出し、メモリ１１０２に記憶する。

【００６９】

次に、第５のフレームにおいては図１４（Ｆ）に示すようにメモリ１１０１から画素Ａのデータを１回、画素Ｂのデータを２回、画素Ｃのデータを１回、画素Ｄのデータを２回、画素Ｅのデータを４回、画素Ｆのデータを２回、画素Ｇのデータを１回、画素Ｈのデータを２回、画素Ｉのデータを１回読み出し、メモリ１１０２に記憶する。

【００７０】

次に、第６のフレームにおいては図１４（Ｇ）に示すようにメモリ１１０１から画素Ａのデータを１回、画素Ｂのデータを１回、画素Ｃのデータを２回、画素Ｄのデータを２回

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、画素Ｅのデータを２回、画素Ｆのデータを４回、画素Ｇのデータを１回、画素Ｈのデータを１回、画素Ｉのデータを２回読み出し、メモリ１１０２に記憶する。

【００７１】

次に、第７のフレームにおいては図１４（Ｈ）に示すようにメモリ１１０１から画素Ａのデータを２回、画素Ｂのデータを１回、画素Ｃのデータを１回、画素Ｄのデータを２回、画素Ｅのデータを１回、画素Ｆのデータを１回、画素Ｇのデータを４回、画素Ｈのデータを２回、画素Ｉのデータを２回読み出し、メモリ１１０２に記憶する。

【００７２】

次に、第８のフレームにおいては図１４（Ｉ）に示すようにメモリ１１０１から画素Ａのデータを１回、画素Ｂのデータを２回、画素Ｃのデータを１回、画素Ｄのデータを１回、画素Ｅのデータを２回、画素Ｆのデータを１回、画素Ｇのデータを２回、画素Ｈのデータを４回、画素Ｉのデータを２回読み出し、メモリ１１０２に記憶する。

【００７３】

次に、第９のフレームにおいては図１４（Ｊ）に示すようにメモリ１１０１から画素Ａのデータを１回、画素Ｂのデータを１回、画素Ｃのデータを２回、画素Ｄのデータを１回、画素Ｅのデータを１回、画素Ｆのデータを２回、画素Ｇのデータを２回、画素Ｈのデータを２回、画素Ｉのデータを４回読み出し、メモリ１１０２に記憶する。

【００７４】

これによって、第１フレーム～第９フレーム間において、どの画素も合計１６回の読み出しがおこなわれ、平均１．７７７回の読み出しがおこなわれる。縦横に関しては１．３３３倍になっていることになる。このようにして縦横とも１．３３３倍のデータをもつ表示に用いる画像データを構成することが可能である。

【００７５】

以上によって、ＱＶＧＡからＶＧＡ、ＳＶＧＡ、ＨＶＧＡへの変換が可能となる。尚、フォーマット変換の方式は以上に述べた方式には限定されず、他の方式を用いても良い。

【００７６】

本実施例は、発明を実施するための最良の形態、実施例１乃至実施例３と自由に組み合わせることが可能である。

【実施例５】

【００７７】

本発明の電気機器について図９を参照して説明する。

【００７８】

図９（Ａ）はデジタルカメラであり、本体３１０１、表示部３１０２、受像部３１０３、操作キー３１０４、外部接続ポート３１０５、シャッター３１０６等を含む。このデジタルカメラにおいて、表示部３１０２は、実施の形態若しくは実施例１乃至４で説明したものと同様の画素を備えている。すなわち、画素の構成として、デルタ配列をおこないながら、素子の配列を有効におこない、スタティックメモリなどを１つの画素に１つ以上配置したとしても、配線の寄生抵抗や配線の寄生容量を低減でき、遅延時間の増加を抑えることができる。また素子及び配線の配置が容易となるという特徴を有している。このような特徴により、デジタルカメラにおいて、低消費電力化を図ることができる。それにより、バッテリーを小型化することができ、軽量薄型化されたデジタルカメラを提供することができる。また、動画及び静止画のいずれについても高品位な画像を表示することができる。

【００７９】

図９（Ｂ）はコンピュータであり、本体３２０１、筐体３２０２、表示部３２０３、キーボード３２０４、外部接続ポート３２０５、ポインティングマウス３２０６等を含む。このコンピュータにおいて、表示部３２０３は、実施の形態若しくは実施例１乃至４で説明したものと同様の画素を備えている。すなわち、画素の構成として、デルタ配列をおこないながら、素子の配列を有効におこない、スタティックメモリなどを１つの画素に１つ以上配置したとしても、配線の寄生抵抗や配線の寄生容量を低減でき、遅延時間の増加を

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抑えることができる。また素子及び配線の配置が容易となるという特徴を有している。このような特徴により、コンピュータにおいて、低消費電力化を図ることができる。それにより、バッテリーを小型化することができ、軽量薄型化されたコンピュータを提供することができる。また、同じ用量のバッテリーを搭載した場合には、充電しないで使用することのできる時間を延ばすことができる。また、動画及び静止画のいずれについても高品位な画像を表示することができる。

【００８０】

図９（Ｃ）は携帯情報端末装置であり、本体３３０１、表示部３３０２、スイッチ３３０３、操作キー３３０４、赤外線ポート３３０５等を含む。この携帯情報端末において、表示部３３０２は、実施の形態若しくは実施例１乃至４で説明したものと同様の画素を備えている。すなわち、画素の構成として、デルタ配列をおこないながら、素子の配列を有効におこない、スタティックメモリなどを１つの画素に１つ以上配置したとしても、配線の寄生抵抗や配線の寄生容量を低減でき、遅延時間の増加を抑えることができる。また素子及び配線の配置が容易となるという特徴を有している。このような特徴により、携帯情報端末装置において、低消費電力化を図ることができる。それにより、バッテリーを小型化することができ、小型軽量化された携帯情報端末装置を提供することができる。また、同じ用量のバッテリーを搭載した場合には、充電しないで使用することのできる時間を延ばすことができる。また、動画及び静止画のいずれについても高品位な画像を表示することができる。

【００８１】

図９（Ｄ）は記録媒体読み込み部を備えた画像再生装置（具体的にはＤＶＤ再生装置）であり、本体３４０１、筐体３４０２、記録媒体（ＣＤ、ＬＤまたはＤＶＤ等）読込部３４０５、操作キー３４０６、表示部（ａ）３４０３、表示部（ｂ）３４０４等を含む。この画像再生装置において、表示部（ａ）３４０３、表示部（ｂ）３４０４は、実施の形態若しくは実施例１乃至４で説明したものと同様の画素を備えている。すなわち、画素の構成として、デルタ配列をおこないながら、素子の配列を有効におこない、スタティックメモリなどを１つの画素に１つ以上配置したとしても、配線の寄生抵抗や配線の寄生容量を低減でき、遅延時間の増加を抑えることができる。また素子及び配線の配置が容易となるという特徴を有している。このような特徴により、画像再生装置において、低消費電力化を図ることができる。それにより、バッテリーを小型化することができ、小型軽量化された画像再生装置を提供することができる。また、バッテリーモードで使用する場合には、長時間の再生が可能であり、映像を鑑賞することのできる時間を延ばすことができる。

【００８２】

図９（Ｅ）は折りたたみ式携帯表示装置であり、本体３５０１に表示部３５０２が設けられている。この携帯表示装置において、表示部３５０２は、実施の形態若しくは実施例１乃至４で説明したものと同様の画素を備えている。すなわち、画素の構成として、デルタ配列をおこないながら、素子の配列を有効におこない、スタティックメモリなどを１つの画素に１つ以上配置したとしても、配線の寄生抵抗や配線の寄生容量を低減でき、遅延時間の増加を抑えることができる。また素子及び配線の配置が容易となるという特徴を有している。このような特徴により、携帯表示装置において、低消費電力化を図ることができる。それにより、バッテリーを小型化することができ、本体３５０１の小型軽量化を図ることができる。

【００８３】

図９（Ｆ）は腕時計であり、ベルト３６０１、表示部３６０２、操作スイッチ３６０３、音声出力部３６０４等を含む。この腕時計において、表示部３６０２は、実施の形態若しくは実施例１乃至４で説明したものと同様の画素を備えている。すなわち、画素の構成として、デルタ配列をおこないながら、素子の配列を有効におこない、スタティックメモリなどを１つの画素に１つ以上配置したとしても、配線の寄生抵抗や配線の寄生容量を低減でき、遅延時間の増加を抑えることができる。また素子及び配線の配置が容易となるという特徴を有している。このような特徴により、腕時計において、低消費電力化を図るこ

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とができる。それにより、バッテリーを小型化することができ、小型軽量化された腕時計を提供することができる。

【００８４】

図９（Ｇ）は携帯電話機であり、本体３７０１は、筐体３７０２、表示部３７０３、音声入力部３７０４、アンテナ３７０５、操作キー３７０６、外部接続ポート３７０７などを含む。この携帯電話機において、表示部３７０３は、実施の形態若しくは実施例１乃至４で説明したものと同様の画素を備えている。すなわち、画素の構成として、デルタ配列をおこないながら、素子の配列を有効におこない、スタティックメモリなどを１つの画素に１つ以上配置したとしても、配線の寄生抵抗や配線の寄生容量を低減でき、遅延時間の増加を抑えることができる。また素子及び配線の配置が容易となるという特徴を有している。このような特徴により、携帯電話機において、低消費電力化を図ることができる。それにより、バッテリーを小型化することができ、軽量化された携帯電話機を提供することができる。また、同じ用量のバッテリーを搭載した場合には、充電しないで使用することのできる時間を延ばすことができる。また、動画及び静止画のいずれについても高品位な画像を表示することができる。

【００８５】

以上の様に、本発明の適用範囲は極めて広く、あらゆる分野の電子機器に適用することが可能である。

【００８６】

なお、本実施例は、発明を実施するための最良の形態、実施例１乃至実施例４と自由に組み合わせることが可能である。

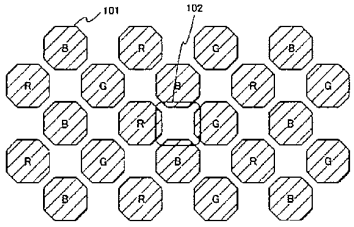
【図面の簡単な説明】

【００８７】

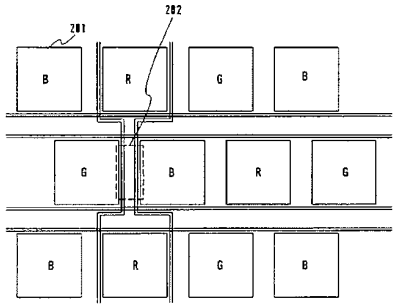
【図１】本発明のデルタ配列画素の概略図。
【図２】従来のデルタ配置画素の概略図。
【図３】本発明のデルタ配列画素の拡大図。
【図４】本発明の画素の実施例の等価回路を示す図。
【図５】本発明のサブフレームの実施例を示す図。
【図６】本発明のサブフレームの実施例を示す図。
【図７】コントローラのブロック図。
【図８】コントローラのブロック図。
【図９】本発明を用いた電子機器の実施例を示す図。
【図１０】本発明の実施例を用いた携帯電話のブロック図。
【図１１】本発明の実施例を用いたフォーマット変換回路のブロック図。
【図１２】画素フォーマットの変換を示す図。
【図１３】画素フォーマットの変換を示す図。
【図１４】画素フォーマットの変換を示す図。

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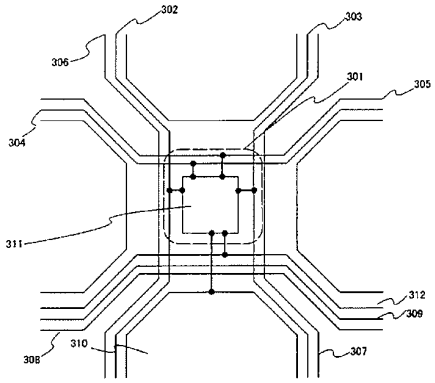
【図１】



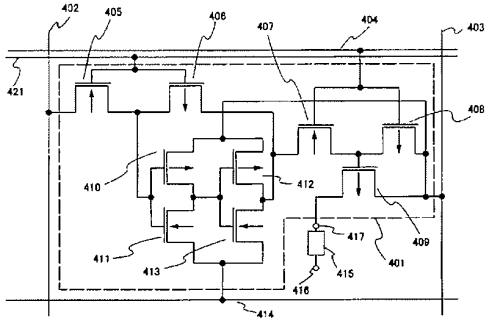

【図２】



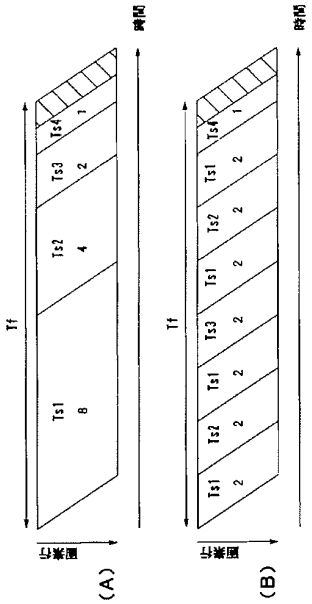

【図３】



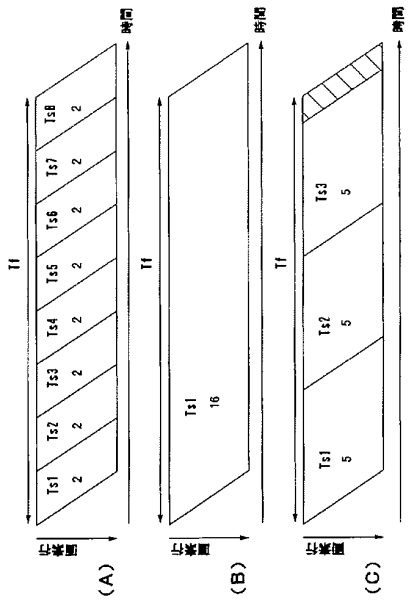

【図４】




【図５】

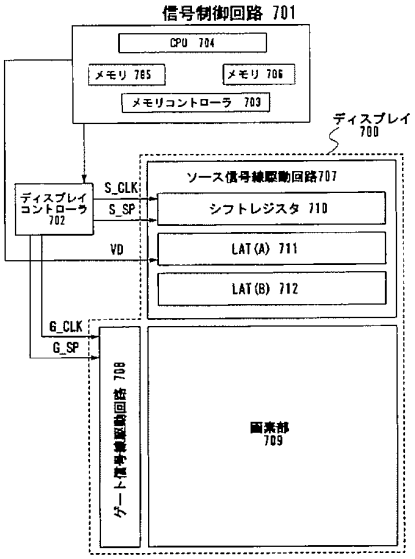



【図６】

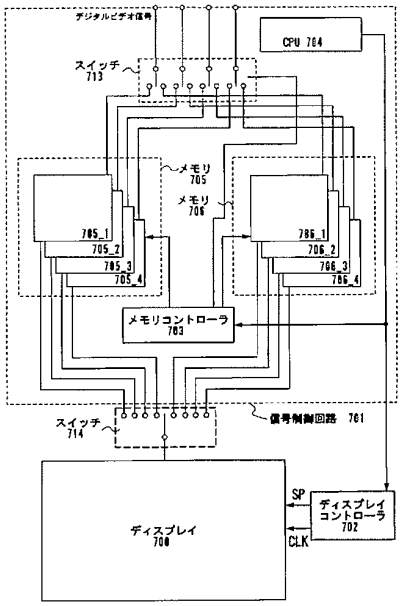



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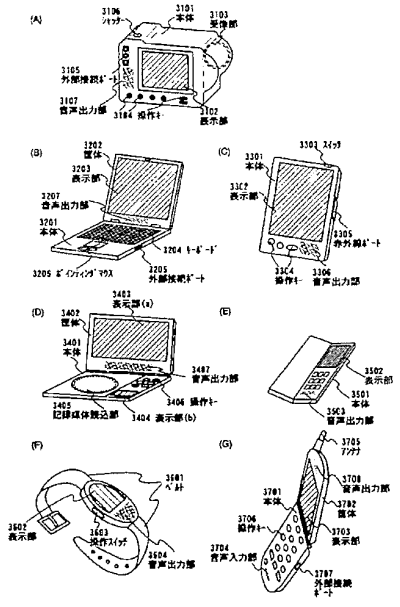
【図７】


信号制御回路 701
CPU 704
メモリ 705
メモリ 706
メモリコントローラ 703
ディスプレイ 700
ディスプレイコントローラ 702
S_CLK
S_SP
VD
G_CLK
G_SP
ソース信号線駆動回路707
シフトレジスタ 710
LAT(A) 711
LAT(B) 712
ゲート信号線駆動回路 708
画素部 709

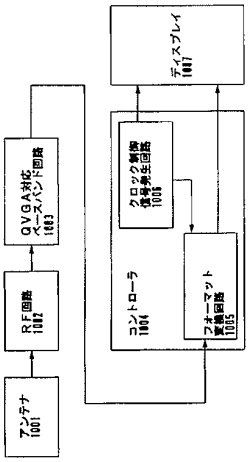
【図８】


CPU 704
スイッチ 713
メモリ 705
メモリ 706
メモリコントローラ 703
スイッチ 714
信号制御回路 761
ディスプレイ 700
ディスプレイコントローラ 702
SP
CLK

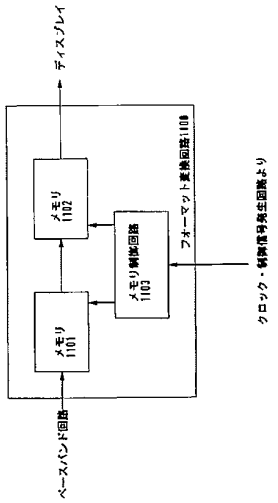
【図９】



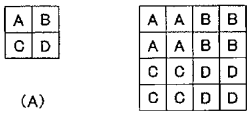
【図１０】


ディスプレイ 1007
QVGA対応ベースバンド回路 1003
RF回路 1002
アンテナ 1001
クロック制御回路 1008
コントローラ 1004
フォーマット変換回路 1005

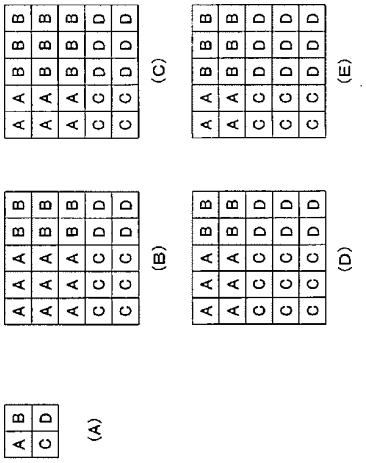
【図１１】



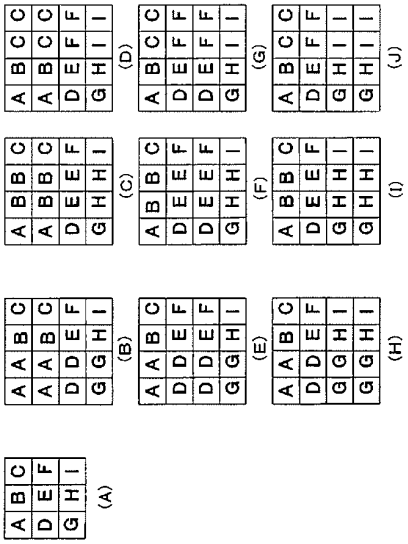

【図１２】




【図１３】




【図１４】



フロントページの続き

| (51)Int.Cl. | | | F I | | | テーマコード（参考） |
|---|---|---|---|---|---|---|
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| | | | H05B | 33/12 | B | |
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| | | | H05B | 33/26 | Z | |
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| | | | G09G | 3/20 | 611A | |
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5C006 AA02 AA13 AA14 AA17 AB01 AF03 AF04 AF07 AF23 AF44
AF47 AF69 AF71 BB16 BC06 BC12 BC16 BF02 BF15 BF45
FA03 FA12 FA29 FA37 FA47 FA56
5C080 AA06 AA10 BB05 DD02 DD08 DD26 EE01 EE19 EE21 EE26
EE29 EE31 FF11 GG05 GG08 GG15 GG17 JJ02 JJ03 JJ04
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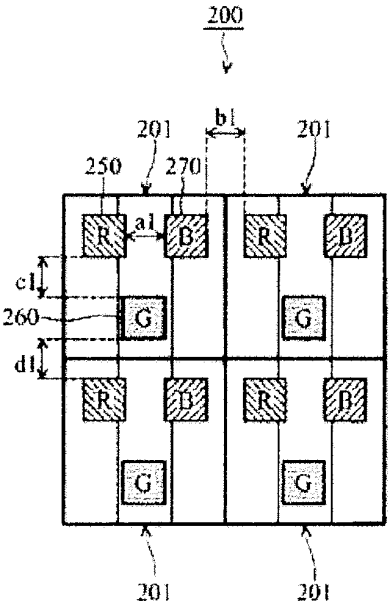
(21)Application number : **2007-171097**
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(71)Applicant : **AU OPTRONICS CORP**
(72)Inventor : **CHAO CHING-IAN**
**WU YUAN-CHUN**

(30)Priority
Priority number : **2006 478921** Priority date : **30.06.2006** Priority country : **US**

## (54) COLOR DISPLAY PANEL AND ITS FORMING METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a display panel capable of displaying a color image, having a large aperture ratio for light emission zones of red, green and blue sub-pixels, reducing the level of difficulty in manufacturing process, and having larger alignment tolerance, and to provide its forming method.
SOLUTION: The display panel capable of displaying a color image and its forming method are provided. The display panel includes a plurality of pixels aligned in a matrix in a row direction and a column direction, wherein each pixel comprises a first to a third sub-pixels adjacently aligned along the row direction of the matrix, and a first to a third light emission zones arranged in a triangle with the geometrical center of each light emission zone located at a respective vertex of the triangle one side of which is substantially parallel to the row direction or the column direction, and each light emission zone emits light in a unique color. In the aligned pixels, any two adjacent light emission zones of different colors respectively define gaps with a distance between the light emission zones in the row direction and the column direction, and both gaps have the same distance.






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(P2008-15521A)
(43)公開日　平成20年1月24日(2008.1.24)

| (51)Int.Cl. | | F I | | | テーマコード（参考） |
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| H01L 27/32 | (2006.01) | G09F | 9/30 | 365Z | 5C094 |
| H01L 51/50 | (2006.01) | H05B | 33/14 | A | |
| H05B 33/12 | (2006.01) | H05B | 33/12 | B | |

審査請求 未請求　請求項の数 32　OL　（全 19 頁）

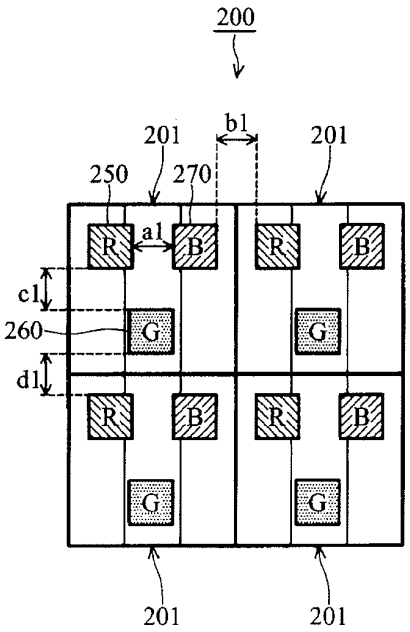
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(22)出願日　平成19年6月28日 (2007.6.28)
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(32)優先日　平成18年6月30日 (2006.6.30)
(33)優先権主張国　米国 (US)

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DD03 EE03 EE06 EE07 FF15
5C094 AA02 AA08 AA37 AA43 BA27
CA19 CA20

(54)【発明の名称】カラーディスプレイパネル及びその形成方法

(57)【要約】
【課題】赤色、緑色及び青色サブピクセルの発光域が大きい開口比を持ち、また製造プロセスの難度を低下させ、より大きなアライメント許容度を有するカラー画像を表示できるディスプレイパネル及びその形成方法を提供すること。
【解決手段】列方向と行方向にマトリクス配列された複数の画素を含み、各画素は、マトリクスの列方向に沿って互いに隣接して配列された第１～３サブピクセルと、三角形に配列され、各発光域の幾何中心が三角形の異なる頂点に位置され、三角形の一辺は列方向又は行方向と実質的に平行であり、それぞれが独自の色の光線を発し、かつ配列された画素が、列方向上及び行方向上に、任意の２つの隣接し、かつ異なる色の発光域間に距離を有する間隙をそれぞれ定義し、両間隙の距離が同一である第１～３発光域とを含むカラー画像を表示できるディスプレイパネル及びその形成方法を採用する。
【選択図】図５




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【特許請求の範囲】
【請求項１】
列方向と行方向にマトリクス配列された複数の画素を含み、カラー画像を表示できるディスプレイパネルであって、各画素は、
前記マトリクスの前記列方向に沿って互いに隣接して配列された第１サブピクセル、第２サブピクセル及び第３サブピクセルと、
三角形に配列され、各発光域の幾何中心が前記三角形の異なる頂点に位置され、前記三角形の一辺は前記列方向と前記行方向の中の１つと実質的に平行であり、それぞれが独自の色の光線を発し、かつ配列された前記画素が、前記列方向上に、任意の２つの隣接し、かつ異なる色の発光域間に距離を有する間隙を定義し、前記行方向上に、任意の２つの隣接し、かつ異なる色の発光域間に距離を有する間隙を定義し、前記両間隙の距離が実質的に又は近似して同一である第１発光域、第２発光域及び第３発光域とを含むディスプレイパネル。
【請求項２】
前記各第１発光域、第２発光域及び第３発光域は、対応する赤色発光域、緑色発光域及び青色発光域の中の１つを含む請求項１に記載のディスプレイパネル。
【請求項３】
前記各赤色発光域、緑色発光域及び青色発光域の幾何中心は、対応する前記第１サブピクセル、前記第２サブピクセル及び前記第３サブピクセルにそれぞれ位置され、前記三角形の一辺は前記列方向と実質的に平行である請求項２に記載のディスプレイパネル。
【請求項４】
前記赤色発光域、前記緑色発光域及び前記青色発光域の中の１つの幾何中心は、前記画素の前記第１サブピクセルと前記第３サブピクセルの中の１つに位置され、かつ前記赤色発光域、前記緑色発光域及び前記青色発光域の残りの幾何中心は、前記画素のもう１つの前記第１サブピクセルと前記第３サブピクセルに位置され、前記三角形の一辺は前記行方向と実質的に平行である請求項２に記載のディスプレイパネル。
【請求項５】
前記各赤色発光域、緑色発光域及び青色発光域は、前記列方向の幅と前記行方向の長さを有する請求項２に記載のディスプレイパネル。
【請求項６】
前記各赤色発光域、緑色発光域及び青色発光域の前記幅と前記長さは、異なる又は実質的に同一である請求項５に記載のディスプレイパネル。
【請求項７】
前記各赤色発光域、緑色発光域及び青色発光域は、赤色、緑色及び青色を放射することができる発光ダイオード素子を含む請求項２に記載のディスプレイパネル。
【請求項８】
前記発光ダイオード素子は、有機発光ダイオード素子又は複数の直列接続された有機発光ダイオード素子を含む請求項７に記載のディスプレイパネル。
【請求項９】
前記各有機発光ダイオード素子は、トップエミッション型有機発光ダイオード素子とボトムエミッション型有機発光ダイオード素子の中の１つを含む請求項８に記載のディスプレイパネル。
【請求項１０】
前記各有機発光ダイオード素子は、正常構造と逆構造の中の１つを含む請求項８に記載のディスプレイパネル。
【請求項１１】
前記各画素の前記赤色発光域、前記緑色発光域及び前記青色発光域をそれぞれ駆動し、前記発光域より対応する色の光線を放射する駆動回路を更に含む請求項８に記載のディスプレイパネル。
【請求項１２】

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前記駆動回路は、前記ディスプレイパネルをパッシブマトリクス有機発光ダイオード素子とアクティブマトリクス有機発光ダイオード素子の中の１つに対応して形成させる請求項１１に記載のディスプレイパネル。

【請求項１３】

列方向と行方向にマトリクス配列された複数の画素で形成され、各画素は前記マトリクスの前記列方向に沿って互いに隣接して配列された第１サブピクセル、第２サブピクセル及び第３サブピクセルと、赤色発光域、緑色発光域及び青色発光域とを含むカラー画像を表示できるディスプレイパネルであって、

前記画素の前記赤色発光域、前記緑色発光域及び前記青色発光域で配列された三角形を含み、各発光域の幾何中心が前記三角形の異なる頂点に位置され、前記三角形の一辺は前記列方向と前記行方向の中の１つと実質的に平行であり、前記画素は、前記列方向上に、任意の２つの隣接し、かつ異なる色の発光域間に距離を有する間隙を定義し、前記行方向上に、任意の２つの隣接し、かつ異なる色の発光域間に距離を有する間隙を定義し、前記両間隙の距離が実質的に又は近似して同一である請求項１３に記載のディスプレイパネル。

【請求項１４】

前記各赤色発光域、緑色発光域と及び青色発光域の幾何中心は、対応する前記第１サブピクセル、前記第２サブピクセル及び前記第３サブピクセルにそれぞれ位置され、前記三角形の一辺は前記列方向と実質的に平行である請求項１３に記載のディスプレイパネル。

【請求項１５】

前記赤色発光域、前記緑色発光域及び前記青色発光域の中の１つの幾何中心は、前記画素の前記第１サブピクセルと前記第３サブピクセルの中の１つに位置され、かつ前記赤色発光域、前記緑色発光域及び前記青色発光域の残りの幾何中心は、前記画素のもう１つの前記第１サブピクセルと前記第３サブピクセルに位置され、前記三角形の一辺は前記行方向と実質的に平行である請求項１３に記載のディスプレイパネル。

【請求項１６】

前記各赤色発光域、緑色発光域及び青色発光域は、前記列方向の幅と前記行方向の長さを有する請求項１３に記載のディスプレイパネル。

【請求項１７】

前記各赤色発光域、緑色発光域及び青色発光域の前記幅と前記長さは、異なる又は実質的に同一である請求項１６に記載のディスプレイパネル。

【請求項１８】

前記各赤色発光域、緑色発光域及び青色発光域は、赤色、緑色及び青色を放射することができる発光ダイオード素子を含む請求項１３に記載のディスプレイパネル。

【請求項１９】

前記発光ダイオード素子は、有機発光ダイオード素子又は複数の直列接続された有機発光ダイオード素子を含む請求項１８に記載のディスプレイパネル。

【請求項２０】

前記各有機発光ダイオード素子は、トップエミッション型有機発光ダイオード素子とボトムエミッション型有機発光ダイオード素子の中の１つを含む請求項１９に記載のディスプレイパネル。

【請求項２１】

前記各有機発光ダイオード素子は、正常構造と逆構造の中の１つを含む請求項１９に記載のディスプレイパネル。

【請求項２２】

列方向と行方向にマトリクス配列された複数の画素を有し、各画素は前記マトリクスの前記列方向に沿って互いに隣接して配列された第１サブピクセル、第２サブピクセル及び第３サブピクセルと、赤色発光域、緑色発光域及び青色発光域とを含むカラー画像を表示するディスプレイパネルの形成方法であって、

前記画素の前記赤色発光域、前記緑色発光域及び前記青色発光域を三角形に配列し、各

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発光域の幾何中心が前記三角形の異なる頂点に位置され、前記三角形の一辺は前記列方向と前記行方向の中の１つと実質的に平行であり、前記画素の前記マトリクスでは、前記列方向上に、任意の２つの隣接し、かつ異なる色の発光域間に距離を有する間隙を定義し、前記行方向上に、任意の２つの隣接し、かつ異なる色の発光域間に距離を有する間隙を定義し、前記両間隙の距離が実質的に又は近似して同一である形成方法。

【請求項２３】

前記各赤色発光域、緑色発光域及び青色発光域の幾何中心は、対応する前記第１サブピクセル、前記第２サブピクセル及び前記第３サブピクセルにそれぞれ位置され、前記三角形の一辺は前記列方向と実質的に平行である請求項２２に記載の方法。

【請求項２４】

前記赤色発光域、前記緑色発光域及び前記青色発光域の中の１つの幾何中心は、前記画素の前記第１サブピクセルと前記第３サブピクセルの中の１つに位置され、かつ前記赤色発光域、前記緑色発光域及び前記青色発光域の残りの幾何中心は、前記画素のもう１つの前記第１サブピクセルと前記第３サブピクセルに位置され、前記三角形の一辺は前記行方向と実質的に平行である請求項２２に記載の方法。

【請求項２５】

前記各赤色発光域、緑色発光域及び青色発光域は、赤色、緑色及び青色を放射することができる発光ダイオード素子を含む請求項２２に記載の方法。

【請求項２６】

前記発光ダイオード素子は、有機発光ダイオード素子又は複数の直列接続された有機発光ダイオード素子を含む請求項２５に記載の方法。

【請求項２７】

前記各有機発光ダイオード素子は、トップエミッション型有機発光ダイオード素子とボトムエミッション型有機発光ダイオード素子の中の１つを含む請求項２６に記載の方法。

【請求項２８】

前記各有機発光ダイオード素子は、正常構造と逆構造の中の１つを含む請求項２６に記載の方法。

【請求項２９】

列方向と行方向にマトリクス配列された複数の画素を含み、カラー画像を表示できるディスプレイパネルであって、各画素は、

第１サブピクセル、第２サブピクセル及び第３サブピクセルと、

三角形に配列され、各発光域の幾何中心が前記三角形の異なる頂点に位置され、前記三角形の一辺は前記列方向と前記行方向の中の１つと実質的に平行であり、それぞれが独自の色の光線を発し、かつ配列された前記画素が、前記列方向上に、任意の２つの隣接し、かつ異なる色の発光域間に距離を有する間隙を定義し、前記行方向上に、任意の２つの隣接し、かつ異なる色の発光域間に距離を有する間隙を定義し、前記両間隙の距離が実質的に又は近似して同一である第１発光域、第２発光域及び第３発光域を含むディスプレイパネル。

【請求項３０】

前記各第１発光域、第２発光域及び第３発光域は、対応する赤色発光域、緑色発光域及び青色発光域の中の１つを含む請求項２９に記載のディスプレイパネル。

【請求項３１】

３原色画素素子のディスプレイであって、

前記３原色画素素子は、列方向と行方向に、画素マトリクスに互いに隣接して配列された第１サブピクセル、第２サブピクセル及び第３サブピクセルと、

三角形に配列され、各発光域の幾何中心が前記三角形の異なる頂点に位置され、前記三角形の一辺は前記列方向と前記列方向に垂直な前記行方向の中の１つと実質的に平行であり、独自の色の光線を発し、かつ前記列方向上に、任意の２つの隣接し、かつ異なる色の発光域間に第１距離を有する間隙を定義し、前記行方向上に、任意の２つの隣接し、かつ異なる色の発光域間に第２距離を有する間隙を定義し、前記第１距離と前記第２距離が実

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質的に又は近似して同一である第１発光域、第２発光域及び第３発光域とを含む３原色画素素子のディスプレイ。
【請求項３２】
請求項３１に記載の３原色画素素子によって製造されるフルカラーディスプレイ。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、フルカラーディスプレイパネルに関し、特に、有機発光ディスプレイ素子のサブピクセルの配列設計に関するものである。
【背景技術】
【０００２】
一般的に、フルカラーディスプレイパネルは、赤色、緑色及び青色等のサブピクセル素子より構成され、ストライプ、モザイク又はデルタ形式で配列され、ディスプレイパネルの異なるサブピクセルより放射された各色の光線を混合することによってフルカラー効果を与えている。小型、高解析度、低消費電力、自己発光及び高速応答等の利点により、有機発光ダイオード（ＯＬＥＤ）ディスプレイパネルは、フルカラー画像の高鮮明度のディスプレイに広く用いられている。
【０００３】
図１８に示されるように、従来、液晶ディスプレイの赤色、緑色及び青色サブピクセル素子の配列は、ＯＬＥＤディスプレイパネルに用いられる。この配列では、画素マトリクス６００の各画素６０１は、第１サブピクセル６１０、第２サブピクセル６２０及び第３サブピクセル６３０を有し、画素マトリクス６００の列方向に沿って互いに隣接して配列され、赤色サブピクセル素子６５０、緑色サブピクセル素子６６０及び青色サブピクセル素子６７０は、画素マトリクス６００の列方向に沿って、第１サブピクセル６１０、第２サブピクセル６２０及び第３サブピクセル６３０の中にそれぞれ設置される。よって、図１８に示されるように、列方向上に、２つの隣接したサブピクセル素子間に距離Ｌｒを有する間隙を定義し、行方向上に、２つの隣接したサブピクセル素子間に距離Ｌｃを有する間隙を定義し、ＬｃはＬｒよりはるかに大きい。
【０００４】
しかし、前記サブピクセルの配列方式は、ディスプレイパネルの製造過程においてかなりの困難をもたらす。例えば、フルカラーＯＬＥＤディスプレイパネルの製造過程では、通常、シャドウマスクアラインメント（ｓｈａｄｏｗ ｍａｓｋ ａｌｉｇｎｍｅｎｔ）法を用いて、ディスプレイパネルの基板上に異なる有機層を堆積することで個別の赤色、緑色及び青色サブピクセル素子を形成する。ＯＬＥＤディスプレイパネルの解像度は、シャドウマスクの開口寸法に関係する。図１８に示すサブピクセル素子の配列では、列方向上の２つの隣接したサブピクセル素子間の距離Ｌｒは、行方向上の２つの隣接したサブピクセル素子間の距離Ｌｃよりはるかに小さい。よって、ディスプレイパネルの製造過程では、列方向上のサブピクセル素子のアラインメント許容度（Ｌｒ／２）は、行方向上のサブピクセル素子のアラインメント許容度（Ｌｃ／２）より、はるかに低い。このため、ＯＬＥＤディスプレイパネルのサブピクセル素子が列方向でアラインメントミスを生じ易くさせ、サブピクセルの各カラーの有機層をその他のサブピクセルに堆積させ、各サブピクセル素子より放射された光線が混合する現象、又は各２つの隣接したサブピクセル素子の上、下電極で短絡を発生して発光をしない問題を生じさせる。このタイプのサブピクセル素子の配列もまた、対応するシャドウマスクのエッチング製造を非常に難しくさせる。よって、従来のサブピクセル素子の配列方式を用いて高解析度のＯＬＥＤディスプレイを製造することが難しい。
【０００５】
特許文献１（特開２００７－１０８１１号公報）には、各ピクセルが３個のサブピクセルを含み、Ｌ字形に配列された３個のサブピクセルを含む第１のピクセルと逆Ｌ字形に配列された３個のサブピクセルを含む第２のピクセルが走査線方向に隣接して配置された表

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示装置が開示されている。また、特許文献２（特開平１０－７４０６９号公報）には、Ｒ（赤）、Ｇ（緑）及びＢ（青）の画素をデルタ配列で配置すると共に、上下のラインでは同一色の画素を水平方向に１．５画素分ずらして配置した液晶パネルを用いたカラー液晶表示装置が記載されている。

【０００６】

しかし、これら特許文献１及び２に示されるカラーピクセルの配列方式では、上述した課題は解決されない。よって、上述の課題を解決する有効な技術を提供する必要がある。

【０００７】

【特許文献１】特開２００７－１０８１１号公報

【特許文献２】特開平１０－７４０６９号公報

【発明の開示】

【発明が解決しようとする課題】

【０００８】

従って、本発明の目的は、赤色、緑色及び青色サブピクセルの発光域が大きい開口比を持ち、また製造プロセスの難度を低下させ、より大きなアライメント許容度を有するカラー画像を表示できるディスプレイパネル及びその形成方法を提供することにある。

【課題を解決するための手段】

【０００９】

本発明の１つの実施形態では、前記ディスプレイパネルは、列方向と行方向にマトリクス配列された複数の画素を含み、各画素は、前記マトリクスの前記列方向に沿って互いに隣接して配列された第１サブピクセル、第２サブピクセル及び第３サブピクセルと、三角形に配列され、各発光域の幾何中心が前記三角形の異なる頂点に位置され、前記三角形の一辺は前記列方向と前記行方向の中の１つに実質的に平行であり、そのそれぞれが独自の色の光線を発する第１発光域、第２発光域及び第３発光域を含む。前記列方向上に配列された前記画素は、任意の２つの隣接し、かつ異なる色の発光域間に距離を有する間隙を定義し、前記行方向上に配列された前記画素は、任意の２つの隣接し、かつ異なる色の発光域間に距離を有する間隙を定義し、前記両間隙の距離は実質的又は近似して同一である。

【００１０】

１つの実施形態では、各第１発光域、第２発光域及び第３発光域は、対応する赤色発光域、緑色発光域及び青色発光域の中の１つを含む。各赤色発光域、緑色発光域及び青色発光域は、前記列方向の幅と前記行方向の長さを有し、各赤色発光域、緑色発光域及び青色発光域の前記幅と前記長さは、異なるか又は実質的に同一である。１つの実施形態では、各赤色発光域、緑色発光域及び青色発光域の幾何中心は、対応する前記第１サブピクセル、前記第２サブピクセル及び前記第３サブピクセルにそれぞれ位置され、前記三角形の一辺は前記列方向に実質的に平行である。もう１つの実施形態では、前記赤色発光域、前記緑色発光域及び前記青色発光域の中の１つの幾何中心は、前記画素の前記第１サブピクセルと前記第３サブピクセルの中の１つに位置され、かつ前記赤色発光域、前記緑色発光域及び前記青色発光域の残りの幾何中心は、前記画素のもう１つの前記第１サブピクセルと前記第３サブピクセルに位置され、前記三角形の一辺は前記行方向に実質的に平行である。

【００１１】

各赤色発光域、緑色発光域及び青色発光域は、赤色、緑色及び青色の異なる色の光線を放射することができる発光ダイオード素子を含む。１つの実施形態では、前記発光ダイオード素子は、有機発光ダイオード（ＯＬＥＤ）素子又は複数の直列接続された有機発光ダイオード（ＯＬＥＤ）素子を含む。各有機発光ダイオード素子の発光方式は、トップエミッション（ｔｏｐ－ｅｍｉｓｓｉｏｎ）型有機発光ダイオード素子又はボトムエミッション（ｂｏｔｔｏｍ－ｅｍｉｓｓｉｏｎ）型有機発光ダイオード素子を含む。また、各有機発光ダイオード素子の構造は、正常構造（ｎｏｒｍａｌ）又は逆構造（ｉｎｖｅｒｔｅｄ）を含む。

【００１２】

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前記ディスプレイパネルは、各画素の前記赤色発光域、前記緑色発光域及び前記青色発光域をそれぞれ駆動し、前記発光域より対応する色の光線を放射する駆動回路を更に含む。１つの実施形態では、前記ディスプレイパネルの駆動回路は、パッシブマトリクス有機発光ダイオード素子とアクティブマトリクス有機発光ダイオード素子の中の１つに対応して形成される。

【００１３】

本発明の他の局面は、列方向と行方向にマトリクス配列された複数の画素で形成され、カラー画像を表示できるディスプレイパネルを提供する。各画素は、前記マトリクスの前記列方向に沿って互いに隣接して配列された第１サブピクセル、第２サブピクセル及び第３サブピクセルと、赤色発光域、緑色発光域及び青色発光域とを含む。１つの実施形態では、前記ディスプレイパネルは、前記画素の前記赤色発光域、前記緑色発光域及び前記青色発光域で配列された三角形を有し、各発光域の幾何中心が前記三角形の異なる頂点に位置され、前記三角形の一辺は前記列方向と前記行方向の中の１つに実質的に平行であり、前記画素は、前記列方向上に、任意の２つの隣接し、かつ異なる色の発光域間に距離を有する間隙を定義し、前記行方向上に、任意の２つの隣接し、かつ異なる色の発光域間に距離を有する間隙を定義し、前記両間隙の距離が実質的又は近似して同一である。各赤色発光域、緑色発光域及び青色発光域は、赤色、緑色及び青色の異なる色の光線を放射することができる発光ダイオード素子を含む。

【００１４】

１つの実施形態では、各赤色発光域、緑色発光域及び青色発光域の幾何中心は、対応する前記第１サブピクセル、前記第２サブピクセル及び前記第３サブピクセルに位置され、前記三角形の一辺は前記列方向に実質的に平行である。もう１つの実施形態では、前記赤色発光域、前記緑色発光域及び前記青色発光域の中の１つの幾何中心は、前記画素の前記第１サブピクセルと前記第３サブピクセルの中の１つに位置され、かつ前記赤色発光域、前記緑色発光域及び前記青色発光域の残りの幾何中心は、前記画素のもう１つの前記第１サブピクセルと前記第３サブピクセルに位置され、前記三角形の一辺は前記行方向に実質的に平行である。

【００１５】

本発明のもう１つの局面は、カラー画像を表示するディスプレイパネルの形成方法を提供する。ディスプレイパネルは、列方向と行方向にマトリクス配列された複数の画素を有し、各画素は、前記マトリクスの前記列方向に沿って互いに隣接して配列された第１サブピクセル、第２サブピクセル及び第３サブピクセルと、赤色発光域、緑色発光域及び青色発光域とを含む。１つの実施形態では、前記方法は、前記画素の前記赤色発光域、前記緑色発光域及び前記青色発光域を三角形に配列し、各発光域の幾何中心が前記三角形の異なる頂点に位置され、前記三角形の一辺は前記列方向と前記行方向の中の１つと実質的に平行であり、前記画素の前記マトリクスでは、前記列方向上に、任意の２つの隣接し、かつ異なる色の発光域間に距離を有する間隙を定義し、前記行方向上に、任意の２つの隣接し、かつ異なる色の発光域間に距離を有する間隙を定義し、前記両間隙の距離が実質的に又は近似して同一である。各赤色発光域、緑色発光域及び青色発光域は、赤色、緑色及び青色の異なる色の光線を放射することができる発光ダイオード素子を含む。

【００１６】

本発明のもう１つの局面は、列方向と行方向にマトリクス配列された複数の画素を含むカラー画像を表示することができるディスプレイパネルを提供する。１つの実施形態では、各画素は、第１サブピクセル、第２サブピクセル及び第３サブピクセルと、三角形に配列された第１発光域、第２発光域及び第３発光域とを含む。各発光域の幾何中心は、前記三角形の異なる頂点に位置され、前記三角形の一辺は前記列方向と前記行方向の中の１つと実質的に平行であり、各第１発光域、第２発光域及び第３発光域が独自の色の光線を発する。１つの実施形態では、各第１発光域、第２発光域及び第３発光域は、対応する赤色発光域、緑色発光域及び青色発光域の中の１つを含む。前記列方向上に配列された前記画素は、任意の２つの隣接し、かつ異なる色の発光域間に距離を有する間隙を定義し、前記

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行方向上に配列された前記画素は、任意の２つの隣接し、かつ異なる色の発光域間に距離を有する間隙を定義し、前記両間隙の距離が実質的又は近似して同一である。

【００１７】

本発明のもう１つの局面は、ディスプレイの３原色画素素子を提供する。１つの実施形態では、前記３原色画素素子は、列方向と行方向に、画素マトリクスに互いに隣接して配列された第１サブピクセル、第２サブピクセル及び第３サブピクセルと、三角形に配列され、各発光域の幾何中心が前記三角形の異なる頂点に位置され、前記三角形の一辺は前記列方向と前記列方向に実質的に垂直な前記行方向の中の１つと実質的に平行であり、前記列方向上に、任意の２つの隣接し、かつ異なる色の発光域間に第１距離を有する間隙を定義し、前記行方向上に、任意の２つの隣接し、かつ異なる色の発光域間に第２距離を有する間隙を定義し、前記第１距離と前記第２距離が実質的又は近似して同一である第１発光域、第２発光域及び第３発光域とを含む。各第１発光域、第２発光域及び第３発光域は、独自の色の光線を発する。

【００１８】

本発明は、前記３原色画素素子より製造されたフルカラーディスプレイを提供する。

【発明の効果】

【００１９】

本発明のカラーディスプレイパネル及びその形成方法によれば、従来のサブピクセルの発光域に比べ、赤色、緑色及び青色サブピクセルの発光域は、より大きい開口比を持ち、ディスプレイパネルの寿命を延ばすことができる。また、本発明は、製造プロセスの難度を低下させ、より大きなアライメント許容度を有することもでき、フルカラーＯＬＥＤディスプレイパネルの製造プロセス中に色混合が生じるのを防ぐことができる。

【発明を実施するための最良の形態】

【００２０】

本発明についての目的、特徴及び長所が一層明確に理解されるよう、以下に実施形態を例示し、図面を参照にしながら、詳細に説明する。

【００２１】

本発明に係るフルカラーディスプレイパネルは、複数の画素（ピクセル）を有し、列方向と列方向に垂直な行方向のマトリクスで形成されている。図１～３を参照するに、各画素１００は、第１サブピクセル１１０、第２サブピクセル１２０及び第３サブピクセル１３０を有し、互いに隣接して画素マトリクスの列方向に沿って配列される。各サブピクセル１１０、１２０及び１３０は、実質的に等しく、かつ列方向のサブピクセルピッチＰｘと行方向のサブピクセルピッチＰｙとを有する。列方向のサブピクセルピッチＰｘと行方向のサブピクセルピッチＰｙの両方は、サブピクセルの面積、即ちＰｘ×Ｐｙを定義する。

【００２２】

また、各画素１００は、赤色（サブピクセル）発光域１５０、緑色（サブピクセル）発光域１６０及び青色（サブピクセル）発光域１７０を有し、三角形に配列されている。各サブピクセルの発光域（１５０、１６０、１７０）の幾何中心は、三角形の異なる頂点に位置される。この三角形の一辺は列方向又は行方向に実質的に平行である。１つの実施形態では、各発光域（１５０、１６０、１７０）の幾何中心（Ｒ、Ｇ、Ｂ）は、画素１００の第１サブピクセル１１０、第２サブピクセル１２０及び第３サブピクセル１３０にそれぞれ位置される。第２サブピクセル１２０の発光域は、行方向上で、第１サブピクセル１１０と第３サブピクセル１３０の発光域と距離Ｌｙでシフトされ、発光域によって形成された三角形の一辺は列方向に実質的に平行である。また、列方向上の第１サブピクセル１１０と第３サブピクセル１３０の両発光域間の距離Ｌｘは、Ｌｙと実質的に又は近似して同一である。例えば、図１に示すように、赤色発光域１５０、緑色発光域１６０及び青色発光域１７０の幾何中心（Ｒ、Ｇ、Ｂ）は、第１サブピクセル１１０、第２サブピクセル１２０及び第３サブピクセル１３０にそれぞれ位置する。行方向上では、緑色発光域１６０は、赤色発光域１５０及び青色発光域１７０とＬｙの距離でシフトされる。この配列で

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は、赤色発光域１５０及び青色発光域１７０によって形成された三角形の一辺は、列方向に実質的に平行であり、赤色発光域１５０及び青色発光域１７０間の距離Ｌｘは、Ｌｙと実質的に又は近似して同一である。

【００２３】

もう１つの実施形態では、赤色発光域１５０、緑色発光域１６０及び青色発光域１７０の中の１つの幾何中心は、画素１００の第１サブピクセル１１０と第３サブピクセル１３０の中の１つに位置する。赤色発光域１５０、緑色発光域１６０及び青色発光域１７０の残りの幾何中心は、画素１００のもう１つの第１サブピクセル１１０と第３サブピクセル１３０に位置し、三角形の一辺を列方向に実質的に平行とされる。図２に示されるように、緑色発光域１６０の幾何中心Ｇは、第１サブピクセル１１０に位置し、赤色発光域１５０と青色発光域１７０の幾何中心（Ｒ、Ｂ）は、第３サブピクセル１３０に位置する。図３では、緑色発光域１６０の幾何中心Ｇは、第３サブピクセル１３０に位置し、赤色発光域１５０と青色発光域１７０の幾何中心（Ｒ、Ｂ）は、第１サブピクセル１１０に位置する。図２及び３に示される赤色発光域１５０、緑色発光域１６０及び青色発光域１７０の配列では、緑色発光域１６０は、列方向上で、赤色発光域１５０と青色発光域１７０は距離Ｌｘでシフトされ、赤色発光域１５０と青色発光域１７０によって形成された三角形の一辺は、行方向に実質的に平行である。Ｌｘは、行方向上に定義された赤色発光域１５０と青色発光域１７０間の距離Ｌｙと実質的に又は近似して同一である。

【００２４】

各赤色発光域１５０、緑色発光域１６０及び青色発光域１７０は、例えば、方形、長方形、円形、三角形、台形、多角形又はそれらの組み合わせの任意の幾何形状に形成することができる。好ましい幾何形状は、図１～３に示される方形又は長方形である。一般的に、各赤色発光域１５０、緑色発光域１６０及び青色発光域１７０は、列方向上に、例えば、Ｒｘ、Ｇｘ又はＢｘの幅を有し、行方向上に、例えば、Ｒｙ、Ｇｙ又はＢｙの長さを有することができる。各赤色発光域１５０、緑色発光域１６０及び青色発光域１７０の幅と長さ（ＲｘとＲｙ、ＧｘとＧｙ、ＢｘとＢｙ）は、異なるか又は実質的に同一であることができる。よって、各赤色発光域１５０、緑色発光域１６０及び青色発光域１７０の開口比（ａｐｅｒｔｕｒｅ ｒａｔｉｏ）は、（Ｒｘ×Ｒｙ）／（Ｐｘ×Ｐｙ）、（Ｇｘ×Ｇｙ）／（Ｐｘ×Ｐｙ）及び（Ｂｘ×Ｂｙ）／（Ｐｘ×Ｐｙ）で定義することができ、（Ｒｘ×Ｒｙ）、（Ｇｘ×Ｇｙ）及び（Ｂｘ×Ｂｙ）は、赤色発光域１５０、緑色発光域１６０及び青色発光域１７０の面積であり、（Ｐｘ×Ｐｙ）は、第１サブピクセル１１０、第２サブピクセル１２０及び第３サブピクセル１３０の面積である。従来のサブピクセルの発光域の配列に比べ、本発明における赤色、緑色及び青色サブピクセルの発光域の配列は、より大きい開口比を約束し、これはディスプレイパネルの寿命を延ばすのに必要である。また、この配列方式は、製造プロセスの難度を低下させ、フルカラーＯＬＥＤディスプレイパネルの製造プロセス中に色混合が生じるのを防ぐためのより大きな許容度を提供する。

【００２５】

好ましくは、各赤色発光域１５０、緑色発光域１６０及び青色発光域１７０は、赤、緑及び青等の異なる色光線を放射できる発光ダイオード素子にそれぞれ対応する。発光ダイオード素子は、ＯＬＥＤ素子又は複数の直列接続したＯＬＥＤ素子を含み、各ＯＬＥＤ素子は、トップエミッション型ＯＬＥＤ素子又はボトムエミッション型ＯＬＥＤ素子である。また、ＯＬＥＤ素子は、正常構造（ｎｏｒｍａｌ ｓｔｒｕｃｔｕｒｅ）又は逆構造（ｉｎｖｅｒｔｅｄ ｓｔｒｕｃｔｕｒｅ）を含む。

【００２６】

本発明の限定されないＯＬＥＤディスプレイパネルのサブピクセル光学素子の例示的な実施形態の配列を下記に示す。

図５は、ＯＬＥＤディスプレイパネルのカラー画素配列の実施形態である。画素マトリクスの各画素２０１は、図４（又は図１）に示されるような赤色サブピクセル発光素子（赤色発光域とも称す）２５０、緑色サブピクセル発光素子（緑色発光域とも称す）２６０

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及び青色サブピクセル発光素子（青色発光域とも称す）２７０の配列ユニットが繰り返される。図５の配列２００では、各赤色サブピクセル発光素子２５０、緑色サブピクセル発光素子２６０及び青色サブピクセル発光素子２７０は、方形の幾何形状をなす。かつ列方向上に、任意の２つの隣接し、かつ異なる色の発光素子間に距離を有する間隙を定義する。例えば、画素２０１の赤色発光域２５０と青色発光域２７０間の列方向上に距離ａ１を定義し、画素２０１の青色発光域２７０と隣接する画素２０１の赤色発光域２５０間の列方向上に距離ｂ１を定義する。ｂ１は、ａ１と同一又は近似している。また、行方向上に、任意の２つの隣接し、かつ異なる色の発光素子間に距離を有する間隙も定義する。例えば、画素２０１の赤色発光域２５０又は青色発光域２７０と緑色発光域２６０間の行方向上に距離ｃ１を定義し、画素２０１の緑色発光域２６０と隣接する画素２０１の赤色発光域２５０又は青色発光域２７０間の行方向上に距離ｄ１を定義する。ｄ１は、ｃ１と同一又は近似する。図５に示すように、ａ１及び／又はｂ１は、ｃ１及び／又はｄ１と同一又は近似する。図７は、図５のカラー画素配列２００の画素マトリクス延伸した部分である。このカラー画素配列２００は、ストライプ（ｓｔｒｉｐｅ）配列に相当する。

【００２７】

図６は、ＯＬＥＤディスプレイパネルのカラー画素配列２００Ａの実施形態である。画素マトリクスの各画素２０１は、図４（又は図１）に示されるような赤色サブピクセル発光素子２５０、緑色サブピクセル発光素子２６０及び青色サブピクセル発光素子２７０の配列ユニットが繰り返される。この実施形態では、赤色サブピクセル発光素子２５０、緑色サブピクセル発光素子２６０及び青色サブピクセル発光素子２７０は、長方形の幾何形状をなしている。図６に示されるように、配列２００Ａでは、列方向上の赤色発光域２５０（青色発光領域２７０）の幅Ｒｘ（Ｂｘ）は、行方向上の赤色発光域２５０（青色発光領域２７０）の長さＲｙ（Ｂｙ）より小さい。緑色発光域２６０では、その幅Ｇｘは、長さＧｙより大きい。同様に、例えば、ａ２とｂ２は、列方向上に、任意の２つの隣接し、かつ異なる色の発光素子間に距離を有する間隙を定義し、ａ２とｂ２は、実質的に又は近似して同一であり、ｃ２とｄ２は、行方向上に、任意の２つの隣接し、かつ異なる色の発光素子間に距離を有する間隙を定義し、ｃ２とｄ２は、実質的に又は近似して同一である。好ましくは、ａ２及びｂ２は、ｃ２及びｄ２と実質的に又は近似して同一である。

【００２８】

１つの実施形態では、間隙の距離（ａｎ、ｂｎ、ｃｎ、ｄｎ）は、下記の関係式、２０μｍ≦ａｎ、ｂｎ、ｃｎ、ｄｎ≦６０μｍ及び０．２（ａｎ＋ｂｎ＋ｃｎ＋ｄｎ）≦ａｎ、ｂｎ、ｃｎ、ｄｎ≦０．３（ａｎ＋ｂｎ＋ｃｎ＋ｄｎ）を満たす必要があり、ｎは１又は２である。

【００２９】

実際には、駆動回路は、各画素の赤色発光域２５０、緑色発光域２６０及び青色発光域２７０をそれぞれ駆動し、発光素子より対応する色の光線を放射する。駆動回路は、パッシブマトリクスアドレス（ａｄｄｒｅｓｓｉｎｇ）法又はアクティブマトリクスアドレス法で形成されることができる。パッシブマトリクスアドレス法は、パッシブマトリクスＯＬＥＤ素子に対応し、アクティブマトリクスアドレス法は、アクティブマトリクスＯＬＥＤ素子に対応する。

【００３０】

図９～１１を参照下するに、これらはＯＬＥＤディスプレイパネルのカラー画素配列の実施形態であり、画素マトリクスの各画素３０１は、図８（又は図１）に示されるような赤色サブピクセル発光素子３５０、緑色サブピクセル発光素子３６０及び青色サブピクセル発光素子３７０の配列ユニットが繰り返される。図９及び１０にそれぞれ示すように、この配列方式３００と３００Ａでは、赤色サブピクセル発光素子３５０、緑色サブピクセル発光素子３６０及び青色サブピクセル発光素子３７０は、方形の幾何形状（図９）又は長方形の幾何形状（図１０）をなしている。画素３０１の緑色発光域３６０と赤色発光域３５０（青色発光域３７０）の間は、距離ａ３（図９）又はａ４（図１０）に分けられる。同時に、列方向上には、画素３０１の赤色発光域３５０（青色発光域３７０）と隣接す

る画素３０１の緑色発光域３６０の間に距離ｂ３（図９）又はｂ４（図１０）に分けられる。ここにおいて、ａ３はｂ３と同一又は近似し（図９）、ａ４はｂ４と同一又は近似する（図１０）。行方向上には、画素３０１の赤色発光域３５０と青色発光域３７０の間に距離ｃ３（図９）又はｃ４（図１０）に分けられ、画素３０１の青色発光域３７０と隣接する画素３０１の赤色発光域３５０の間に距離ｄ３（図９）又はｄ４（図１０）に分けられる。ｃ３はｄ３と実質的に同一又は近似し（図９）、ｃ４はｄ４と実質的に同一又は近似する（図１０）。更に好ましくは、全ての距離は、ａ３、ｂ３、ｃ３及びｄ３は、実質的に同一又は近似し（図９）、ａ４、ｂ４、ｃ４及びｄ４は、実質的に同一又は近似する（図１０）。１つの実施形態では、各距離（ａｎ、ｂｎ、ｃｎ及びｄｎ）は、約２０～６０μｍであり、０．２（ａｎ＋ｂｎ＋ｃｎ＋ｄｎ）より大きく、０．３（ａｎ＋ｂｎ＋ｃｎ＋ｄｎ）より小さく、ここでｎは３又は４である。

【００３１】

図１１は、図９のカラー画素配列３００の画素マトリクスを延伸した部分である。このカラー画素配列３００は、ストライプ（ｓｔｒｉｐｅ）配列に相当する。

【００３２】

表１に、従来のストライプ形式と本発明の赤色サブピクセル素子、緑色サブピクセル素子及び青色サブピクセル素子の配列の開口比とアラインメント許容度（ａｌｉｇｎｍｅｎｔ　ｔｏｌｅｒａｎｃｅ）を示す。

【００３３】

【表１】

| 画素型式 | 開口比(%) | | | 許容度(μm) | |
|---|---|---|---|---|---|
| | 紅(R) | 緑(G) | 青(B) | X(列方向) | Y(行方向) |
| 従来のストライプ配列 | 17.8 | 13.2 | 26 | ±15 | ±15 |
| 本発明の図１２の配列 | 22.9 | 15.7 | 31.2 | ±17 | ±20 |
| 本発明の図１３の配列 | 22.9 | 14.7 | 31.2 | ±17 | ±20 |

【００３４】

図１２及び１３は、本発明の上述の実施形態に基づいた２．４インチＯＬＥＤディスプレイパネルの２つの画素レイアウト４００Ａ及び４００Ｂをそれぞれ表している。画素レイアウト４００Ａでは、画素ユニット４０１Ａは、第１サブピクセル４１０Ａ、第２サブピクセル４２０Ａ及び第３サブピクセル４３０Ａを有し、互いに隣接して配列される。画素ユニット４０１Ａは、また３角形で配列された赤色ＯＬＥＤ素子Ｒ、緑色ＯＬＥＤ素子Ｇ及び青色ＯＬＥＤ素子Ｂを含み、Ｒ、Ｇ、Ｂの３つのＯＬＥＤ素子をサブピクセル４１０Ａ、４２０Ａ及び４３０Ａにそれぞれ位置させる。同様に、画素レイアウト４００Ｂでは、画素ユニット４０１Ｂは、第１サブピクセル４１０Ｂ、第２サブピクセル４２０Ｂ及び第３サブピクセル４３０Ｂを有し、互いに隣接して配列される。画素ユニット４０１Ｂは、また、３角形で配列された赤色ＯＬＥＤ素子Ｒ、緑色ＯＬＥＤ素子Ｇ及び青色ＯＬＥＤ素子Ｂを含み、Ｒ、Ｇ、Ｂの３つのＯＬＥＤ素子をサブピクセル４１０Ｂ、４２０Ｂ及

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び４３０Ｂにそれぞれ位置させる。表１より、本発明の開口比とアラインメント許容度が従来のストライプ配列より優れている結果を明白に見ることができる。例えば、従来のストライプ形式と比べ、本発明の画素レイアウト４００Ａ及び４００Ｂのアラインメント許容度は、列方向（Ｘ）で約２μｍ増加し、行方向（Ｙ）で約５μｍ増加している。また、開口比は、平均して約２１％増加し、このため本発明のカラー画素配列によって、ディスプレイパネルの寿命を約３０％増加させることができる。

【００３５】

図１４～１７を参照するに、本発明の上述の実施形態に基づいたカラー画素の配列方式である。図１４は、図２及び３を組み合わせた配列方式のカラー画素配列ユニット５０１である。配列ユニット５０１は、２つの行方向に沿って配列し、かつ隣接した画素５０１ａと５０１ｂを含む。赤色発光域５５０、緑色発光域５６０及び青色発光域５７０は、図２に示されるように三角形で画素５０１ａに配列され、図３に示すような三角形で画素５０１ｂに配列される。図１５及び１６にそれぞれ示されるように、画素ユニット５０１は、画素マトリクスの行方向に沿って繰り返し配列され、フルカラーＯＬＥＤディルプレイパネルのカラー画素配列５００と５００Ａを完成する。カラー画素配列５００では、各赤色発光域５５０、緑色発光域５６０及び青色発光域５７０は、方形の幾何形状をなし、カラー画素配列５００Ａでは、長方形の幾何形状をなす。各赤色発光域５５０、緑色発光域５６０及び青色発光域５７０の方形又は長方形の幾何形状の面積は、実質的に同一又は異なることができる。

【００３６】

図１５及び１６に示すように、列方向上に、任意の２つの隣接し、かつ異なる色の発光素子ほぼ同一の距離に分けられ、例えば、緑色発光域５６０と赤色発光域５５０間のａ５（ａ６）と赤色発光域５５０と隣接した緑色発光域５６０間のｂ５（ｂ６）において、ａ５はｂ５と実質的に同一又は近似し（図１５）、ａ６はｂ６と実質的に同一又は近似する（図１６）。また、行方向上に、任意の２つの隣接し、かつ異なる色の発光素子間も実質的に同一の距離に分けられ、例えば、赤色発光域５５０と青色発光域５７０間のｃ５（ｃ６）と青色発光域５７０と隣接する緑色発光域５６０間のｄ５（ｄ６）では、ｃ５はｄ５と実質的に同一又は近似し（図１５）、ｃ６はｄ６と実質的に同一又は近似する（図１６）。更に、好ましくは、列方向及び行方向に分けられた距離は、実質的に近似して同一であり、例えば、全ての距離ａ５、ｂ５、ｃ５及びｄ５は、実質的に又は近似して同一であり（図１５）又はａ６、ｂ６、ｃ６及びｄ６は、実質的に又は近似して同一である（図１６）。１つの実施形態では、各距離（ａｎ、ｂｎ、ｃｎ及びｄｎ）は、実質的に２０～６０μｍであり、０．２（ａｎ＋ｂｎ＋ｃｎ＋ｄｎ）≦ａｎ、ｂｎ、ｃｎ、ｄｎ≦０．３（ａｎ＋ｂｎ＋ｃｎ＋ｄｎ）であり、ここでｎは５又は６である。

【００３７】

図１７は、図１５に示されるＯＬＥＤディスプレイパネルのカラー画素配列５００の画素マトリクスを延伸した部分である。このカラー画素配列５００は、三角形（ｄｅｌｔａ）配列に相当する。

【００３８】

本発明の上述した各実施形態では、ＯＬＥＤディスプレイパネルの赤、緑及び青色発光域は、三角形で配列され、列方向上に、任意の２つの隣接し、かつ異なる色の発光素子間に第１距離を有する間隙を定義し、行方向上に、任意の２つの隣接し、かつ異なる色の発光素子間に第２距離を有する間隙を定義する。第１及び第２距離は、実質的に又は近似して同一である。この発光素子のサブピクセルの配列方式は、ＯＬＥＤディスプレイパネルの製造プロセス、特にシャドウマスクプロセス、スタンダード製造プロセスのアラインメントの困難度を低下させることが確実にできる。

【００３９】

本発明は、またディスプレイパネルでカラー画像を表示する方法を提供する。ディスプレイパネルは、複数の列方向と行方向に沿って配列された画素より構成される。各画素は、互いに隣接して画素マトリクスの列方向に沿って配列される第１サブピクセル、第２サ

ブピクセル及び第３サブピクセルと赤色発光域、緑色発光域及び青色発光域を含む。１つの実施形態では、前記方法は、各発光域の幾何中心が三角形の異なる頂点に位置される方式で、画素の赤、緑及び青色発光域を三角形に配置するステップを含み、三角形の一辺は列方向と行方向の中の１つに実質的に平行である。よって、複数の画素では、列方向上に、任意の２つの隣接し、かつ異なる色の発光素子間に距離を有する間隙を定義し、行方向上に、任意の２つの隣接し、かつ異なる色の発光素子間に距離を有する間隙を定義する。両間隙の距離は、実質的に又は近似して同一である。

【００４０】

また、本発明の実施形態は、上述の赤色、緑色、青色等のカラーサブピクセル又は発光域を限定するものではなく、その他の色、例えば、茶色、黄色、ピンク色、紫色、赤み掛かったオレンジ色、オレンジ色、青緑色、サーモンピンク、藤色又はその他の色等を選択的に用いることもできる。

【００４１】

以上、本発明の好適な実施形態を例示したが、これは本発明を限定するものではなく、本発明の精神及び範囲を逸脱しない限りにおいては、当業者であれば行い得る少々の変更や修飾を付加することは可能である。従って、本発明が保護を請求する範囲は、特許請求の範囲を基準とする。

【産業上の利用可能性】

【００４２】

本発明は、従来のサブピクセルの発光域に比べ、より大きい開口比を持ち、ディスプレイパネルを長寿命化することができる。また、本発明によって、製造プロセスの難度を低下させ、より大きなアライメント許容度を有することもでき、フルカラーＯＬＥＤディスプレイパネルの製造プロセス中に色混合が生じるのを防止できる。

従って、本発明は、カラー画像表示用ディスプレイの分野において、好適に利用できる。

【図面の簡単な説明】

【００４３】

【図１】図１は、本発明に用いられる赤、緑及び青色発光域の配列ユニットの第１実施形態を示す図である。

【図２】図２は、本発明に用いられる赤、緑及び青色発光域の配列ユニットの第２実施形態を示す図である。

【図３】図３は、本発明に用いられる赤、緑及び青色発光域の配列ユニットの第３実施形態を示す図である。

【図４】図４は、本発明に用いられる赤、緑及び青色発光域の配列ユニットの第４実施形態を示す図である。

【図５】図５は、図４の配列ユニットを用いた配列方式の１実施形態を示す図である。

【図６】図６は、図４の配列ユニットを用いた配列方式の他の実施形態を示す図である。

【図７】図７は、図５の延伸部分を示す図である。

【図８】図８は、本発明に用いられる赤、緑及び青色発光域の配列ユニットの第５実施形態を示す図である。

【図９】図９は、図８の配列ユニットを用いた配列方式の１実施形態を示す図である。

【図１０】図１０は、図８の配列ユニットを用いた配列方式の他の実施形態を示す図である。

【図１１】図１１は、図９の延伸部分を示す図である。

【図１２】図１２は、本発明の１実施形態を示し、赤、緑及び青色発光域の配列のレイアウトを表す図である。

【図１３】図１３は、本発明の他の実施形態を示し、赤、緑及び青色発光域の配列のレイアウトを表す図である。

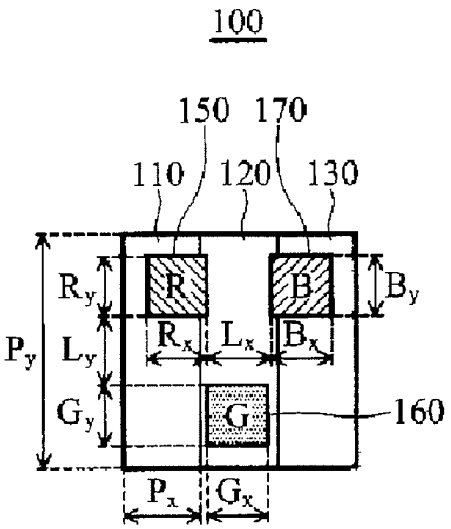
【図１４】図１４は、本発明に用いられる赤、緑及び青色発光域の配列ユニットの第６実施形態を示す図である。

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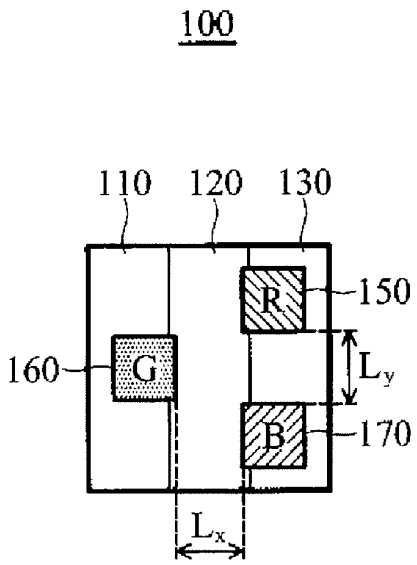
【図１５】図１５は、図１４の配列ユニットを用いた配列方式の１実施形態を示す図である。
【図１６】図１６は、図１４の配列ユニットを用いた配列方式の他の実施形態を示す図である。
【図１７】図１７は、図１５の延伸部分を示す図である。
【図１８】図１８は、従来の赤、緑及び青色発光域のストライプ配列を示す図である。
【符号の説明】
【００４４】
１００、２０１、３０１、４０１Ａ、４０１Ｂ、５０１ａ、５０１ｂ　画素
１１０、４１０Ａ、４１０Ｂ　第１画素
１２０、４２０Ａ、４２０Ｂ　第２画素
１３０、４３０Ａ、４３０Ｂ　第３画素
２００、２００Ａ、３００、３００Ａ、４００Ａ、４００Ｂ、５００、５００Ａ　画素レイアウト
１５０、２５０、３５０、５５０　赤色発光域
１６０、２６０、３６０、５６０　緑色発光域
１７０、２７０、３７０、５７０　青色発光域
５０１　画素配列ユニット
ａ１、ａ２、ａ３、ａ４、ａ５、ａ６　列方向上の同一の画素が隣接し、かつ異なる色の発光素子間の距離
ｂ１、ｂ２、ｂ３、ｂ４、ｂ５、ｂ６　列方向上の隣接した画素が隣接し、かつ異なる色の発光素子間の距離
ｃ１、ｃ２、ｃ３、ｃ４、ｃ５、ｃ６　行方向上の同じ画素が隣接し、かつ異なる色の発光素子間の距離
ｄ１、ｄ２、ｄ３、ｄ４、ｄ５、ｄ６　行方向上の隣接した画素が隣接し、かつ異なる色の発光素子間の距離
Ｌｘ　列方向上の発光域のシフト距離
Ｌｙ　列方向上の発光域のシフト距離
Ｐｘ　列方向のサブピクセルの距離
Ｐｙ　行方向のサブピクセルの距離
Ｒ　赤色発光域の幾何中心（赤色ＯＬＥＤ域）
Ｇ　緑色発光域の幾何中心（緑色ＯＬＥＤ域）
Ｂ　青色発光域の幾何中心（青色ＯＬＥＤ域）
Ｒｘ　赤色発光域の列方向幅
Ｇｘ　緑色発光域の列方向幅
Ｂｘ　青色発光域の列方向幅
Ｒｙ　赤色発光域の行方向幅
Ｇｙ　緑色発光域の行方向幅
Ｂｙ　青色発光域の行方向幅
６００　画素マトリクス
６０１　画素
６１０　第１サブピクセル
６２０　第２サブピクセル
６３０　第３サブピクセル
６５０　赤色サブピクセル素子
６６０　緑色サブピクセル素子
６７０　青色サブピクセル素子
Ｌｒ　列方向上の２つの隣接したサブピクセル素子間の距離
Ｌｃ　行方向上の２つの隣接したサブピクセル素子間の距離

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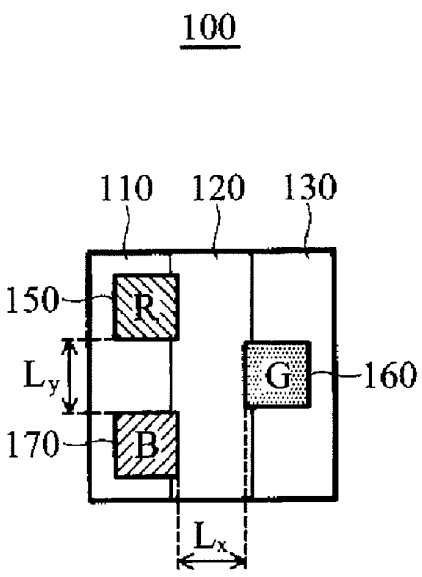
【図１】


100
150
170
110
120
130
$R_y$
$B_y$
$P_y$
$L_y$
$G_y$
$R_x$
$L_x$
$B_x$
R
B
G
160
$P_x$
$G_x$

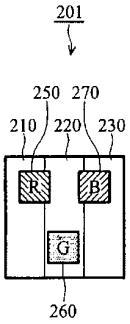
【図２】


100
110
120
130
R
150
160
G
$L_y$
B
170
$L_x$

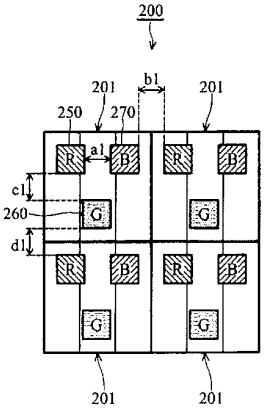
【図３】


100
110
120
130
150
R
G
160
$L_y$
170
B
$L_x$

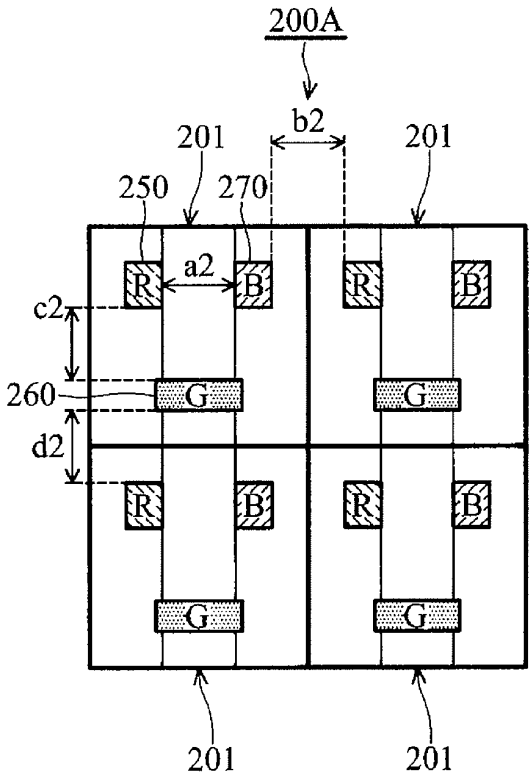
【図４】


201
250
270
210
220
230
R
B
G
260

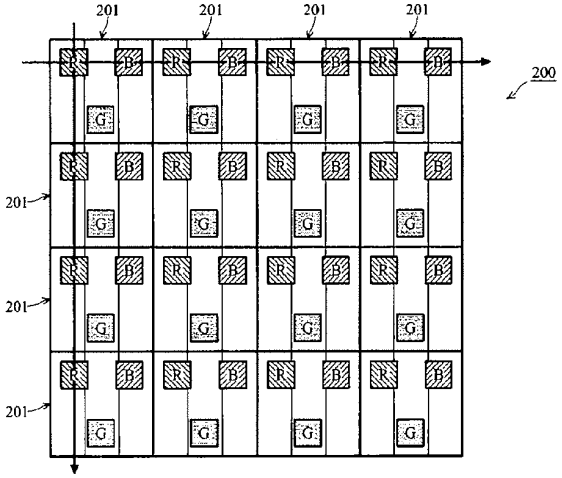
【図５】


200
201
b1
201
250
270
a1
c1
260
d1
R
B
G
201
201

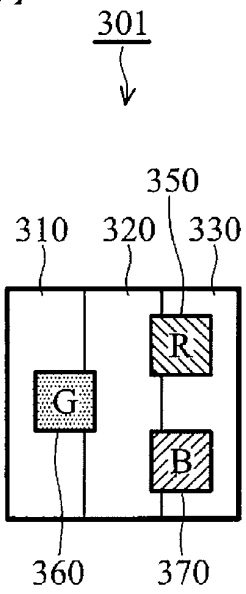
【図６】


200A
b2
201
201
250
270
a2
c2
260
d2
R
B
G
201
201

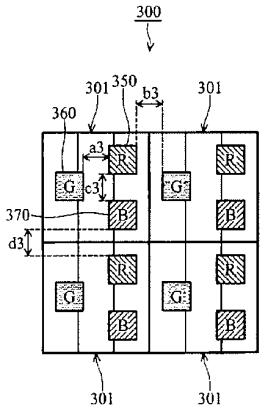
【図７】


201
201
201
201
200
201
201
201
R
B
G

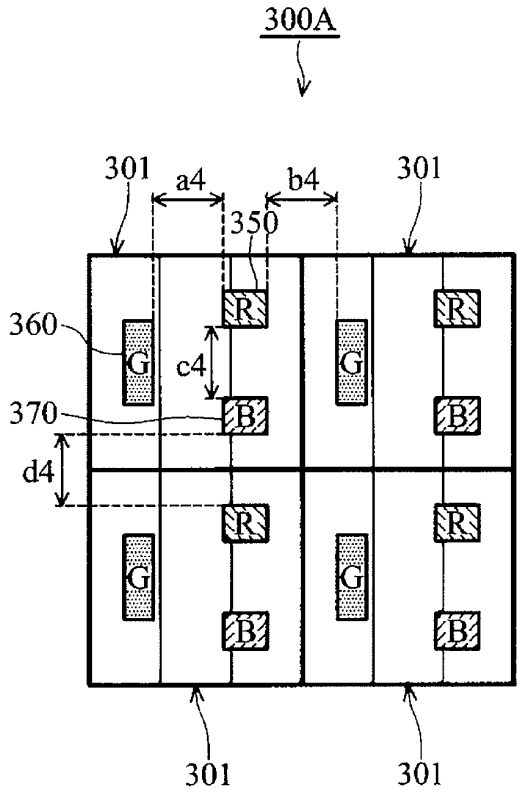
【図８】


301
350
310
320
330
R
G
B
360
370

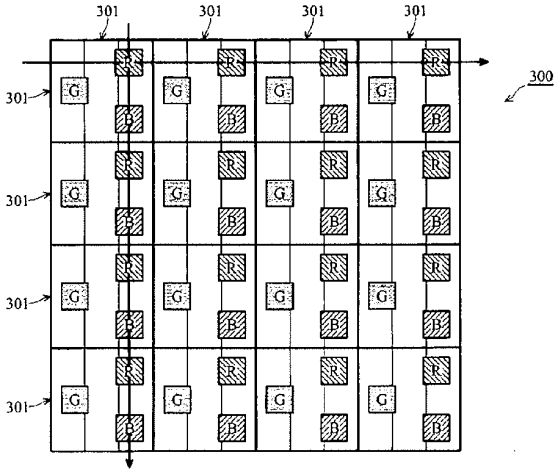
【図９】


300
301
350
b3
301
360
a3
c3
370
d3
R
G
B
301
301

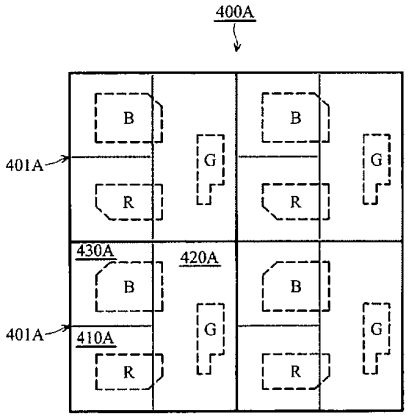
【図１０】



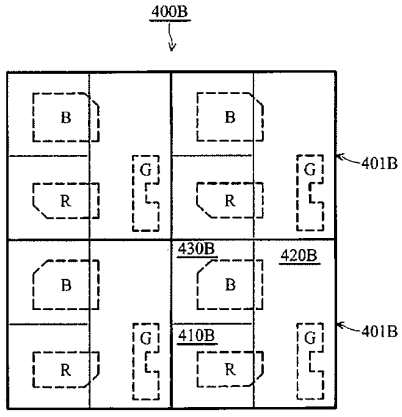

【図１１】



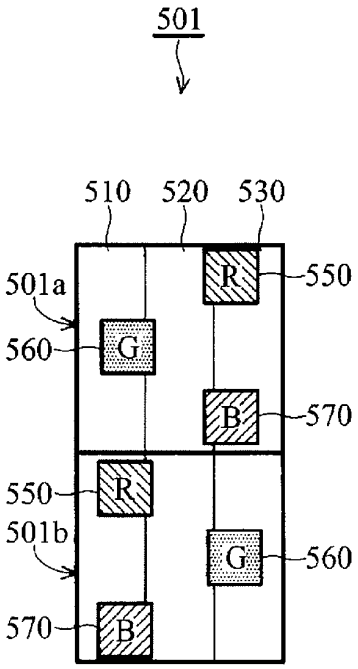

【図１２】



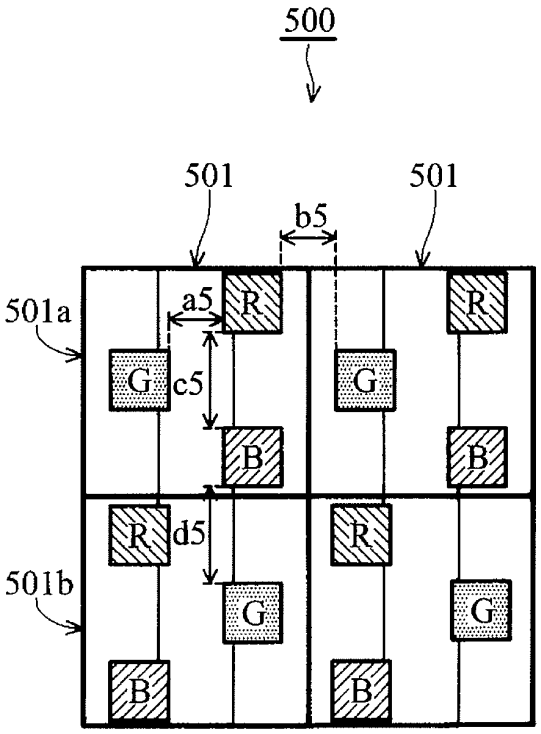

【図１３】



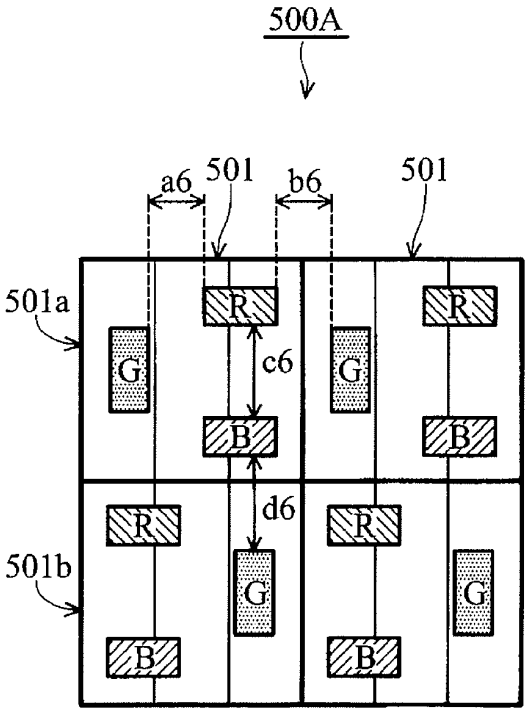
【図１４】



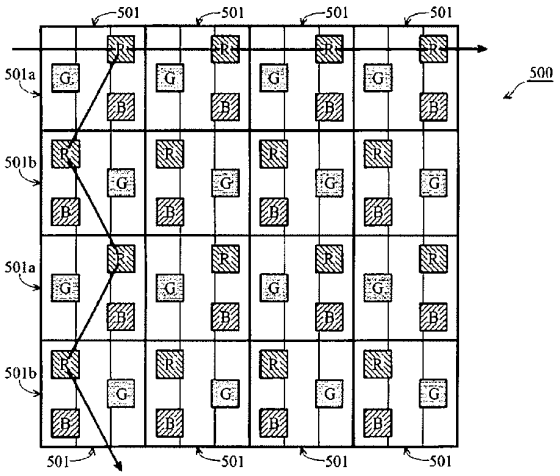

【図１５】



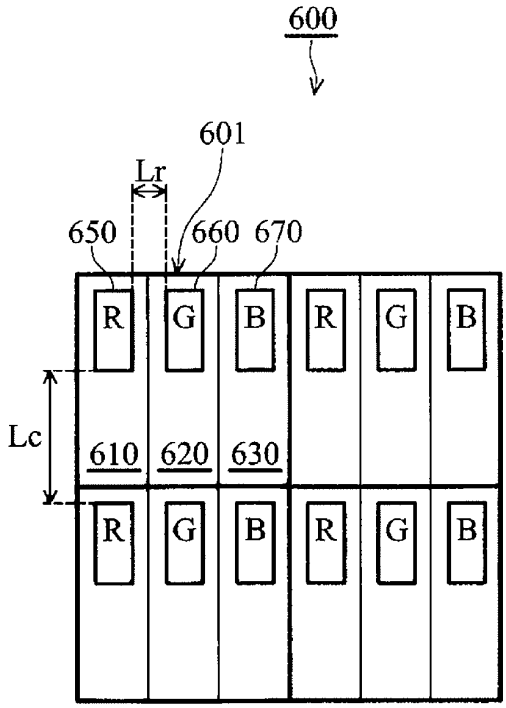

【図１６】




【図１７】



【図１８】



# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 16725674 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Youg E. Jeon/Diane Goss |
| **Filer Authorized By:** | Jun-Youg E. Jeon |
| **Attorney Docket Number:** | 69657/P849 |
| **Receipt Date:** | 29-AUG-2013 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 17:20:07 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 69657ids.pdf | 90846<br>46393f1e87e882720ebaf7efb82e5a6119951541 | yes | 3 |

| | Multipart Description/PDF files in .zip description | | | | |
|---|---|---|---|---|---|
| | **Document Description** | | **Start** | **End** | |
| | Transmittal Letter | | 1 | 2 | |
| | Information Disclosure Statement (IDS) Form (SB08) | | 3 | 3 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Foreign Reference | GB_110.pdf | 929823<br>fa309d79bc18e2b9f200eaebb66cca41e5398b2d | no | 29 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Foreign Reference | JP_891.pdf | 761296<br>5aeb151ab3da80ca5ed22307bbc3c3342fcceae1 | no | 11 |
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| **Information:** | | | | | |
| 4 | Foreign Reference | JP_182.pdf | 929083<br>0f13518a13163619d39112e7f0714c4326789f46 | no | 18 |
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| **Information:** | | | | | |
| 5 | Foreign Reference | JP_521.pdf | 1108175<br>5fd3e9c33ce220673dde42373cd5f2d5f7d0537c | no | 20 |
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| **Information:** | | | | | |
| 6 | Non Patent Literature | EP_SearchRpt.pdf | 1025657<br>5f94143b5e74656a318f927ffd2b37492904d894 | no | 6 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 4844880 | | |

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**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on August 29, 2013 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Diane L. Goss

| | | |
|---|---|---|
| Inventor | : Sang-Shin Lee | Confirmation No. 4264 |
| Application No. | : 13/614,197 | |
| Filed | : September 13, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| Grp./Div. | : 2691 | |
| Examiner | : Amr A. Awad | |
| Docket No. | : 69657/S1437 | |

**INFORMATION DISCLOSURE STATEMENT**
**37 CFR § 1.97(b)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
August 29, 2013

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is FORM PTO/SB/08A/B listing the references that are known to applicant. Copies of each of the non-U.S. listed references are enclosed. This filing is timely because it is made during one of the periods described in 37 CFR § 1.97(b).

It is respectfully requested that the listed references be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of FORM PTO/SB/08A/B be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
CHRISTIE, PARKER & HALE, LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/dg
Enclosures: PTO/SB/08A/B, w/references

DLG PAS1254687.1-*-08/29/13 9:24 AM



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UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NUMBER | FILING or 371(c) DATE | GRP ART UNIT | FIL FEE REC'D | ATTY.DOCKET.NO | TOT CLAIMS | IND CLAIMS |
|---|---|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | 2691 | 1250 | 69657/P849 | 20 | 1 |

**CONFIRMATION NO. 4264**

**REPLACEMENT FILING RECEIPT**

23363
CHRISTIE, PARKER & HALE, LLP
PO BOX 29001
Glendale, CA 91209-9001




Date Mailed: 05/06/2013

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

**Inventor(s)**

Sang-Shin Lee, Yongin-si, KOREA, REPUBLIC OF;

**Applicant(s)**

Sang-Shin Lee, Yongin-si, KOREA, REPUBLIC OF;

**Power of Attorney:** The patent practitioners associated with Customer Number 23363

**Domestic Applications for which benefit is claimed - None.**
*A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.*

**Foreign Applications** (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
REPUBLIC OF KOREA 10-2012-0022967 03/06/2012

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

**If Required, Foreign Filing License Granted:** 09/25/2012
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/614,197**



Petitioner Ex 1015, p. 891
BOE et al. v. Samsung, IPR2023-00988

**Projected Publication Date:** 09/12/2013

**Non-Publication Request:** No

**Early Publication Request:** No

**Title**

PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

**Preliminary Class**

345

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:**

## PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).



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## LICENSE FOR FOREIGN FILING UNDER

## Title 35, United States Code, Section 184

## Title 37, Code of Federal Regulations, 5.11 & 5.15

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The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

**NOT GRANTED**

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

---


## *SelectUSA*

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

Doc Code: PD.TO.AUTH
Document Description: Authorization to access Appl. by Trilateral Office

PTO/SB/39 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

# AUTHORIZATION TO PERMIT ACCESS TO APPLICATION BY PARTICIPATING OFFICES

Send completed form to: Commissioner for Patents
P.O. Box 1450, Alexandria, VA 22313-1450

| COMPLETE IF KNOWN | |
|---|---|
| Application Number | 13/614,197 |
| Filing Date | September 13, 2012 |
| First Named Inventor | Sang-Shin Lee |
| Attorney Docket Number | 69657/P849 |
| Title (Required) | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |

The undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the above-identified patent application is filed access to the above-identified patent application. See 37 CFR 1.14(c) and (h).

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the above-identified application with respect to: 1) the above-identified patent application-as-filed; 2) any foreign application to which the above-identified patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the above-identified patent application; and 3) any U.S. application-as-filed from which benefit is sought in the above-identified patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing the Authorization to Permit Access to Application by Participating Offices.

This written authorization should be submitted prior to the filing of a subsequent foreign application, in which priority is claimed to the above-identified patent application, with any intellectual property office (e.g., the EPO, JPO, KIPO, or DAS Accessing Office). However, if applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the above-identified patent application is filed to have access to the above-identified patent application, this written authorization should not be filed.

No fee will be charged under 37 CFR 1.19(b)(1) for providing a participating intellectual property office with an electronic copy of the above-identified patent application.

**This form must be signed by an authorized party in accordance with 37 CFR 1.14(c).**

| | |
|---|---|
|  Signature | May 2, 2013 Date |
| Jun-Young E. Jeon Printed or Typed Name | 626-795-9900 Telephone Number |
| Attorney of Record Title | 43693 Registration Number, if applicable |

This collection of information is required by 37 CFR 1.14(h). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process an application). Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 15680114 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Youg E. Jeon/Christina Jauregui |
| **Filer Authorized By:** | Jun-Youg E. Jeon |
| **Attorney Docket Number:** | 69657/P849 |
| **Receipt Date:** | 02-MAY-2013 |
| **Filing Date:** | 13-SEP-2012 |
| **Time Stamp:** | 19:57:57 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | no |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Authorization to access Appl. by Trilateral Office | 69657_SB39.pdf | 43929<br>197287761b06054a06950b500a8a7a9dd8c f5056 | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |

| | |
|---|---|
| **Total Files Size (in bytes):** | 43929 |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NUMBER | FILING or 371(c) DATE | GRP ART UNIT | FIL FEE REC'D | ATTY.DOCKET.NO | TOT CLAIMS | IND CLAIMS |
|---|---|---|---|---|---|---|
| 13/614,197 | 09/13/2012 | 2628 | 1250 | 69657/P849 | 20 | 1 |

**CONFIRMATION NO. 4264**

23363
CHRISTIE, PARKER & HALE, LLP
PO BOX 29001
Glendale, CA 91209-9001

**FILING RECEIPT**

*OC000000056759067*

Date Mailed: 09/28/2012

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

**Inventor(s)**

Sang-Shin Lee, Yongin-si, KOREA, REPUBLIC OF;

**Applicant(s)**

Sang-Shin Lee, Yongin-si, KOREA, REPUBLIC OF;

**Power of Attorney:** The patent practitioners associated with Customer Number 23363

**Domestic Priority data as claimed by applicant**

**Foreign Applications** (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
REPUBLIC OF KOREA 10-2012-0022967 03/06/2012

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

**If Required, Foreign Filing License Granted:** 09/25/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/614,197**

**Projected Publication Date:** 09/12/2013

**Non-Publication Request:** No

**Early Publication Request:** No

**Title**

PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

**Preliminary Class**

345

## PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

## LICENSE FOR FOREIGN FILING UNDER

## Title 35, United States Code, Section 184

## Title 37, Code of Federal Regulations, 5.11 & 5.15

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set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

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**NOT GRANTED**

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## PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/614,197

### APPLICATION AS FILED - PART I

| FOR | (Column 1) NUMBER FILED | (Column 2) NUMBER EXTRA | SMALL ENTITY RATE($) | SMALL ENTITY FEE($) | OR | OTHER THAN SMALL ENTITY RATE($) | OTHER THAN SMALL ENTITY FEE($) |
|---|---|---|---|---|---|---|---|
| BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | | | N/A | 380 |
| SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | | | N/A | 620 |
| EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | | | N/A | 250 |
| TOTAL CLAIMS (37 CFR 1.16(i)) | 20 minus 20 = | * | | | OR | x 60 = | 0.00 |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | 1 minus 3 = | * | | | | x 250 = | 0.00 |
| APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | | | | 0.00 |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | | | | 0.00 |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | | | TOTAL | 1250 |

### APPLICATION AS AMENDED - PART II

| | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | SMALL ENTITY RATE($) | SMALL ENTITY ADDITIONAL FEE($) | OR | OTHER THAN SMALL ENTITY RATE($) | OTHER THAN SMALL ENTITY ADDITIONAL FEE($) |
|---|---|---|---|---|---|---|---|---|---|---|
| AMENDMENT A | Total (37 CFR 1.16(i)) | * | Minus | ** | = | x = | | OR | x = | |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = | x = | | OR | x = | |
| | Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | OR | | |
| | | | | | | TOTAL ADD'L FEE | | OR | TOTAL ADD'L FEE | |

| | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | SMALL ENTITY RATE($) | SMALL ENTITY ADDITIONAL FEE($) | OR | OTHER THAN SMALL ENTITY RATE($) | OTHER THAN SMALL ENTITY ADDITIONAL FEE($) |
|---|---|---|---|---|---|---|---|---|---|---|
| AMENDMENT B | Total (37 CFR 1.16(i)) | * | Minus | ** | = | x = | | OR | x = | |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = | x = | | OR | x = | |
| | Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | OR | | |
| | | | | | | TOTAL ADD'L FEE | | OR | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

**UTILITY PATENT APPLICATION TRANSMITTAL**
**(Only for new nonprovisional applications under 37 CFR 1.53(b))**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on September 13, 2012 at or before 11:59 p.m. Eastern Standard Time under the Rules of 37 CFR § 1.10.*

Sandra Medina
Signature

Docket No. : 69657/P849
Inventor(s) : Sang-Shin Lee
Title : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

**ADDRESS TO:** Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

September 13, 2012

1. __X__ **FEE TRANSMITTAL FORM**

2. **IF A CONTINUING APPLICATION**
   _____ This application is a _____ of patent application No. _____.

   Prior application information: Examiner _____; Group Art Unit: _____.

   _____ This application claims the benefit of Provisional Application No. _____ pursuant to 35 U.S.C. §119(e) and 37 CFR §1.78(a)(4).

3. **APPLICATION COMPRISED OF**

   **Specification**
   __20__ Specification, claims and Abstract (total pages)

   **Drawings**
   __5__ Sheets of formal drawing(s) (FIGS. 1 to 5)

   **Declaration and Power of Attorney**
   __X__ Newly executed
   _____ Unexecuted declaration
   _____ Copy from a prior application (37 CFR 1.63(d))(for continuation and divisional)

4. _____ **Microfiche Computer Program** *(Appendix)*

5. _____ **Nucleotide and/or Amino Acid Sequence Submission** *(if applicable, all necessary)*
   _____ Computer Readable Copy

**UTILITY PATENT APPLICATION TRANSMITTAL**
**(Only for new nonprovisional applications under 37 CFR 1.53(b))**

**Docket No.: 69657/P849**

_____ Paper Copy (identical to computer copy)
_____ Statement verifying identity of above copies

6. **APPLICANT(S) STATUS UNDER 37 CFR §1.27**
_____ Applicant(s) and any others associated with it/them under §1.27(a) are a SMALL ENTITY

7. **ALSO ENCLOSED ARE**
_____ Request and Certificate under 35 U.S.C. §122(b)(2)(B)(i) **Request for Non-Publication)**
_____ Preliminary Amendment
_____ Includes "Cross-Reference to Related Applications"
_____ A Petition for Extension of Time for the parent application and the required fee are being filed concurrently herewith.
_____ This application is owned by _____ pursuant to an Assignment recorded at Reel _____, Frame _____
__X__ Information Disclosure Statement (IDS)/PTO/SB/08A/B
__X__ Copies of IDS Citations
_____ Certified copy of Priority Document(s) (*paper filing only, if foreign priority is claimed)*
_____ English Translation Document *(if applicable)*
_____ Return Receipt Postcard (MPEP 503) (should be specifically itemized).
__X__ Other: Application Data Sheet

8. **DIRECT ALL CORRESPONDENCE TO: CUSTOMER NUMBER 23363**

Respectfully submitted,

CHRISTIE, PARKER & HALE, LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

***CHRISTIE, PARKER & HALE, LLP, P.O. BOX 29001, GLENDALE, CA 91209-9001***



Petitioner Ex 1015, p. 902
BOE et al. v. Samsung, IPR2023-00988

**FEE TRANSMITTAL**
**UTILITY PATENT APPLICATION**

**DATE: September 13,2012**

Docket No. : 69657/P849 Duplicate __
Inventor(s) : Sang-Shin Lee
Title : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

## FEE CALCULATION

| CLAIMS AS FILED | | | | | |
|---|---|---|---|---|---|
| | Number Filed | Number Extra | Small Entity Rate | Large Entity Rate | Fee |
| TOTAL CLAIMS | 20 – 20 | = 0 | 0 * $30.00 | 0 * $60.00 | $0.00 |
| INDEPENDENT CLAIMS | 1 – 3 | = 0 | 0 * $125.00 | 0 * $250.00 | $0.00 |
| MULTIPLE-DEPENDENT CLAIMS FEE | | | $225.00 | $450.00 | $0.00 |

| BASIC FILING, SEARCH, AND EXAMINATION FEES | | | |
|---|---|---|---|
| | Small Entity Rate | Large Entity Rate | Fee |
| BASIC FILING FEE | $95.00 | $380.00 | $380.00 |
| SEARCH FEE | $310.00 | $620.00 | $620.00 |
| EXAMINATION FEE | $125.00 | $250.00 | $250.00 |

| APPLICATION SIZE FEE | | | | | | |
|---|---|---|---|---|---|---|
| EFS Paper Size Equivalent | Total Sheets | Extra Sheets | Number of each additional 50 or fraction thereof (round up to whole number) | Small Entity Rate | Large Entity Rate | Fee |
| 25 *.75 | = 19 – 100 | = 0/50 | = 0 | 0 * $155.00 | 0 * $310.00 | $0.00 |

| NON-ELECTRONIC FILING FEE | | | |
|---|---|---|---|
| | Small Entity Rate | Large Entity Rate | Fee |
| NON-ELECTRONIC FILING FEE | $200.00 | $400.00 | $0.00 |
| | | TOTAL AMOUNT OF FEES | $1,250.00 |
| List Independent Claims: 1 | | | |

## METHOD OF PAYMENT

__X__ Submitted herewith is the fee of $1,250.00.

__X__ The Commissioner is hereby authorized to charge any fees under 37 CFR 1.16 and 1.17 which may be required during the **entire pendency** of the application to Deposit Account No. 03-1728. Please show our docket number with any charge or credit to our Deposit Account.

Respectfully submitted,
CHRISTIE, PARKER & HALE, LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/smm

PTO/SB/14 (11-08)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | 69657/P849 |
|---|---|---|
| | Application Number | |
| Title of Invention | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

## Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

## Applicant Information:

**Applicant 1** Remove

**Applicant Authority** ◉ Inventor ○ Legal Representative under 35 U.S.C. 117 ○ Party of Interest under 35 U.S.C. 118

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|---|---|---|---|---|
| | Sang-Shin | | Lee | |

**Residence Information (Select One)** ○ US Residency ◉ Non US Residency ○ Active US Military Service

| City | Yongin-si | Country Of Residence[i] | KR |
|---|---|---|---|
| Citizenship under 37 CFR 1.41(b)[i] | KR | | |

**Mailing Address of Applicant:**

| Address 1 | 95, Samsung 2 Ro, Giheung-gu | | |
|---|---|---|---|
| Address 2 | | | |
| City | Yongin-si, Gyeonggi-do | State/Province | |
| Postal Code | | Country[i] | KR |

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

## Correspondence Information:

**Enter either Customer Number or complete the Correspondence Information section below.**
**For further information see 37 CFR 1.33(a).**

☐ **An Address is being provided for the correspondence Information of this application.**

| Customer Number | 23363 | | |
|---|---|---|---|
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## Application Information:

| Title of the Invention | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | | |
|---|---|---|---|
| Attorney Docket Number | 69657/P849 | Small Entity Status Claimed | ☐ |
| Application Type | Nonprovisional | | |
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| Suggested Technology Center (if any) | | | |
| Total Number of Drawing Sheets (if any) | 5 | Suggested Figure for Publication (if any) | |

PTO/SB/14 (11-08)
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| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | 69657/P849 |
|---|---|---|
| | Application Number | |
| Title of Invention | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |

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| Prior Application Status | | | Remove |
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| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) |
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| Application Number | Country [i] | Parent Filing Date (YYYY-MM-DD) | Priority Claimed |
|---|---|---|---|
| 10-2012-0022967 | KR | 2012-03-06 | ◉ Yes ○ No |

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | 69657/P849 |
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| | Application Number | |
| Title of Invention | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |

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| **Signature** | /Jun-Young E. Jeon/ | | | Date (YYYY-MM-DD) | 2012-09-12 |
|---|---|---|---|---|---|
| First Name | Jun-Young E. | Last Name | Jeon | Registration Number | 43693 |

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# PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE

## CROSS-REFERENCE TO RELATED PATENT APPLICATION

**[0001]** This application claims priority to and the benefit of Korean Patent Application No. 10-2012-0022967, filed in the Korean Intellectual Property Office on March 6, 2012, the entire content of which is incorporated herein by reference.

## BACKGROUND

### 1. Field

**[0002]** Aspects of embodiments of the present invention relate generally to a pixel arrangement structure of an organic light emitting diode (OLED) display.

### 2. Description of the Related Art

**[0003]** A display device is a device that displays an image. Recently, an OLED display has been drawing attention. The OLED display has a self-luminous characteristic. Because the OLED display does not need a separate light source, unlike a liquid crystal display, it can have a relatively smaller thickness and weight than liquid crystal displays. In addition, the OLED display exhibits high-quality characteristics such as low power consumption, high luminance, high response speed, etc.

**[0004]** In general, the OLED display includes a plurality of pixels for emitting light of different colors. The plurality of pixels emit light to display an image. Here, the pixel refers to a minimum unit for displaying the images. For instance, there may be a gate line, a data line, and a power line such as a driving power line to drive each pixel. In addition, there may be an insulation layer such as a pixel definition layer to define an area and a shape of each pixel. Further, each pixel may be positioned between its neighboring pixels.



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**[0005]** An organic emission layer included in the pixel of an OLED display may be deposited and formed by using a mask such as a fine metal mask (FMM). When reducing a gap between the neighboring pixels to obtain a high aperture ratio of the pixel, deposition reliability may be deteriorated. On the other hand, when increasing the gap between the pixels to improve the deposition reliability, the aperture ratio of the pixel may be deteriorated.

**[0006]** The above information disclosed in this Background section is only for enhancement of understanding of the background of the invention. Therefore, it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

## SUMMARY

**[0007]** Aspects of embodiments of the present invention relate generally to a pixel arrangement structure of an OLED display. More particularly, aspects relate to a pixel arrangement structure of an OLED display for displaying images by emitting light through a plurality of pixels. An exemplary embodiment of the present invention provides a pixel arrangement structure for an OLED display having an improved aperture ratio of a pixel while efficiently setting up a gap between the pixels.

**[0008]** According to an exemplary embodiment of the present invention, a pixel arrangement structure of an organic light emitting diode display is provided. The pixel arrangement structure includes: a first pixel having a center coinciding with a center of a virtual square; a second pixel separated from the first pixel and having a center at a first vertex of the virtual square; and a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square.

**[0009]** The second pixel may include a pair of second pixels. The second pixels may be separated from each other by the first pixel.



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**[0010]** The third pixel may include a pair of third pixels. The third pixels may be separated from each other by the first pixel.

**[0011]** The second pixels and the third pixels may enclose the first pixel in the virtual square.

**[0012]** The first pixel, the second pixels, and the third pixels may have polygonal shapes. The second pixels and the third pixels may have a larger area than the first pixel.

**[0013]** The first pixel may have a quadrilateral shape. The second pixels and the third pixels may have hexagonal or octagonal shapes.

**[0014]** The second pixels and the third pixels may have octagonal shapes.

**[0015]** The second pixels and the third pixels may have a same area. A distance between the first pixel and the second pixels, a distance between the first pixel and the third pixels, and a distance between the second pixels and the third pixels may be a same first length.

**[0016]** The first pixel may include a plurality of first pixels. The plurality of first pixels may have a same quadrilateral shape. A distance between neighboring ones of the plurality of first pixels may be a second length that is longer than the first length.

**[0017]** The second pixels may have a larger area than the third pixels. A distance between the second pixels and the third pixels may be a first length. A distance between the first pixel and the second pixels, and a distance between the first pixel and the third pixels may be a same second length.

**[0018]** The first pixel may include a plurality of first pixels. The plurality of first pixels may have a same quadrilateral shape. A distance between neighboring ones of the plurality of first pixels may be a third length that is longer than the first length and the second length.

**[0019]** The first pixel may include a plurality of first pixels. Neighboring ones of the plurality of first pixels may have quadrilateral shapes that are symmetrical to each other.



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A distance between the neighboring ones of the plurality of first pixels may be a third length that is longer than the first length and the second length.

**[0020]** The first pixel may include a plurality of first pixels. Neighboring ones of the plurality of first pixels may have quadrilateral shapes that are symmetrical to each other.

**[0021]** The second pixels may have a larger area than the third pixels.

**[0022]** The third pixels may have a larger area than the second pixels.

**[0023]** The first pixel, the second pixel, and the third pixel may be configured to emit different color lights.

**[0024]** The first pixel, the second pixel, and the third pixel may be configured to emit green light, blue light, and red light, respectively.

**[0025]** According to an exemplary embodiment of the present invention, the pixel arrangement structure of the OLED display improves the aperture ratio of the pixel while efficiently setting up the gap between the pixels.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0026]** FIG. 1 is a view of a pixel arrangement structure of an OLED display according to a first exemplary embodiment.

**[0027]** FIG. 2 is a view of a pixel arrangement structure of an OLED display according to a second exemplary embodiment.

**[0028]** FIG. 3 is a view of a pixel arrangement structure of an OLED display according to a third exemplary embodiment.

**[0029]** FIG. 4 is a view of a pixel arrangement structure of an OLED display according to a fourth exemplary embodiment.

**[0030]** FIG. 5 is a view of a pixel arrangement structure of an OLED display according to a fifth exemplary embodiment.



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## DETAILED DESCRIPTION

**[0031]** Several exemplary embodiments according to the present invention are described hereinafter in detail with reference to the accompanying drawings to allow one of a person of ordinary skill in the art to practice the invention without undue experimentation. The present invention can be embodied in several different forms, and is not limited to exemplary embodiments that are described herein.

**[0032]** In order to clarify the description of embodiments of the present invention, parts that are not related to the embodiments may be omitted. In addition, the same elements or equivalents are referred to with the same reference numerals throughout the specification. For example, the same reference numerals are used for the elements having the same constructions throughout. Such elements are representatively described in a first exemplary embodiment, and in remaining exemplary embodiments, only different constructions from those of the first exemplary embodiment may be described.

**[0033]** Further, since sizes and thicknesses of constituent members shown in the accompanying drawings are arbitrarily given for better understanding and ease of description, the present invention is not limited to the illustrated sizes and thicknesses. In addition, unless explicitly described to the contrary, the word "comprise" and variations such as "comprises" or "comprising" will be understood to imply the inclusion of stated elements but not the exclusion of any other elements.

**[0034]** Nevertheless, even though each of the pixels are drawn as stereotypical polygonal shapes in the drawings, the present invention is not limited to this shape. That is, the shapes of the pixels may be modified to avoid interference with the other components of the OLED (e.g., wirings) within the spirit and scope of the appended claims.



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**[0035]** A pixel arrangement structure (or pixel arrangement) of an OLED display according to a first exemplary embodiment will be described with reference to FIG. 1. FIG. 1 is a view schematically showing a portion of pixels forming an OLED display.

**[0036]** As shown in FIG. 1, the pixel arrangement structure of the OLED display includes a plurality of first pixels 100, a plurality of second pixels 200, and a plurality of third pixels 300. Here, the pixel refers to a minimum unit for displaying an image (for example, the minimum addressable unit of the display).

**[0037]** Further, among the first pixels 100, the second pixels 200, and the third pixels 300, power lines for driving each of the pixels, such as a gate line, a data line, a driving power line, and the like, may be located. In addition, an insulation layer, such as a pixel defining layer, for defining each of the pixels may be disposed. Finally, an OLED including an anode, an organic emission layer, and a cathode to correspond to each of the first pixels 100, the second pixels 200, and the third pixels 300 may be disposed. These configurations are technologies known in the art and further description thereof is omitted for ease of description. A shape of each of the pixels may be defined by the power lines, the pixel defining layer, the anode, or the like, but is not limited thereto.

**[0038]** In the pixel arrangement of FIG. 1, each of the first pixels 100 has a smaller area than neighboring second pixels 200 and third pixels 300, and has a quadrilateral (i.e., four-sided) shape among polygon shapes. For example, in the pixel arrangement of FIG. 1, each of the first pixels 100 has the same quadrilateral shape (e.g., a square or rhombus). The first pixels 100 are spaced apart from each other and arranged in rows, such as along a first virtual straight line VL1. The first pixels 100 emit green light, and may include an organic emission layer for emitting green light.

**[0039]** The second pixels 200 are arranged diagonally with respect to the first pixels 100, such as at first vertices P1 along one diagonal of a virtual square VS having one of the first pixels 100 as a center point (or center) of the virtual square VS. In a similar



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fashion, the third pixels 300 are arranged diagonally with respect to the first pixels 100, such as at second vertices P2 along the other diagonal of the virtual square VS.

**[0040]** In the virtual square VS, each of the second pixels 200 is separated from the first pixel 100, and is centered at one of the first vertices P1 of the virtual square VS. Each of the second pixels 200 has a larger area than the neighboring first pixel 100 and has an octagonal (i.e., eight-sided) shape. In FIG. 1, the second pixels 200 each have the same octagonal shape. In addition, the second pixels 200 are arranged diagonally and separated from each other by the first pixels 100. The second pixels 200 emit blue light, and may include an organic emission layer for emitting blue light.

**[0041]** In a similar fashion, in the virtual square VS, each of the third pixels 300 is separated from the first pixel 100 and the second pixels 200, and is centered at one of the second vertices P2 neighboring the first vertices P1 of the virtual square VS. Each of the third pixels 300 has a larger area than the neighboring first pixel 100 and the same area as each of the second pixels 200. Further, the third pixels have an octagonal shape (e.g., similar to or the same as the second pixels 200). In FIG. 1, the third pixels 300 each have the same octagonal shape. In addition, the third pixels 300 are arranged diagonally and separated from each other by the first pixels 100. The third pixels 300 emit red light, and may include an organic emission layer for emitting red light.

**[0042]** The third pixels 300 and the second pixels 200 are spaced apart from each other and alternately arranged in rows, such as along a second virtual straight line VL2. In a similar fashion, the third pixels 300 and the second pixels 200 are spaced apart from each other and alternately arranged in columns. Accordingly, in the virtual square VS, two of the second pixels 200 having their corresponding centers positioned at the first vertices P1 and two of the third pixels 300 having their corresponding centers positioned at the second vertices P2 to enclose a corresponding one of the first pixels 100 (e.g., in the virtual square VS).



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**[0043]** As described above, the center of each of the second pixels 200 is positioned at one of the first vertices P1 of the virtual square VS. In addition, the center of the corresponding first pixel 100 is the center of the virtual square VS. Further, the center of each of the third pixels 300 is positioned at one of the second vertices P2. Moreover, the second pixels 200 and the third pixels 300 each have the same area.

**[0044]** As a non-limiting example, the distance (e.g., a shortest distance) between one of the first pixels 100 and an adjacent one of the second pixels 200 is a first length L1, the distance between one of the first pixels 100 and an adjacent one of the third pixels 300 is the same first length L1, and the distance between one of the second pixels 200 and an adjacent one of the third pixels 300 is the same first length L1, as shown in FIG. 1. In addition, the distance (e.g., a shortest distance) between the neighboring first pixels 100 is a second length L2 that is longer than the first length L1. It should be noted that L1, L2, L3, . . . may be used throughout to represent shortest distances between corresponding pixels.

**[0045]** Therefore, the gap of the first length L1 is formed between adjacent pairs of the first pixels 100 and the second pixels 200, between adjacent pairs of the first pixels 100 and the third pixels 300, and between adjacent pairs of the second pixels 200 and the third pixels 300. In addition, the gap of the second length L2 that is longer than the first length L1 is formed between the neighboring ones of the first pixels 100. This results in improved deposition reliability when using a fine metal mask to form the green, blue, and red organic emission layers respectively included in the first pixels 100, the second pixels 200, and the third pixels 300.

**[0046]** In addition, by enclosing each of the first pixels 100 by a pair of the second pixels 200 and a pair of the third pixels 300, the aperture ratio of the first pixels 100, the second pixels 200, and the third pixels 300 may be improved. Accordingly, a manufacturing time and manufacturing cost of the entire OLED display may be reduced and the display quality of the image of the OLED display may be improved.



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**[0047]** As described above, in the pixel arrangement structure of the OLED display of FIG. 1, the first pixels 100, the second pixels 200, and the third pixels 300 have polygonal shapes (e.g., the first pixels have a quadrilateral shape and the second pixels 200 and the third pixels 300 have an octagonal shape). In addition, it is worth considering that the deposition process of the organic emission layer is one of the unique manufacturing characteristics of the OLED display. Accordingly, to improve the deposition reliability of the organic emission layer in the deposition process using the fine metal mask and to improve the aperture ratio of the first pixels 100, the second pixels 200, and the third pixels 300, the center of each of the first pixels 100 is positioned at the center of a virtual square VS formed by a first pair of diagonal vertices P1 and a second pair of diagonal vertices P2. In the virtual square VS, the centers of a pair of the second pixels 200 are positioned at the first vertices P1, and the centers of a pair of the third pixels 300 are positioned at the second vertices P2.

**[0048]** In addition, in the pixel arrangement structure of the OLED display of FIG. 1, the first pixels 100, the second pixels 200, and the third pixels 300 respectively emit green, blue, and red light. However, in pixel arrangement structures of other OLED displays, the first pixels 100, the second pixels 200, and the third pixels 300 may emit light of different colors. For example, at least one of the second pixels 200 or the third pixels may emit white light.

**[0049]** Next, a pixel arrangement structure of an OLED display according to a second exemplary embodiment will be described with reference to FIG. 2. Parts that are different from the exemplary embodiment of FIG. 1 will be described, while the description of parts that are equivalent to the first exemplary embodiment may be omitted. For better comprehension and ease of description, constituent elements of the second exemplary embodiment that are the same as or similar to those of the first embodiment of FIG. 1 will have the same reference numerals.



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**[0050]** As shown in FIG. 2, the pixel arrangement structure of the OLED display includes a plurality of first pixels 100, a plurality of second pixels 200, and a plurality of third pixels 300. The plurality of first pixels 100 have the same quadrilateral shape (e.g., a parallelogram). In addition, the second pixels 200 have a larger area than the third pixels 300. The second pixels 200 and the third pixels 300 may have polygonal shapes, such as octagonal or hexagonal (i.e., six-sided).

**[0051]** In a similar fashion to that of FIG. 1, the centers of a pair of the second pixels 200 are positioned at first vertices P1 along one diagonal of a virtual square VS having a center coinciding with a center of one of the first pixels 100. In addition, the centers of a pair of the third pixels 300 are positioned at second vertices P2 along another diagonal of the virtual square VS. However, in FIG. 2, the second pixels 200 have a larger area than the third pixels 300.

**[0052]** As a non-limiting example, the distance between adjacent ones of the second pixels 200 and the third pixels 300 is a third length L3, while the distance between each of the first pixels 100 and adjacent ones of the second pixels 200 or the third pixels 300 have a same fourth length L4. In addition, the distance between neighboring ones of the first pixels 100 is a fifth length L5 that is longer than the third length L3 and the fourth length L4.

**[0053]** Accordingly, the gap of the fourth length L4 is formed between adjacent pairs of the first pixels 100 and the second pixels 200, and between adjacent pairs of the first pixels 100 and the third pixels 300. In addition, the gap of the third length L3 is formed between adjacent pairs of the second pixels 200 and the third pixels 300. Further, the gap of the fifth length L5 that is longer than the third length L3 and the fourth length L4 is formed between the neighboring ones of the first pixels 100. This results in improved deposition reliability in the deposition process using the fine metal mask to form the green, blue, and red organic emission layers respectively included in the first pixels 100, the second pixels 200, and the third pixels 300.



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**[0054]** In addition, by enclosing each of the first pixels 100 by a pair of the second pixels 200 and a pair of the third pixels 300, the aperture ratio of the first pixels 100, the second pixels 200, and the third pixels 300 may be improved. Accordingly, the manufacturing time and the manufacturing cost of the OLED display may be reduced and the display quality of the image of the OLED display may be improved.

**[0055]** Further, in the pixel arrangement structure of the OLED display of FIG. 2, the second pixels 200 that emit blue have the shortest life span among the first pixels 100, the second pixels 200, and the third pixels 300. Accordingly, the second pixels 200 have a larger area than the third pixels 300, thereby suppressing the deterioration of the life span of the OLED display. That is, the pixel arrangement structure of the OLED display of FIG. 2 provides improved life span.

**[0056]** Next, a pixel arrangement structure of an OLED display according to a third exemplary embodiment will be described with reference to FIG. 3. Parts that are different from the above exemplary embodiments will be described, while the description of parts that are equivalent to the above exemplary embodiments may be omitted. For better comprehension and ease of description, constituent elements of the third exemplary embodiment that are the same as or similar to the above exemplary embodiments will have the same reference numerals.

**[0057]** As shown in FIG. 3, the pixel arrangement structure of the OLED display includes a plurality of first pixels 100, a plurality of second pixels 200, and a plurality of third pixels 300. Among the plurality of first pixels 100, the neighboring first pixels 100 have a quadrilateral shape (e.g., parallelogram) and are symmetrical to each other. In addition, the second pixels 200 have a larger area than the third pixels 300. The second pixels 200 and the third pixels may have polygonal shapes (e.g., hexagonal or octagonal).

**[0058]** In a similar fashion to that of FIGs. 1–2, the centers of a pair of the second pixels 200 are positioned at first vertices P1 along one diagonal of a virtual square VS



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having a center coinciding with a center of one of the first pixels 100. In addition, the centers of a pair of the third pixels 300 are positioned at second vertices P2 along another diagonal of the virtual square VS. However, in FIG. 3, the neighboring first pixels 100 have a quadrilateral shape and are symmetrical to each other, while the second pixels 200 have a larger area than the third pixels 300. This results in improved deposition reliability in the deposition process using the fine metal mask to form the green, blue, and red organic emission layers respectively included in the first pixels 100, the second pixels 200, and the third pixels 300.

**[0059]** In addition, by placing each of the first pixels 100 between a pair of the second pixels 200 and between a pair of the third pixels 300, the aperture ratio of the first pixels 100, the second pixels 200, and the third pixels 300 may be improved. Accordingly, the manufacturing time and the manufacturing cost of the OLED display may be reduced and the display quality of the image of the OLED display may be improved.

**[0060]** Further, in the pixel arrangement structure of the OLED display of FIG. 3, the second pixels 200 that emit blue have the shortest life span among the first pixels 100, the second pixels 200, and the third pixels 300. Accordingly, the second pixels 200 have a larger area than the third pixels 300, thereby suppressing the deterioration of the life span of the OLED display. That is, the pixel arrangement structure of the OLED display provides improved life span.

**[0061]** Next, a pixel arrangement structure of an OLED display according to a fourth exemplary embodiment will be described with reference to FIG. 4. Parts that are different from the above exemplary embodiments will be described, while the description of parts that are equivalent to the above exemplary embodiments may be omitted. For better comprehension and ease of description, constituent elements of the fourth exemplary embodiment that are the same as or similar to the above exemplary embodiments will have the same reference numerals.



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**[0062]** As shown in FIG. 4, the pixel arrangement structure of the OLED display includes a plurality of first pixels 100, a plurality of second pixels 200, and a plurality of third pixels 300. Among the plurality of first pixels 100, the neighboring first pixels 100 have a quadrilateral shape (e.g., parallelogram) and are symmetrical to each other. In addition, the third pixels 300 have a larger area than the second pixels 200. The second pixels 200 and the third pixels may have polygonal shapes (e.g., hexagonal or octagonal).

**[0063]** In a similar fashion to that of FIGs. 1–3, the centers of a pair of the second pixels 200 are positioned at the first vertices P1 along one diagonal of a virtual square VS having a center coinciding with a center of one of the first pixels 100. In addition, the centers of a pair of the third pixels 300 are positioned at second vertices P2 along another diagonal of the virtual square VS. However, in FIG. 4, the neighboring first pixels 100 have a quadrilateral shape and are symmetrical to each other, while the third pixels 300 have a larger area than the second pixels 200. This results in improved deposition reliability in the deposition process using the fine metal mask to form the green, blue, and red organic emission layers respectively included in the first pixels 100, the second pixels 200, and the third pixels 300.

**[0064]** In addition, by enclosing each of the first pixels 100 by a pair of the second pixels 200 and a pair of the third pixels 300, the aperture ratio of the first pixels 100, the second pixels 200, and the third pixels 300 may be improved. Accordingly, the manufacturing time and the manufacturing cost of the OLED display may be reduced and the display quality of the image of the OLED display may be improved.

**[0065]** Next, a pixel arrangement structure of an OLED display according to a fifth exemplary embodiment will be described with reference to FIG. 5. Parts that are different from the above exemplary embodiments will be described, while the description of parts that are equivalent to the above exemplary embodiments may be omitted. For better comprehension and ease of description, constituent elements of the fifth



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exemplary embodiment that are the same as or similar to the above exemplary embodiments will have the same reference numerals.

**[0066]** As shown in FIG. 5, the pixel arrangement structure of the OLED display includes a plurality of first pixels 100, a plurality of second pixels 200, and a plurality of third pixels 300. Among the plurality of first pixels 100, the neighboring first pixels 100 have a octagonal shape and are symmetrical to each other. In addition, the second pixels 200 have a larger area than the third pixels 300. The second pixels 200 and the third pixels 300 may have quadrilateral shapes (e.g., rhombus).

**[0067]** In a similar fashion to that of FIGs. 1–3, the centers of a pair of the second pixels 200 are positioned at the first vertices P1 along one diagonal of a virtual square VS having a center coinciding with a center of one of the first pixels 100. In addition, the centers of a pair of the third pixels 300 are positioned at second vertices P2 along another diagonal of the virtual square VS. However, in FIG. 5, the neighboring first pixels 100 have a octagonal shape and are symmetrical to each other, while the second pixels 200 have a larger area than the third pixels 300. This results in improved deposition reliability in the deposition process using the fine metal mask to form the green, blue, and red organic emission layers respectively included in the first pixels 100, the second pixels 200, and the third pixels 300.

**[0068]** In addition, by enclosing each of the first pixels 100 by a pair of the second pixels 200 and a pair of the third pixels 300, the aperture ratio of the first pixels 100, the second pixels 200, and the third pixels 300 may be improved. Accordingly, the manufacturing time and the manufacturing cost of the OLED display may be reduced and the display quality of the image of the OLED display may be improved.

**[0069]** While this invention has been described in connection with what is presently considered to be practical exemplary embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to



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cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims, and equivalents thereof.

<Description of Some Symbols>

first pixels 100, second pixels 200, third pixels 300



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**WHAT IS CLAIMED IS:**

1. A pixel arrangement structure of an organic light emitting diode display, comprising:

a first pixel having a center coinciding with a center of a virtual square;

a second pixel separated from the first pixel and having a center at a first vertex of the virtual square; and

a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square.

2. The pixel arrangement structure of claim 1, wherein

the second pixel comprises a pair of second pixels, and

the second pixels are separated from each other by the first pixel.

3. The pixel arrangement structure of claim 2, wherein

the third pixel comprises a pair of third pixels, and

the third pixels are separated from each other by the first pixel.

4. The pixel arrangement structure of claim 3, wherein the second pixels and the third pixels enclose the first pixel in the virtual square.

5. The pixel arrangement structure of claim 4, wherein

the first pixel, the second pixels, and the third pixels have polygonal shapes, and

the second pixels and the third pixels have a larger area than the first pixel.



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6. The pixel arrangement structure of claim 5, wherein

the first pixel has a quadrilateral shape, and

the second pixels and the third pixels have hexagonal or octagonal shapes.

7. The pixel arrangement structure of claim 6, wherein the second pixels and the third pixels have octagonal shapes.

8. The pixel arrangement structure of claim 7, wherein:

the second pixels and the third pixels have a same area, and

a distance between the first pixel and the second pixels, a distance between the first pixel and the third pixels, and a distance between the second pixels and the third pixels is a same first length.

9. The pixel arrangement structure of claim 8, wherein

the first pixel comprises a plurality of first pixels,

the plurality of first pixels have a same quadrilateral shape, and

a distance between neighboring ones of the plurality of first pixels is a second length that is longer than the first length.

10. The pixel arrangement structure of claim 6, wherein

the second pixels have a larger area than the third pixels,

a distance between the second pixels and the third pixels is a first length, and

a distance between the first pixel and the second pixels, and a distance between the first pixel and the third pixels is a same second length.

11. The pixel arrangement structure of claim 10, wherein

the first pixel comprises a plurality of first pixels,



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the plurality of first pixels have a same quadrilateral shape, and

a distance between neighboring ones of the plurality of first pixels is a third length that is longer than the first length and the second length.

12. The pixel arrangement structure of claim 10, wherein

the first pixel comprises a plurality of first pixels,

neighboring ones of the plurality of first pixels have quadrilateral shapes that are symmetrical to each other, and

a distance between the neighboring ones of the plurality of first pixels is a third length that is longer than the first length and the second length.

13. The pixel arrangement structure of claim 6, wherein

the first pixel comprises a plurality of first pixels, and

neighboring ones of the plurality of first pixels have quadrilateral shapes that are symmetrical to each other.

14. The pixel arrangement structure of claim 13, wherein the second pixels have a larger area than the third pixels.

15. The pixel arrangement structure of claim 13, wherein the third pixels have a larger area than the second pixels.

16. The pixel arrangement structure of claim 5, wherein

the first pixel has a octagonal shape, and

the second pixels and the third pixels have quadrilateral shapes.

17. The pixel arrangement structure of claim 16, wherein



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the second pixels have a larger area than the third pixels,

a distance between the second pixels and the third pixels is a first length, and

a distance between the first pixel and the second pixels, and a distance between the first pixel and the third pixels is a same second length.

18. The pixel arrangement structure of claim 17, wherein

the first pixel comprises a plurality of first pixels,

neighboring ones of the plurality of first pixels have octagonal shapes that are symmetrical to each other, and

a distance between the neighboring ones of the plurality of first pixels is a third length that is longer than the first length and the second length.

19. The pixel arrangement structure of claim 1, wherein the first pixel, the second pixel, and the third pixel are configured to emit different color lights.

20. The pixel arrangement structure of claim 19, wherein the first pixel, the second pixel, and the third pixel are configured to emit green light, blue light, and red light, respectively.



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## ABSTRACT

A pixel arrangement structure of an OLED display is provided. The pixel arrangement structure includes: a first pixel having a center coinciding with a center of a virtual square; a second pixel separated from the first pixel and having a center at a first vertex of the virtual square; and a third pixel separated from the first pixel and the second pixel, and having a center at a second vertex neighboring the first vertex of the virtual square.

SRH PAS1171792.3-*-05/10/12 12:09 PM



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# FIG.1

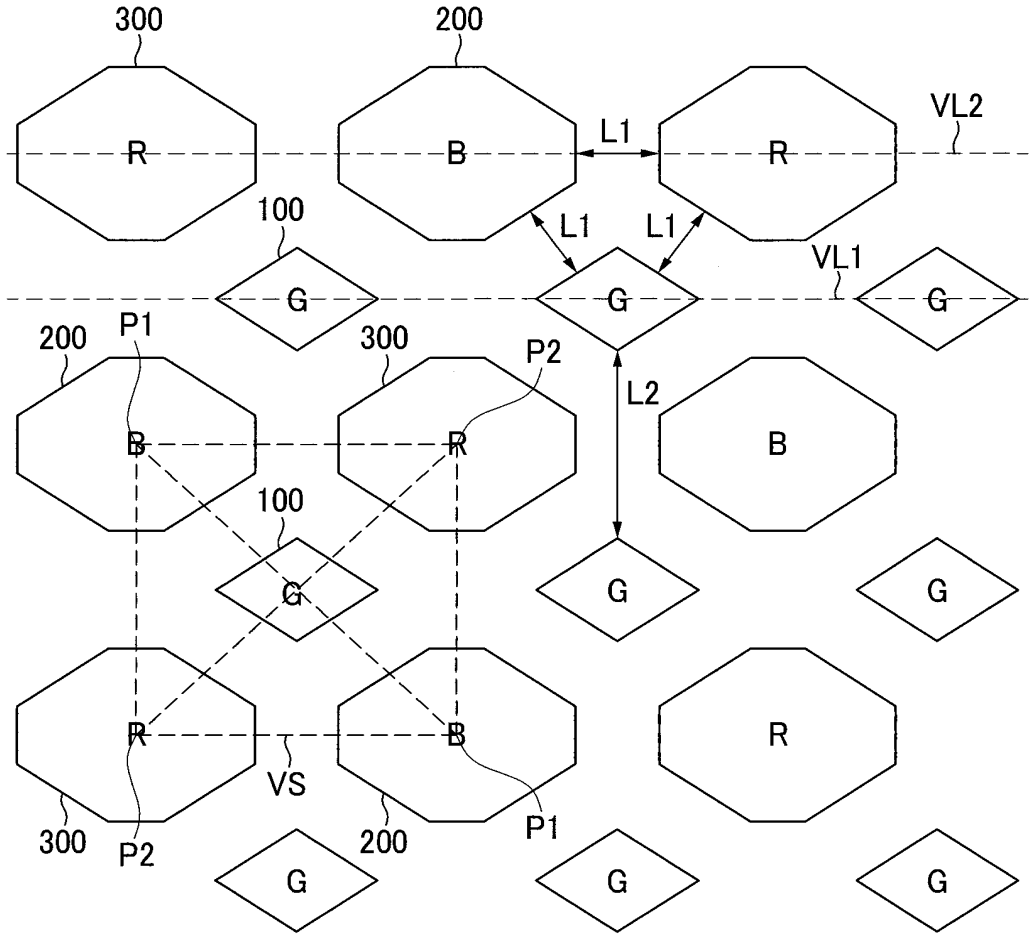
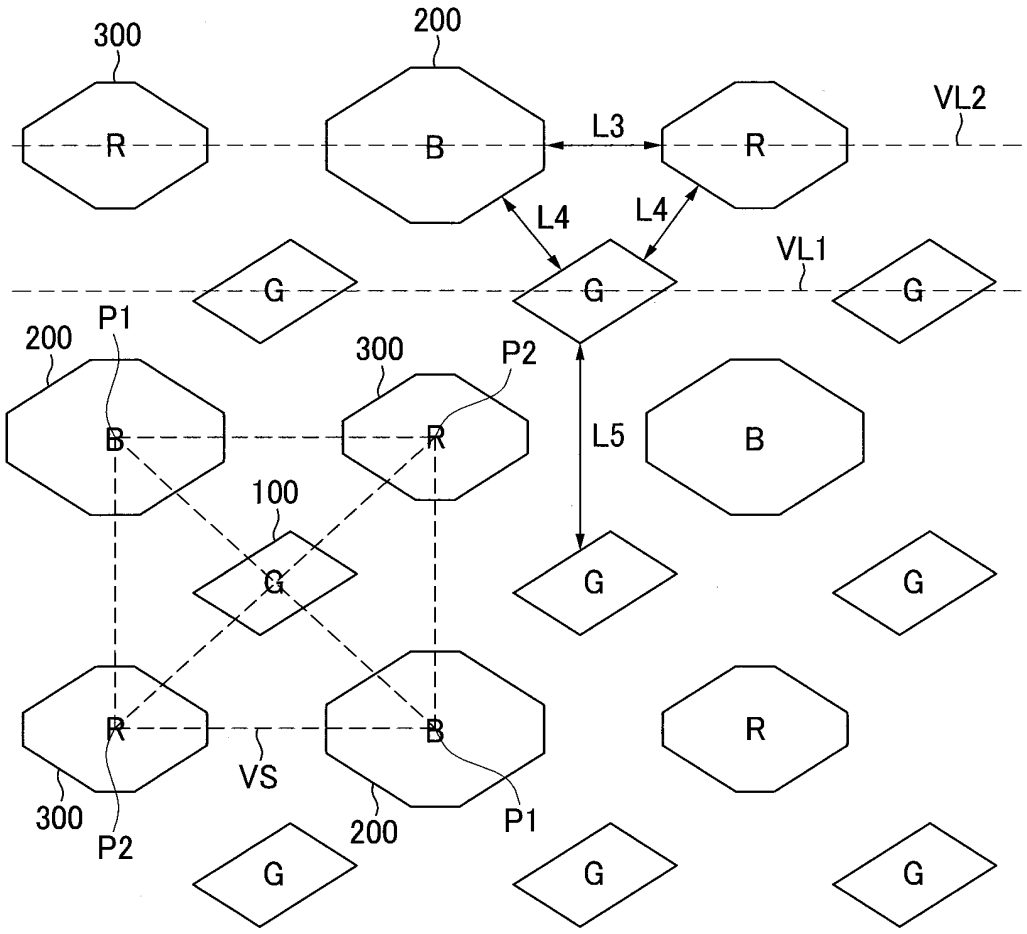
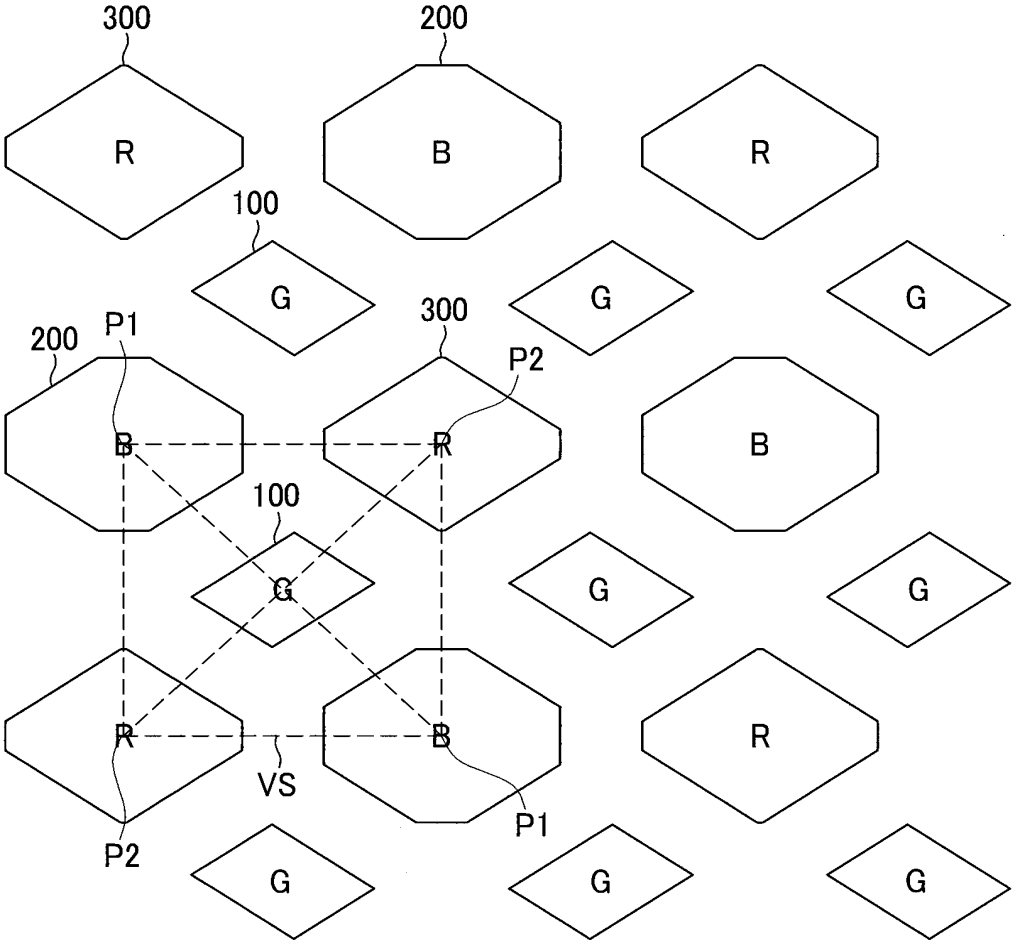

300
200
R
B
L1
R
VL2
100
L1
L1
VL1
G
G
G
200
P1
300
P2
L2
B
R
B
100
G
G
G
R
B
R
VS
300
P2
200
P1
G
G
G

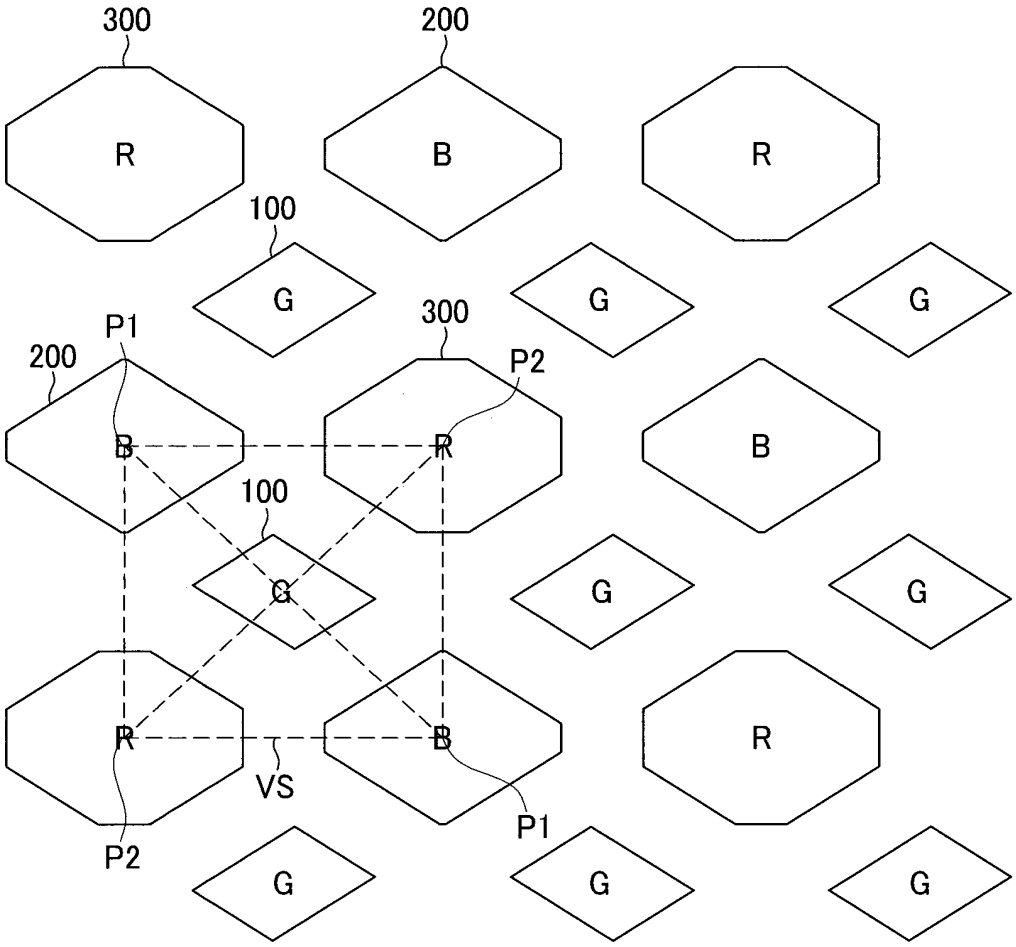
FIG.2


300
200
VL2
R
B
L3
R
L4
L4
VL1
G
G
G
200
P1
300
P2
B
R
L5
B
100
G
G
G
R
B
R
VS
300
P2
200
P1
G
G
G

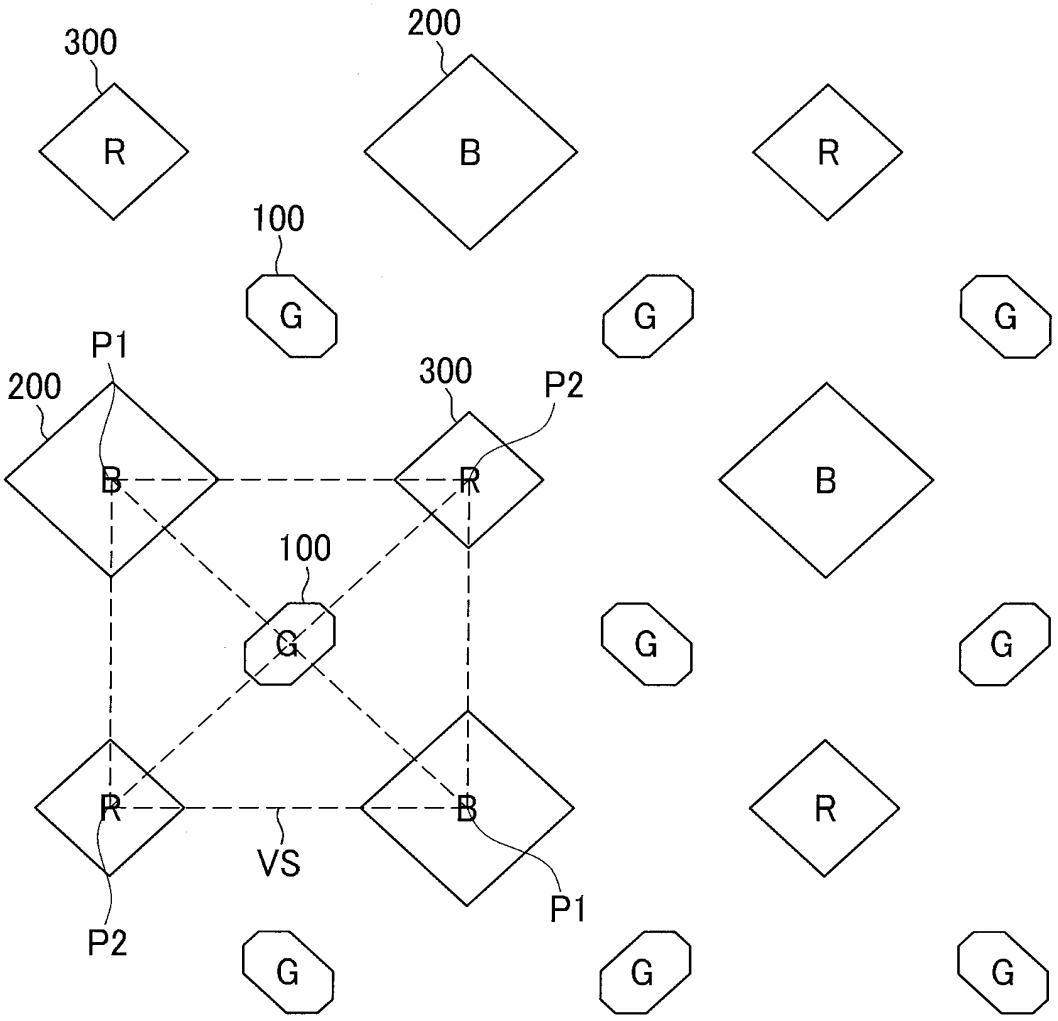
# FIG.3



# FIG.4



# FIG.5



x

**DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION** PATENT

Docket No. : 69657/P849

As a below named inventor, I hereby declare that:

My residence, mailing address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE**, the specification of which is attached hereto unless the following is checked:

_____ was filed on _____ as United States Application Number or PCT International Application Number _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of the foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States of America, listed below and have also identified below, any foreign application for patent or inventor's certificate, or any PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

| Application Number | Country | Filing Date (day/month/year) | Priority Claimed |
|---|---|---|---|
| 10-2012-0022967 | KR | 6 March 2012 | YES |

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below.

| Application Number | Filing Date |
|---|---|

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

| Application Number | Filing Date | Patented/Pending/Abandoned |
|---|---|---|



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DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION

Docket No. : 69657/P849

**POWER OF ATTORNEY:** I hereby appoint the practitioners associated with the law firm of Christie, Parker & Hale, LLP,

## CUSTOMER NUMBER 23363

to prosecute this application and any U.S. continuation or divisional application based on it, and to prosecute any international application under the Patent Cooperation Treaty based on it, and to transact all business in the U.S. Patent and Trademark Office connected with either of them in accordance with instructions from the assignee of the entire interest in this application; or from the first or sole inventor named below in the event the application is not assigned; or from **PanKorea Patent & Law Firm** in the event the power granted herein is for an application filed on behalf of a foreign attorney or agent.

The authority under this Power of Attorney of each person associated with the law firm of Christie, Parker & Hale, LLP, Customer Number 23363, shall automatically terminate and be revoked upon such person ceasing to be a member or associate of or of counsel to that law firm.

**DIRECT ALL CORRESPONDENCE TO: CUSTOMER NUMBER 23363**

**DIRECT TELEPHONE CALLS TO: Jun-Young E. Jeon, 626/795-9900**
**CHRISTIE, PARKER & HALE, LLP**
**P.O. Box 29001**
**Glendale, CA 91209-9001**

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

| NAME OF SOLE OR FIRST INVENTOR<br>Sang-Shin Lee | | | |
|---|---|---|---|
| Inventor's Signature Sang-Shin Lee | | | Date<br>September 10, 2012 |
| Residence: City<br>Yongin-city | State | Country<br>Republic of Korea | Citizenship<br>Korean |
| Mailing Address: | 95, Samsung 2 Ro, Giheung-Gu, Yongin-City, Gyeonggi-Do, Korea | | |



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**KOREAN PATENT ABSTRACTS XML** 1(1-1)

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KOREAN PATENT ABSTRACTS

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(71) Applicant:
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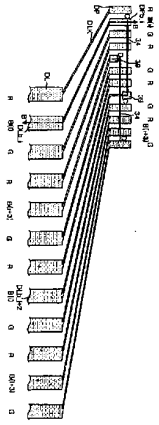
(72) Inventor:
- CHOO, GYO SEOP
- PARK, JUN HO

(54) DATA WIRING STRUCTURE OF PENTILE MATRIX PANEL

(57) Abstract:

PURPOSE: A data wiring structure of a pentile matrix panel is provided to realize the data wiring structure appropriate for the pentile matrix panel, and reduce tape carrier packages connected between gate and data drivers and data pads.

CONSTITUTION: Data wiring is formed of data pads(DP) contacting with an external data driver, and data lines(DL) connected to the data pads through data links(DLK). Each pixel of a pentile matrix panel is formed of one B sub-pixel, two R sub-pixels, and two G sub-pixels. Two B data lines are connected to one B data pad at a pad area to share one B data signal. The data pads which are fewer than the data lines are arranged at the pad area at inequal gaps.



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For more registration information

Legal Status

| No. | Receipt/Delivery No. | Receipt/Delivery Date | Document Title (KOR.) | Status (KOR.) |
|---|---|---|---|---|
| 1 | 1-1-2001-0261694-81 | 2001.10.12 | Patent Application (특허출원서) | Acceptance (수리) |



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| | | | | |
|---|---|---|---|---|
| 2 | 1-1-2006-0667809-39 | 2006.09.15 | Request for Examination<br>(출원심사청구서) | Acceptance<br>(수리) |
| 3 | 1-1-2006-0667804-12 | 2006.09.15 | Amendment to Description, etc.<br>(명세서등보정서) | Regarded as an acceptance of amendment<br>(보정승인간주) |
| 4 | 9-1-9999-9999999-89 | 2007.06.07 | Request for Prior Art Search<br>(선행기술조사의뢰서) | Acceptance<br>(수리) |
| 5 | 9-1-2007-0038425-12 | 2007.07.11 | Report of Prior Art Search<br>(선행기술조사보고서) | Acceptance<br>(수리) |
| 6 | 1-1-2007-0595202-59 | 2007.08.17 | ([대리인선임]대리인(대표자)에 관한 신고서) | Acceptance<br>(수리) |
| 7 | 9-5-2007-0545932-01 | 2007.10.12 | Notification of reason for refusal<br>(의견제출통지서) | Dispatched<br>(발송처리완료) |
| 8 | 1-1-2007-0890735-69 | 2007.12.11 | [Opinion according to the Notification of Reasons for Refusal] Written Opinion(Written Reply, Written Substantiation)<br>([거절이유 등 통지에 따른 의견]의견(답변, 소명)서) | Acceptance<br>(수리) |
| 9 | 1-1-2007-0890734-13 | 2007.12.11 | [Amendment to Description, etc.] Amendment<br>([명세서등 보정]보정서) | Regarded as an acceptance of amendment<br>(보정승인간주) |
| 10 | 9-5-2008-0076923-56 | 2008.02.14 | Decision to grant<br>(등록결정서) | Dispatched<br>(발송처리완료) |
| 11 | 4-1-2008-5061241-15 | 2008.04.18 | Notification of change of applicant's information<br>(출원인정보변경(경정)신고서) | Acceptance<br>(수리) |
| 12 | 4-1-2010-5241074-12 | 2010.12.21 | Notification of change of applicant's information<br>(출원인정보변경(경정)신고서) | Acceptance<br>(수리) |
| 13 | 4-1-2011-5199065-15 | 2011.10.04 | Notification of change of applicant's information<br>(출원인정보변경(경정)신고서) | Acceptance<br>(수리) |
| 14 | 4-1-2011-5262372-95 | 2011.12.29 | Notification of change of applicant's information<br>(출원인정보변경(경정)신고서) | Acceptance<br>(수리) |



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JP09230303 A
KR1020000027749 A
전체 청구항 수 : 총 9 항

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(74) 대리인
**허용록**

심사관 : 이동윤

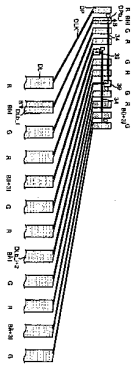
# (54) 펜타일 매트릭스 패널의 데이터배선 구조

## (57) 요 약

본 발명은 펜타일 매트릭스 패널에 적합한 데이터배선 구조에 관한 것이다.

본 발명의 펜타일 매트릭스 패널의 데이터배선 구조는 하나의 화소가 하나의 청색 서브화소와, 2개씩의 적색 서브화소들 및 녹색 서브화소들로 구성된 펜타일 매트릭스 패널에서, 수평라인 방향으로 배열된 청색 서브화소들에서 2개씩의 청색 서브화소들이 하나의 청색 데이터신호를 공유하게 하기 위하여, 상기 2개의 청색 서브화소들 각각에 접속되어진 제1 및 제2 청색 데이터라인이 외부 구동회로부터 상기 하나의 청색 데이터신호를 공급받는 하나의 청색 데이터패드에 접속되고, 상기 청색 데이터패드를 포함하는 데이터패드들이 형성된 패드영역에는 상기 패널에 형성된 데이터라인들 보다 적은 수의 데이터패드들이 비등간격 또는 등간격으로 배치된 것을 특징으로 한다.

***대표도*** - 도6





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## *특허청구의 범위*

### 청구항 1

하나의 화소가 하나의 청색 서브화소와, 2개씩의 적색 서브화소들 및 녹색 서브화소들로 구성된 펜타일 매트릭스 패널에 있어서,

수평라인 방향으로 배열된 청색 서브화소들에서 2개씩의 청색 서브화소들이 하나의 청색 데이터신호를 공유하게 하기 위하여, 상기 2개의 청색 서브화소들 각각에 접속되어진 제1 및 제2 청색 데이터라인이 외부 구동회로부터 상기 하나의 청색 데이터신호를 공급받는 하나의 청색 데이터패드에 접속되고,

상기 청색 데이터패드를 포함하는 데이터패드들이 형성된 패드영역에는 상기 패널에 형성된 데이터라인들 보다 적은 수의 데이터패드들이 비등간격 또는 등간격으로 배치되며,

상기 하나의 화소에서 상기 청색 데이터 라인과 접속된 청색 서브 화소 좌측에 배치된 적색과 녹색 서브 화소들은 제 1 데이터 라인에 의해 접속되고, 상기 청색 서브 화소 우측에 배치된 적색과 녹색 서브 화소들은 제 2 데이터 라인에 의해 각각 접속된 것을 특징으로 하는 펜타일 매트릭스 패널의 데이터배선 구조.

### 청구항 2

제 1 항에 있어서,

상기 하나의 청색 데이터패드에 접속된 제1 및 제2 청색 데이터라인들은 하나의 청색 데이터라인 및 다수의 적색 및 녹색 데이터라인들을 사이에 두고 배치된 것을 특징으로 하는 펜타일 매트릭스 패널의 데이터배선 구조.

### 청구항 3

제 1 항에 있어서,

상기 제1 청색 데이터라인은 제1 데이터링크를 경유하여 상기 청색 데이터패드에 접속되고,

상기 제2 청색 데이터라인은 제2 데이터링크와, 그 제2 데이터링크와 상기 청색 데이터패드 사이에 접속된 연결부를 경유하여 상기 청색 데이터패드에 접속된 것을 특징으로 하는 펜타일 매트릭스 패널의 데이터배선 구조.

### 청구항 4

제 3 항에 있어서,

상기 연결부는,

상기 청색 데이터패드에 접속되고 다수의 데이터패드들 또는 데이터링크들을 가로지르는 방향으로 배치된 게이트금속패턴과,

상기 제2 데이터링크와 상기 게이트금속패턴을 접속시키는 접촉부로 구성된 것을 특징으로 하는 펜타일 매트릭스 패널의 데이터배선 구조.

### 청구항 5

제 4 항에 있어서,

상기 게이트금속패턴은

상기 청색 데이터패드의 소스/드레인 금속층에 접속되어진 투명전극물질의 패드 단자전극을 통해 상기 청색 데이터패드와 접속되고,

상기 접촉부에 형성되어진 투명전극물질의 접촉전극을 통해 상기 제2 데이터링크의 소스/드레인 금속층과 접속되는 것을 특징으로 하는 펜타일 매트릭스 패널의 데이터배선 구조.

### 청구항 6

제 4 항에 있어서,

상기 접촉부는



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상기 데이터패드들이 비등간격으로 배치된 경우 그 비등간격을 가지는 데이터패드들 사이에 위치하고,

상기 데이터패드들이 등간격으로 배치된 경우 상기 데이터링크들 사이에 위치하는 것을 특징으로 하는 펜타일 매트릭스 패널의 데이터배선 구조.

**청구항 7**

제 2 항에 있어서,

상기 제1 청색 데이터라인은 제1 데이터링크를 경유하여 상기 청색 데이터패드에 접속되고,

상기 제2 청색 데이터라인은 그 제2 청색 데이터라인과 상기 제1 데이터링크 사이에 접속된 연결부를 경유하여 상기 청색 데이터패드에 접속되고,

상기 데이터패드들은 등간격으로 배치된 것을 특징으로 하는 펜타일 매트릭스 패널의 데이터배선 구조.

**청구항 8**

제 7 항에 있어서,

상기 연결부는,

상기 제1 데이터링크와 상기 제2 청색 데이터라인 사이에서 다수의 다른 데이터링크들을 가로지르는 방향으로 배치된 게이트금속패턴과,

상기 제1 데이터링크와 게이트금속패턴을 접속시키는 제1 접촉부와,

상기 게이트금속패턴과 상기 제2 청색 데이터라인을 접속시키는 제2 접촉부로 구성된 것을 특징으로 하는 펜타일 매트릭스 패널의 데이터배선 구조.

**청구항 9**

제 8 항에 있어서,

상기 게이트금속패턴은

상기 제1 접촉부에 형성되어진 투명전극물질의 제1 접촉전극을 통해 상기 제1 청색 데이터링크의 소스/드레인 금속층과 접속되고,

상기 제2 접촉부에 형성되어진 투명전극물질의 제2 접촉전극을 통해 상기 제2 청색 데이터라인의 소스/드레인 금속층과 접속되는 것을 특징으로 하는 펜타일 매트릭스 패널의 데이터배선 구조.

## *명 세 서*

## *발명의 상세한 설명*

### *발명의 목적*

#### *발명이 속하는 기술 및 그 분야의 종래기술*

<29> 본 발명은 디스플레이 패널에 데이터 공급을 위한 데이터배선의 구조에 관한 것으로, 특히 펜타일 매트릭스 패널에 적합한 데이터배선 구조에 관한 것이다.

<30> 통상의 액정표시장치는 전계를 이용하여 액정의 광투과율을 조절함으로써 화상을 표시하게 된다. 이를 위하여, 액정표시장치는 액정셀들이 매트릭스 형태로 배열되어진 액정패널과 이 액정패널을 구동하기 위한 구동회로를 구비한다.

<31> 실제로, 액정표시장치는 도 1에 도시된 바와 같이 액정셀들이 매트릭스 형태로 배열되어진 액정패널(2)과, 액정패널(2)의 게이트라인들(GL0 내지 GLn)을 구동하기 위한 게이트드라이버(4)와, 액정패널(2)의 데이터라인들(DL1 내지 DLm)을 구동하기 위한 데이터드라이버(6)와, 데이터드라이버(6)에 감마전압을 공급하기 위한 감마전압 발생부(8)와, 게이트드라이버(4)와 데이터드라이버(6)를 제어하기 위한 타이밍 제어부(10)를 구비한다.

<32> 타이밍 제어부(10)는 외부로부터 입력되는 클럭신호, 수평 및 수직 동기신호 등에 응답하여 게이트 드라이버



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(4)와 데이터 드라이버(6)의 구동 타이밍을 제어하게 된다. 다시 말하여, 타이밍 제어부(10)는 클럭신호와 수평 및 수직 동기신호에 응답하여 게이트 쉬프트 클럭(GSC), 게이트 스타트 펄스(GSP) 등을 생성하여 게이트 드라이버(4)에 공급한다. 또한, 제어부(10)는 입력 클럭신호와 수평 및 수직 동기신호에 응답하여 데이터 클럭신호, 데이터 제어 신호, 극성제어신호 등을 생성하여 데이터 드라이버(6)에 공급함과 아울러 데이터 클럭신호에 동기하여 외부로부터 입력되어진 적색(R), 녹(G), 청(B) 비디오데이터들을 데이터드라이버(6)에 공급한다.

<33> 게이트 드라이버(4)는 타이밍 제어부(10)의 제어에 응답하여 게이트라인들(GL1 내지 GLn)에 해당 주사기간동안(1H) 게이트 하이전압을 공급하여 박막 트랜지스터들(TFT)이 구동되게 하고, 나머지 기간에서는 게이트 로우전압을 인가한다. 또한, 게이트 드라이버(4)는 첫번째 주사라인의 스토리지 캐패시터(Cst)를 위해 형성된 최상측의 게이트라인(GL0)에는 게이트 로우전압을 인가한다.

<34> 데이터 드라이버(6)는 타이밍 제어부(10)의 제어에 응답하여 타이밍 제어부(10)로부터의 디지털 데이터신호를 아날로그 데이터신호로 변환하여 게이트라인(GL1 내지 GLn)에 게이트 하이전압이 공급되는 1수평기간(1H)마다 1수평라인분의 데이터신호를 데이터라인들(DL1 내지 DLm)에 공급한다. 이때, 감마전압 발생부(8)는 데이터신호의 전압레벨에 따라 서로 다른 레벨을 가지게끔 미리 설정된 감마전압을 데이터 드라이버(6)에 공급한다. 데이터 드라이버(6)는 감마전압을 이용하여 디지털 데이터신호를 아날로그 데이터신호로 변환함으로써 액정표시장치에서의 감마특성이 보정되게 한다. 또한, 데이터 드라이버(6)는 타이밍제어부(10)로부터 극성제어신호에 따라 데이터라인들(DL1 내지 DLm)에 공급되는 데이터신호들의 극성을 반전시키게 된다. 도트 인버전 방식으로 액정패널(2)을 구동하는 경우 데이터 드라이버(6)는 액정 패널(2)상의 액정셀들 각각에 수직 및 수평 방향들 쪽에서 인접하는 액정셀들에 공급되는 데이터신호들과 상반된 극성의 데이터신호가 공급되게 함과 아울러 프레임마다 액정 패널 상의 모든 액정셀들에 공급되는 데이터 신호들의 극성이 반전되게 한다.

<35> 액정패널(2)은 매트릭스 형태로 배열되어진 액정셀들과, n+1개의 게이트라인들(GL0 내지 GLn)과 m개의 데이터라인들(DL1 내지 DLm)의 교차부에 각각 형성된 박막트랜지스터(TFT)를 구비한다. 박막트랜지스터(TFT)는 게이트라인(GL1 내지 GLn)으로부터의 게이트하이전압에 응답하여 데이터라인(DL1 내지 DLm)으로부터의 데이터신호를 액정셀에 공급한다. 액정셀은 액정을 사이에 두고 대면하는 공통전극과 박막트랜지스터(TFT)에 접속된 화소전극을 포함하는 액정용량 캐패시터(Clc)로 등가적으로 표시될 수 있다. 그리고, 액정셀 내에는 액정용량 캐패시터(Clc)에 충전된 데이터전압을 다음 데이터전압이 충전될 때까지, 즉 게이트로우전압이 인가되는 동안 유지시키기 위한 스토리지 캐패시터(Cst)가 더 형성된다. 스토리지 캐패시터(Cst)는 이전단 게이트라인과 화소전극 사이에 형성된다.

<36> 이러한 액정패널(2)에서 액정셀의 형상을 좌우하는 박막 트랜지스터 기판의 전극배치 구조를 상세히 하면 도 2에 도시된 바와 같다. 도 2를 참조하면, 게이트라인들(GL1, GL2, ...)과 데이터라인들(DL1, DL2, ...)의 교차구조로 마련된 셀영역에는 화소전극(9)이 마련된다. 화소전극(9)은 박막 트랜지스터(1)의 소오스 및 드레인 전극(5, 7)을 경유하여 데이터라인들(DL1, DL2, ...) 중 어느 하나에 접속된다. 박막 트랜지스터(1)의 게이트전극(3)은 게이트라인들(GL1, GL2, ...) 중 어느 하나에 접속된다. 스토리지 캐패시터(11)는 해당 화소전극(9)과 이전단 게이트라인(GLi-1)과의 중첩부에 형성된다. 데이터라인들(DL1, DL2, ...) 각각에는 칼라표시를 위한 적, 녹, 청색 데이터신호가 각각 공급된다.

<37> 이러한 박막트랜지스터 기판과 액정층을 사이에 두고 대면하는 도시하지 않은 상부기판에는 적, 녹, 청색 칼라필터들이 화소전극(9)이 형성된 셀영역에 대응되게 형성됨과 아울러 액정층에 기준전압을 공급하기 위한 공통전극이 전면으로 형성된다. 적, 녹, 청색 칼라필터가 형성된 액정셀들 각각은 서브화소(R, G, B)에 해당되고, 나란하게 배치된 적, 녹, 청색 서브화소(R, G, B)의 조합으로 하나의 화소를 표현하게 된다.

<38> 이러한 구조를 가지는 액정패널의 박막 트랜지스터기판의 가장자리 영역에는 IC(Integrated Circuit) 칩으로 제작된 게이트 드라이버 및 데이터 드라이버의 출력단자들과 테이프 캐리어 패키지(Tape Carrier Package)를 통해 1:1로 접촉되는 패드가 마련되어 있다. 패드는 액정패널 상의 게이트라인들 및 데이터라인들과 1:1로 대응되게 형성된다.

<39> 실제로, 데이터패드(DP)는 도 3에 도시된 바와 같이 데이터링크(DLK)를 통해 데이터라인(DL)과 연결된다. 데이터 드라이브 IC 칩이 실장된 테이프 캐리어 패키지가 부착되는 데이터패드들(DP)은 그 드라이브 IC 칩의 출력단자와 접촉되기 위하여 상대적으로 좁은 등간격을 가지고 배치된다. 화상표시영역에 형성되는 데이터라인들(DL)은 상대적으로 넓은 등간격을 가지고 배치된다. 이러한 데이터패드(DP)와 데이터라인(DL)은 데이터링크(DLK)와 함께 일체로 형성된다.



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<40> 다시 말하여, 도 4에 도시된 바와 같이 하부기판(12) 위의 게이트절연막(14) 상에 형성된 소스/드레인 금속층(16)이 데이터패드(DP)부 및 데이터링크(DLK)부와 데이터라인(DL)부로 구성된다. 소스/드레인 금속층(16) 위에는 보호막(18)이 형성되고 패터닝되어 데이터패드(DP)부가 위치하는 부분에 컨택홀이 형성된다. 그리고, 투명전극물질로 이루어진 패드 단자전극(20)이 화상표시영역의 화소전극과 함께 형성되어 소스/드레인 금속층(16)의 데이터패드(DP)부와 접촉된다.

<41> 이러한 구성을 가지는 종래의 액정표시장치는 선명한 화상을 표시하기 위하여 고해상도화 되어감에 따라 화소수가 증가되어가고 있다. 이러한 화소수 증대로 그들을 구동하기 위한 드라이브 IC(Integrated Circuit)들의 수, 특히 고가의 데이터 드라이브 IC의 수가 증대되어 코스트가 상승되게 되었다. 또한, 종래의 액정표시장치에서는 적색(R), 녹색(G), 청색(B) 서브화소들이 스트라이프 형상으로 고정배치됨에 따라 고해상도 구현에 한계가 있었다.

<42> 이러한 해상도 한계를 극복하기 위하여, 최근에는 하나의 화소가 5개의 서브화소로 구성되는 펜타일 매트릭스(PenTile Matrix) 구조가 제안되어졌다. 펜타일 매트릭스의 화소는 중앙에 위치하는 하나의 청색 서브화소, 그 청색 서브화소 주위에서 한 대각선 방향으로 위치하는 2개의 적색 서브화소와, 다른 대각선 방향으로 위치하는 2개의 녹색 서브화소로 구성된다. 이러한 화소들로 구성되는 펜타일 매트릭스는 서브화소들이 스트라이프 형상으로 배치된 기존 매트릭스 보다 훨씬 작은 화소수로도 동등한 해상도 구현이 가능하여 더욱 부드러운 폰트 구현이 가능하다는 장점을 가지고 있다.

<43> 이러한 펜타일 매트릭스는 한 화소가 5개의 서브화소를 구비함에 따라 기존과는 다른 데이터 구동방식으로 그 서브화소들에 데이터를 공급해야만 한다. 특히, 펜타일 매트릭스의 구동방법으로는 고가의 데이터 드라이브 IC의 수를 줄이기 위하여 2개의 청색(B) 서브화소가 하나의 데이터라인을 공유하는 방안이 제안되어졌다. 그러나, 2개의 청색(B) 서브화소가 하나의 데이터라인을 공유하는 기술적인 수단이 구체화되지 않은 상태로 그에 적합한 데이터배선, 즉 데이터패드 및 데이터링크와 데이터라인의 구조가 필요하게 되었다.

### *발명이 이루고자 하는 기술적 과제*

<44> 따라서, 본 발명의 목적은 2개의 청색(B) 서브화소가 하나의 데이터라인을 공유할 수 있는 펜타일 매트릭스에 적합한 데이터배선의 구조를 제공하는 것이다.

### *발명의 구성 및 작용*

<45> 상기 목적을 달성하기 위하여, 본 발명에 따른 펜타일 매트릭스 패널의 데이터배선 구조는 하나의 화소가 하나의 청색 서브화소와, 2개씩의 적색 서브화소들 및 녹색 서브화소들로 구성된 펜타일 매트릭스 패널에 있어서, 수평라인 방향으로 배열된 청색 서브화소들에서 2개씩의 청색 서브화소들이 하나의 청색 데이터신호를 공유하게 하기 위하여, 상기 2개의 청색 서브화소들 각각에 접속되어진 제1 및 제2 청색 데이터라인이 외부 구동회로부터 상기 하나의 청색 데이터신호를 공급받는 하나의 청색 데이터패드에 접속되고, 상기 청색 데이터패드를 포함하는 데이터패드들이 형성된 패드영역에는 상기 패널에 형성된 데이터라인들 보다 적은 수의 데이터패드들이 비등간격 또는 등간격으로 배치되며, 상기 하나의 화소에서 상기 청색 데이터 라인과 접속된 청색 서브 화소 좌측에 배치된 적색과 녹색 서브 화소들은 제 1 데이터 라인에 의해 접속되고, 상기 청색 서브 화소 우측에 배치된 적색과 녹색 서브 화소들은 제 2 데이터 라인에 의해 각각 접속된 것을 특징으로 한다.

<46> 특히, 상기 제1 청색 데이터라인은 제1 데이터링크를 경유하여 상기 청색 데이터패드에 접속되고, 상기 제2 청색 데이터라인은 제2 데이터링크와, 그 제2 데이터링크와 상기 청색 데이터패드 사이에 접속된 연결부를 경유하여 상기 청색 데이터패드에 접속된 것을 특징으로 한다.

<47> 또한, 상기 제1 청색 데이터라인은 제1 데이터링크를 경유하여 상기 청색 데이터패드에 접속되고, 상기 제2 청색 데이터라인은 그 제2 청색 데이터라인과 상기 제1 데이터링크 사이에 접속된 연결부를 경유하여 상기 청색 데이터패드에 접속되고, 상기 데이터패드들은 등간격으로 배치된 것을 특징으로 한다.

<48> 상기 목적들 외에 본 발명의 다른 목적 및 이점들은 첨부한 도면을 참조한 실시 예에 대한 상세한 설명을 통하여 명백하게 드러나게 될 것이다.

<49> 이하, 본 발명의 바람직한 실시예들을 첨부한 도 5 내지 도 13을 참조하여 상세하게 설명하기로 한다.

<50> 도 5는 본 발명에 따른 데이터배선이 적용되어지는 펜타일 매트릭스를 도시한 평면도이다. 펜타일 매트릭스에 포함되는 각 화소들은 하나의 청색(B) 서브화소(B)를 중심으로 한 대각선 방향으로 위치하는 2개의 적색(R) 서



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브화소(R1, R2)들과, 다른 대각선 방향으로 위치하는 녹색(G) 서브화소(G1, G2)들로 구성된다. 이렇게, 각 화소가 5개의 서브화소(R1, B, G1, G2, R2)로 구성됨에 따라 펜타일 매트릭스는 각 화소가 3개의 서브화소(R, G, B)로 구성된 종래의 매트릭스 보다 적은 화소들을 이용하여 동일한 해상도를 구현할 수 있게 된다.

<51> 각 서브화소(R1, B, G1, G2, R2)들에는 스위칭소자로서 게이트라인(GL)과 데이터라인(DL)에 접속된 박막트랜지스터(28)가 마련된다. 박막 트랜지스터(28)는 게이트라인들(GL1, GL2, ...)들 중 어느 하나에 접속된 게이트전극(22)과 데이터라인들(DL1, DL2, ...) 중 어느 하나에 접속된 소스전극(24)과, 게이트전극(22)에 인가되는 게이트하이전압으로 반도체층(도시하지 않음)이 활성화되면 소스전극(24)과 접속되는 드레인전극(26)으로 구성된다. 그리고, 드레인전극(26)에는 서브화소영역에 마련된 화소전극(30)이 접속된다. 이러한 박막트랜지스터(28)들과 화소전극(30)이 형성된 박막트랜지스터 기판과 액정층을 사이에 두고 대면하는 상부기판(도시하지 않음)에는 적, 녹, 청 칼라필터들이 화소전극(30)이 형성된 서브화소영역에 대응되게 형성됨과 아울러, 액정층에 기준전압을 공급하기 위한 공통전극이 전면으로 형성된다. 이에 따라, 서브화소들(R1, B, G1, G2, R2) 각각은 화소전극(30)에 공급되는 데이터전압에 따라 구동되어 해당색의 빛을 방출함으로써 화상이 표시된다.

<52> 도 5에 있어서, 한 화소에 포함되는 5개의 서브화소들(R1, B, G1, G2, R2)은 2개의 게이트라인에 의해 구동된다. 예를 들면, 첫번째 주사라인을 이루는 화소들에 포함되는 서브화소들(R1, B, G1, G2, R2) 중 상단에 위치하는 제1 적색(R) 및 녹색(G) 서브화소들(R1, G1)은 제1 게이트라인(GL1)에 게이트하이전압이 공급되는 기간에 구동되고, 하단에 위치하는 제2 녹색(G) 및 적색(R) 서브화소(G2, R2)들은 제2 게이트라인(GL2)에 게이트하이전압이 공급되는 기간에 구동된다. 그리고, 청색(B) 서브화소(B)는 제1 및 제2 게이트라인들(GL1, GL2) 중 어느 하나에 게이트하이전압이 공급되는 기간에 구동된다. 다시 말하여, 하나의 주사라인에 포함되는 서브화소들(R1, B, G1, G2, R2) 중 청색(B) 서브화소(B)에 포함되는 게이트전극(22)들은 제1 및 제2 게이트라인(GL1, GL2)에 교번적으로 접속된다.

<53> 또한, 한 화소에 포함되는 서브화소들(R1, B, G1, G2, R2)은 3개의 데이터라인을 통해 데이터신호를 공급받는다. 예를 들면, 첫번째 화소의 서브화소들(R1, B, G1, G2, R2) 중 좌측에 위치하는 제1 적색(R) 서브화소(R1)와 제2 녹색(G) 서브화소(G2)는 제1 데이터라인(DL1)에 접속되고, 우측에 위치하는 제1 녹색(G) 서브화소(G1)와 제2 적색(R) 서브화소(R)는 제3 데이터라인(DL3)에 접속된다. 이에 따라, 제1 및 제3 데이터라인(DL1, DL3)은 1수평주기(1H)마다 적색(R) 데이터신호와 녹색(G) 데이터신호를 교번하여 공급한다. 그리고, 제2 데이터라인(DL2)에는 청색(B) 서브화소(B)들만이 접속되므로 제2 데이터라인(DL)은 청색(B) 데이터신호를 공급한다.

<54> 한편, 펜타일 매트릭스는 데이터라인들을 구동하는 데이터 드라이브 IC의 수를 줄이고자 2개의 청색(B) 서브화소들이 하나의 데이터라인을 공유하게 한다. 특히, 임의의 서브화소가 그에 인접한 서브화소들과는 상반된 극성을 가지게 하는 도트 인버젼 방식으로 데이터를 공급하기 위하여 청색(B) 서브화소는 하나의 청색(B) 서브화소를 건너서 위치하는 청색(B) 서브화소와 데이터라인을 공유하게 한다. 예를 들면, 제2 데이터라인(DL2)에 접속된 청색(B) 서브화소(B)들을 그 다음번째인 제4 데이터라인들(DL4)을 건너 위치하는 제6 데이터라인(DL6)에 접속된 청색(B) 서브화소(B)과 단락되게 하여 동일한 데이터신호를 공급받게 한다.

<55> 이렇게, 2개의 청색(B) 서브화소(B)가 동일한 데이터신호를 공급받게 하기 위한 본 발명의 제1 실시 예에 따른 데이터배선은 도 6에 도시된 바와 같은 구조를 가지게 된다.

<56> 도 6을 참조하면, 데이터배선은 외부의 데이터 드라이버(도시하지 않음)와 접촉되는 데이터패드(DP)들과, 데이터링크(DLK)를 통해 데이터패드(DP)에 접속되는 데이터라인(DL)들로 구성된다. 여기서, 청색(B) 데이터신호를 공급하는 2개의 데이터라인들이 패드영역에서 하나의 데이터패드(DP)에 접속된다. 예를 들면, 패드영역에서 i번째 청색(B) 데이터신호(Bi)를 공급하는 데이터패드(DPb_i)에는 i번째 청색(B) 데이터라인(DLb_i)과 i+2번째 청색(B) 데이터라인(DLb_i+2)과 공통으로 접속된다. 이에 따라, 청색(B) 데이터라인들(DLb_i, DLb_i+2)에는 동일한 i번째 청색(B) 데이터신호(Bi)가 공급될 수 있게 된다.

<57> 이를 위하여, 패드영역에서 데이터라인들(DL) 보다 적은 수를 가지는 데이터패드(DP)들이 비등간격으로 배치된다. 다시 말하여, 패드영역에서 데이터 드라이버와 직접 접촉될 필요가 없는 청색(B) 데이터패드(DP) 영역에는 데이터패드(DP)를 형성하지 않는다. 대신, 데이터패드(DP)가 형성되지 않는 부분에 게이트금속패턴(34)을 통해 i번째 청색(B) 데이터패드(DPb_i)와 접속됨과 아울러 데이터링크(DLK)부를 통해 i+2번째 청색(B) 데이터라인(DLb_i+2)과 접속되는 접촉부(39)가 마련된다. 다시 말하여, i+2번째 청색(B) 데이터라인(DLb_i+2)에서 연장되는 데이터링크(DLK)는, 접촉부(39)와 다른 데이터패드(DP)들을 간섭없이 가로지르는 게이트금속패턴(34)으로 구성되어 패드영역에 형성된 연결부를 통해 i번째 청색(B) 데이터패드(DPb_i)에 접속된다.



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<58> 도 7 내지 도 9 각각은 도 6에 도시된 데이터배선부를 B-B', C-C', D-D'선 각각을 따라 절단하여 도시한 단면도이다.

<59> 도 7 내지 도 9를 참조하면, 하부기판(32) 위에 데이터패드(DP)들을 가로지르는 방향으로 게이트금속패턴(34)이 형성되고, 그 위에 게이트절연막(36)이 도포된다. 게이트절연막(36) 위에는 데이터패드(DP)와 데이터라인(DL) 및 데이터링크(DLK)를 이루는 소스/드레인 금속층(38)이 형성된다. 소스/드레인 금속층(38) 위에는 보호막(40)이 형성되고 패터닝되어 데이터패드(DP) 영역에 제1 컨택홀(31)들이 형성된다. 이때, 데이터패드(DP)부와 접촉부(39)에서 소스/드레인 금속층(38)과 접촉되는 게이트금속패턴(34)이 위치하는 부분에서는 보호막(40) 및 게이트절연막(36)에 제2 컨택홀(33)들이 형성된다. 그리고, 투명전극물질로 이루어진 패드 단자전극(42)이 형성되어 제1 컨택홀(31)을 통해 소스/드레인 금속층(38)의 데이터패드(DP)부와 접촉된다. 특히, 게이트금속패턴(34)이 형성되어진 청색(B) 데이터패드(DPb_i)부에 접촉되는 패드 단자전극(42)은 제2 컨택홀(33)을 통해 소스/드레인 금속층(38)과 게이트금속패턴(34)에 공통 접속된다. 이러한 패드 단자전극(42)과 동시에 데이터패드(DP)가 형성되지 않는 부분인 접촉부(39)에 접촉전극(37)이 형성된다. 이 접촉전극(37)은 제2 컨택홀(33)을 통해 게이트금속패턴(34)과 접속됨과 아울러 제1 컨택홀(31)을 통해 소스/드레인 금속층(38)의 데이터링크(DLK)부와 접촉된다.

<60> 이러한 구성에 의해, 하나의 청색(B) 데이터패드(DPb_i)가 2개의 청색(B) 데이터라인들(DLb_i, DLb_i+1)에 공통 접속되어 데이터 드라이버로부터 공급된 하나의 청색(B) 데이터신호(Bi)를 2개의 청색(B) 데이터라인들(DLb_i, DLb_i+1)에 공급할 수 있게 된다.

<61> 도 10은 본 발명의 다른 실시 예에 따른 펜타일 매트릭스 패널의 데이터배선 구조를 도시한 평면도이다.

<62> 도 10을 참조하면, 데이터패드(DP)들이 등간격으로 배치되면서 청색(B) 데이터신호를 공급하는 2개의 데이터라인들이 데이터링크(DLK) 영역에서 하나의 데이터패드(DP)에 접속된다. 예를 들면, i번째 청색(B) 데이터신호(Bi)를 공급하는 데이터패드(DPb_i)가 i번째 청색(B) 데이터라인(DLb_i)과 i+2번째 청색(B) 데이터라인(DLb_i+2)과 공통으로 접속됨으로써 그 두 청색(B) 데이터라인들(DLb_i, DLb_i+2)에는 동일한 i번째 청색(B) 데이터신호(Bi)가 공급될 수 있게 된다. 이에 따라, 패드영역에는 데이터 드라이버로부터 i+2번째 청색(B) 데이터라인(DLb_i+2)에 개별적으로 청색(B) 데이터신호를 공급할 데이터패드(DP)가 필요없게 된다. 이 결과, 패드영역에는 데이터라인(DL)들 보다 적은 수의 데이터패드(DP)들이 등간격으로 배치된다. 여기서, i+2번째 청색(B) 데이터라인(DLb_i+2)은 도 6에 도시된 바와 같이 동일하게 데이터링크(DLK)와 게이트금속패턴(44)을 경유하여 i번째 청색(B) 데이터패드(DPb_i)에 접속된다. 이 경우, 도 6에서는 데이터패드(DP)들이 비등간격으로 배치됨에 따라 데이터링크(DLK)와 게이트금속패턴(44)이 접촉되는 접촉부(도시되지 않음)가 하나의 청색(B) 데이터패드 영역을 차지하여 형성되는 반면에, 도 8에서는 데이터패드(DP)들이 등간격으로 배치됨에 따라 데이터링크(DLK)들 사이에 위치하게 된다.

<63> 도 11 및 도 12 각각은 도 10에 도시된 데이터배선부를 E-E', F-F'선 각각을 따라 절단하여 도시한 단면도이다.

<64> 도 11 및 도 12를 참조하면, 하부기판(32) 위에 데이터패드(DP)들을 가로지르는 방향으로 게이트금속패턴(44)이 형성되고, 그 위에 게이트절연막(36)이 도포된다. 게이트절연막(36) 위에는 데이터패드(DP)와 데이터라인(DL) 및 데이터링크(DLK)를 이루는 소스/드레인 금속층(46)이 형성된다. 소스/드레인 금속층(46) 위에는 보호막(40)이 형성되고 패터닝되어 데이터패드(DP) 영역에 제1 컨택홀(31)들이 형성된다. 이때, 데이터패드(DP)부 및 접촉부(도시되지 않음)에서 소스/드레인 금속층(46)과 접촉되는 게이트금속패턴(44)이 위치하는 부분에서는 보호막(40) 및 게이트절연막(36)에 제2 컨택홀(33)들이 형성된다. 그리고, 투명전극물질로 이루어진 패드 단자전극(42)이 형성되어 제1 컨택홀(31)을 통해 소스/드레인 금속층(46)의 데이터패드(DP)부와 접촉된다. 특히, 게이트금속패턴(44)이 형성되어진 청색(B) 데이터패드(DPb_i)부에 접촉되는 패드 단자전극(42)은 제2 컨택홀(33)을 통해 소스/드레인 금속층(46)과 게이트금속패턴(44)에 공통 접속된다. 이러한 패드 단자전극(42)과 데이터링크(DLK) 영역에 위치하는 접촉부에 접촉전극(43)이 형성된다. 이 접촉전극(43)은 제2 컨택홀(33)을 통해 게이트금속패턴(44)과 접속됨과 아울러 제1 컨택홀(31)을 통해 소스/드레인 금속층(46)의 데이터링크(DLK)부와 접촉된다.

<65> 이러한 구성에 의해, 하나의 청색(B) 데이터패드(DPb_i)가 2개의 청색(B) 데이터라인들(DLb_i, DLb_i+1)에 공통 접속되어 데이터 드라이버로부터 공급된 하나의 청색(B) 데이터신호(Bi)를 2개의 청색(B) 데이터라인(DLb_i, DLb_i+1)에 공급할 수 있게 된다.



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<66> 도 13은 본 발명의 또 다른 실시 예에 따른 펜타일 매트릭스 패널의 데이터배선 구조를 도시한 평면도이다.

<67> 도 13을 참조하면, 데이터패드(DP)들은 등간격으로 배치되면서 청색(B) 데이터신호를 공급하는 2개의 데이터라인들(DLb_i, DLb_i+2)이 데이터라인(DL)들에 근접한 영역에서 하나의 데이터링크(DLKb_i)에 접속된다. 예를 들면, i번째 청색(B) 데이터패드(DPb_i)로부터 i번째 청색(B) 데이터신호(Bi)를 공급하는 데이터링크(DLKb_i)가 i번째 청색(B) 데이터라인(DLb_i)과 i+2번째 청색(B) 데이터라인(DLb_i+2)과 공통으로 접속됨으로써 그 두 청색(B) 데이터라인들(DLb_i, DLb_i+2)에는 동일한 i번째 청색(B) 데이터신호(Bi)가 공급될 수 있게 된다. 이에 따라, 패드영역 및 링크영역에는 데이터 드라이버로부터 i+2번째 청색(B) 데이터라인(DLb_i+2)에 개별적으로 청색(B) 데이터신호를 공급할 데이터패드(DP) 및 데이터링크(DLK)가 필요없게 된다. 이 결과, 패드영역에는 데이터라인(DL)들 보다 적은 수의 데이터패드(DP)들이 등간격으로 배치된다. 여기서, i+2번째 청색(B) 데이터라인(DLb_i+2)은 접촉부(52)와 게이트금속패턴(50)을 경유하여 i번째 청색(B) 데이터패드(DPb_i)에 접속된다. 접촉부(52)는 i+2번째 청색(B) 데이터라인(DLb_i+2)으로부터 돌출된 형태로 마련된다.

<68> 도 14 및 도 15 각각은 도 13에 도시된 데이터배선부를 G-G', I-I'선 각각을 따라 절단하여 도시한 단면도이다.

<69> 도 14 및 도 15를 참조하면, i번째 청색(B) 데이터링크(DLKb_i)와 접촉부(52) 사이에 접속되는 게이트금속패턴(50)은 하부기판(32) 위에 데이터링크(DLK)들을 간섭없이 가로지르게 형성되고, 그 위에 게이트절연막(36)이 도포된다. 게이트절연막(36) 위에는 데이터패드(DP)와 데이터라인(DL) 및 데이터링크(DLK)를 이루는 소스/드레인 금속층(54)이 형성된다. 소스/드레인 금속층(54) 위에는 보호막(40)이 형성되고 패터닝되어 데이터패드(DP) 영역에 제1 컨택홀(도시되지 않음)들이 형성된다. 이때, 데이터링크(DLK)부 및 접촉부(52)에서 소스/드레인 금속층(54)과 접촉되는 게이트금속패턴(50)이 위치하는 부분에서는 보호막(40) 및 게이트절연막(36)에 제2 컨택홀(53)들이 형성됨과 아울러, 소스/드레인 금속층(54)이 위치하는 부분에서는 보호막(40)에 제3 컨택홀(55)들이 형성된다. 그리고, 투명전극물질로 이루어진 패드 단자전극(도시되지 않음)이 형성되어 제1 컨택홀을 통해 소스/드레인 금속층(54)의 데이터패드(DP)부와 접촉된다. 이 패드 단자전극과 동시에 청색(B) 데이터링크(DLKb)부와 접촉부의 게이트금속패턴(50)에는 접촉전극(58)이 형성된다. 이 접촉전극(58)은 제2 컨택홀(53)을 통해 게이트금속패턴(50)과 접속됨과 아울러 제3 컨택홀(55)을 통해 소스/드레인 금속층(54)의 데이터링크(DLK)부 및 데이터라인(DL)부와 접속된다.

<70> 이러한 구성에 의해, 하나의 청색(B) 데이터패드(DPb_i) 및 청색(B) 데이터링크(DLKb_i)가 2개의 청색(B) 데이터라인들(DLb_i, DLb_i+1)에 공통접속되어 데이터 드라이버로부터 공급된 하나의 청색(B) 데이터신호(Bi)를 2개의 청색(B) 데이터라인들(DLb_i, DLb_i+1)에 공급할 수 있게 된다.

### *발명의 효과*

<71> 상술한 바와 같이, 본 발명에 따른 펜타일 매트릭스 패널의 데이터배선 구조는 데이터패드 영역, 데이터링크영역 또는 데이터라인에 근접한 영역에서 2개의 청색(B) 데이터배선이 접속되게 함으로써 하나의 청색(B) 데이터신호를 2개의 청색(B) 데이터라인들에 공급하는 펜타일 매트릭스의 도트 인버젼 구동방식에 적합하게 된다. 특히, 본 발명에 따른 펜타일 매트릭스의 데이터배선 구조에서는 2개의 청색(B)데이터배선이 하나의 데이터패드 또는 데이터링크에 접속됨에 따라 필요가 없게 된 청색(B) 데이터패드를 형성하지 않으면서, 데이터라인들의 수보다 적은 데이터패드들을 비등간격 또는 등간격으로 배치함에 따라 드라이버와 패드 사이에 접속되는 테이프 캐리어 패키지를 절감할 수 있게 된다.

<72> 이상 설명한 내용을 통해 당업자라면 본 발명의 기술사상을 일탈하지 아니하는 범위에서 다양한 변경 및 수정이 가능함을 알 수 있을 것이다. 따라서, 본 발명의 기술적 범위는 명세서의 상세한 설명에 기재된 내용으로 한정되는 것이 아니라 특허 청구의 범위에 의해 정하여 져야만 할 것이다.

### *도면의 간단한 설명*

<1> 도 1은 통상적인 액정표시장치의 구성을 도시한 블록도.

<2> 도 2는 도 1에 도시된 액정패널의 액정셀 구조를 도시한 평면도.

<3> 도 3은 도 2에 도시된 데이터라인들에 접속되는 데이터패드 구조를 도시한 평면도.

<4> 도 4는 도 3에 도시된 A-A'선을 따라 절단한 데이터패드부의 단면도.



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<5> 도 5는 본 발명에 적용되는 펜타일 매트릭스 구조를 도시한 평면도.

<6> 도 6은 본 발명의 실시 예에 따른 펜타일 매트릭스 패널의 데이터배선 구조를 도시한 평면도.

<7> 도 7은 도 6에 도시된 B-B'선을 따라 절단한 데이터배선부의 단면도.

<8> 도 8은 도 6에 도시된 C-C'선을 따라 절단한 데이터배선부의 단면도.

<9> 도 9는 도 7에 도시된 D-D'선을 따라 절단한 데이터배선부의 단면도.

<10> 도 10은 본 발명의 다른 실시 예에 따른 펜타일 매트릭스 패널의 데이터배선 구조를 도시한 평면도.

<11> 도 11은 도 10에 도시된 E-E'선을 따라 절단한 데이터배선부의 단면도.

<12> 도 12는 도 10에 도시된 F-F'선을 따라 절단한 데이터배선부의 단면도.

<13> 도 13은 본 발명의 또 다른 실시 예에 따른 펜타일 매트릭스 패널의 데이터패드 구조를 도시한 단면도.

<14> 도 14는 도 13에 도시된 G-G'선을 따라 절단한 데이터배선부의 단면도.

<15> 도 15는 도 13에 도시된 I-I'선을 따라 절단한 데이터배선부의 단면도.

<16> < 도면의 주요 부분에 대한 부호의 설명 >

<17> 1, 28 : 박막트랜지스터 2 : 액정패널

<18> 3、22 : 게이트전극 4 : 게이트드라이버

<19> 5, 24 : 소스전극 6 : 데이터드라이버

<20> 7, 26 : 드레인전극 10 : 타이밍제어부

<21> 9, 30 : 화소전극 8 : 감마전압 발생부

<22> 11 : 스토리지 캐패시터 12, 32 : 하부기판

<23> 14, 36 : 게이트절연막 16、38、46, 54 : 소스/드레인 금속층

<24> 18, 40 : 보호막 20, 42 : 패드 단자전극

<25> 31, 33, 53, 55 : 컨택홀 34, 44, 50 : 게이트금속패턴

<26> 37, 43, 58 : 접촉전극 39、52 : 접촉부

<27> DP : 데이터패드 DLK : 데이터링크

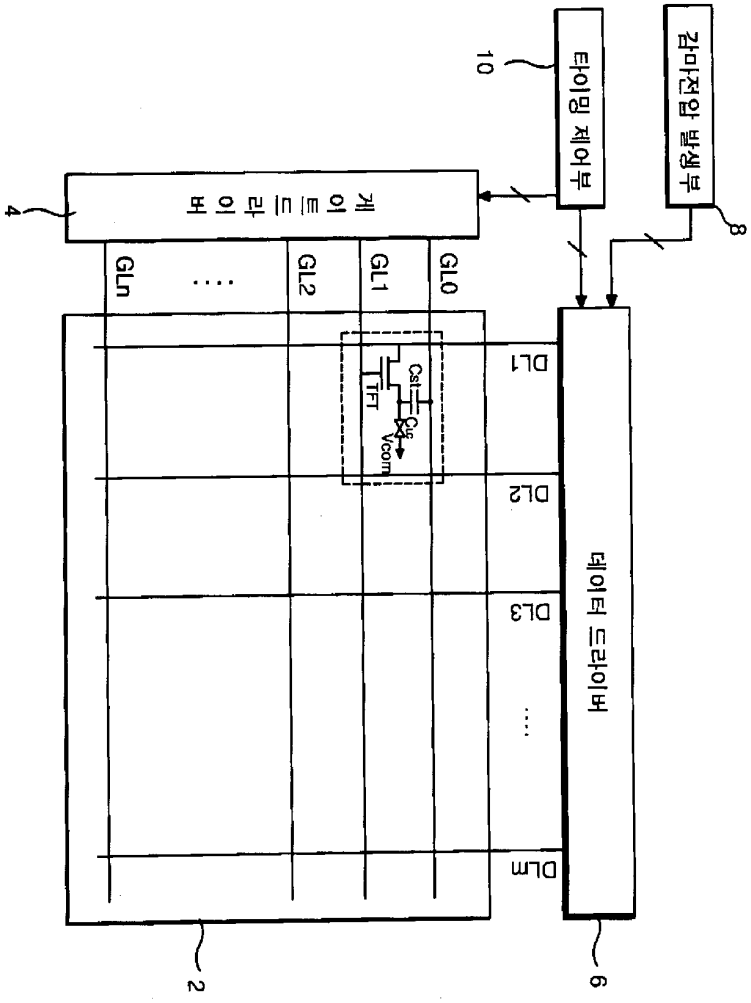
<28> DL : 데이터라인



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도면

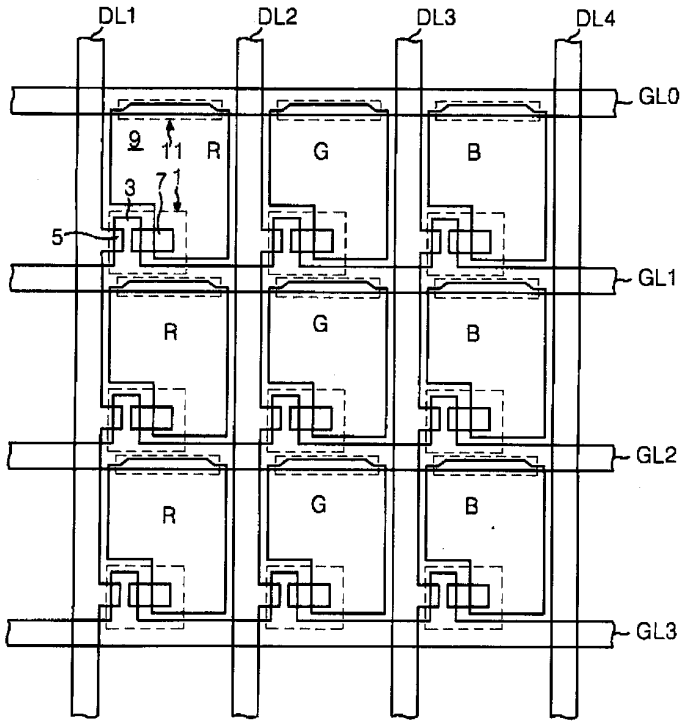
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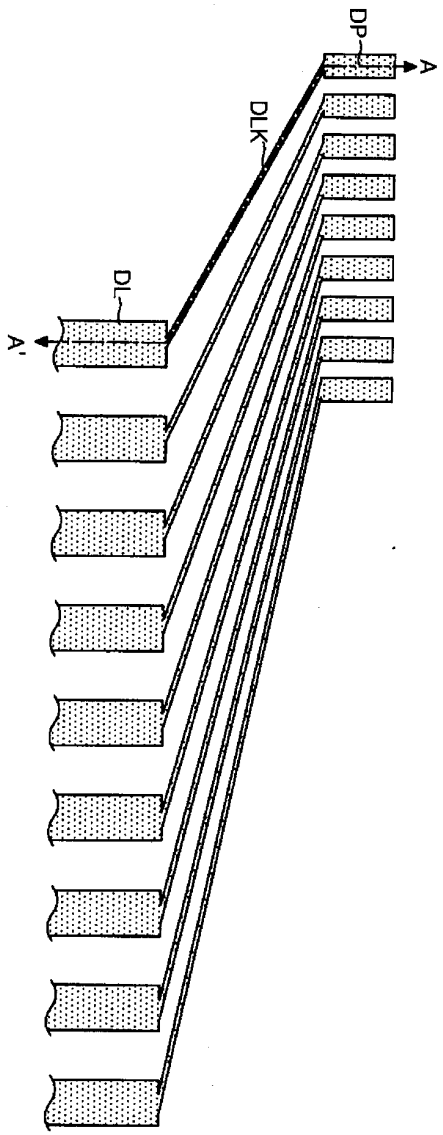
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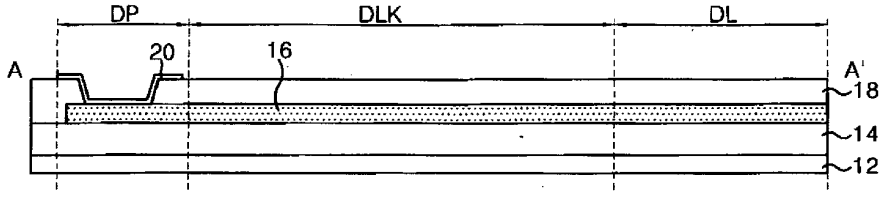



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도면3



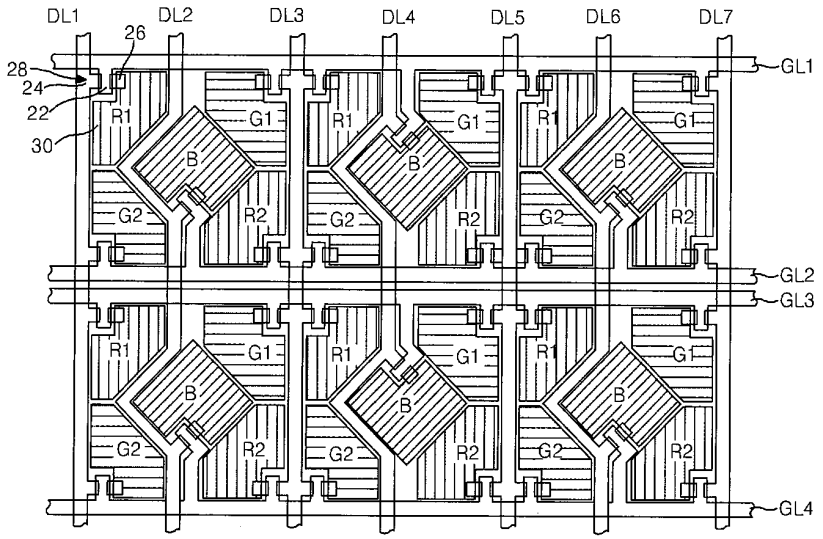

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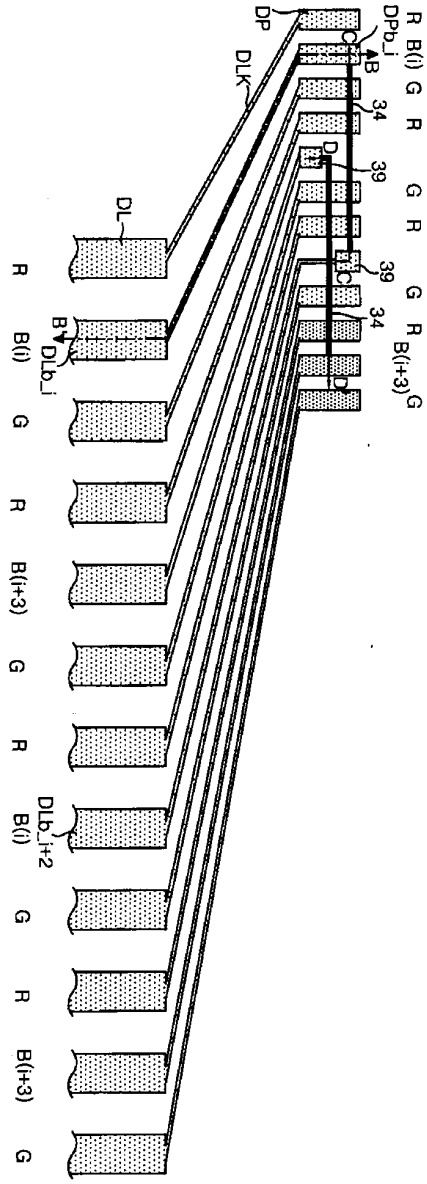
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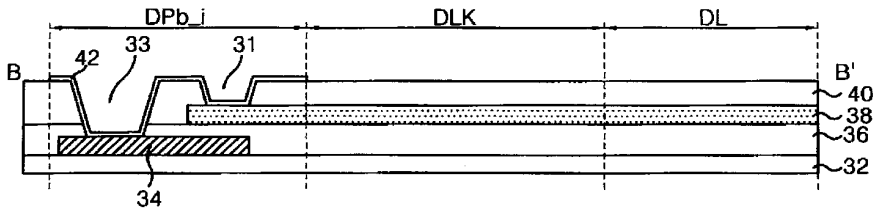
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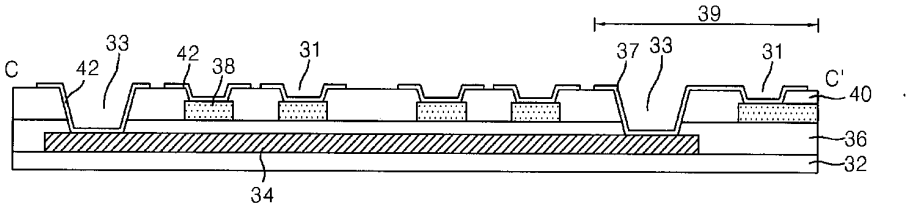



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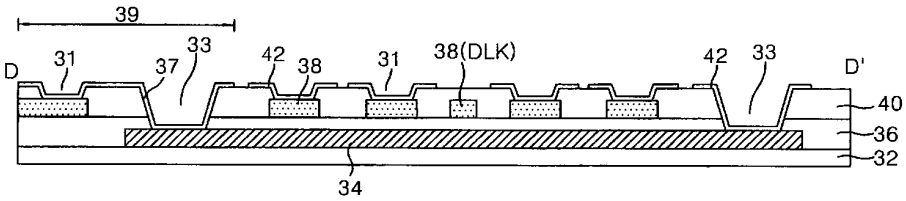
도면7




도면8



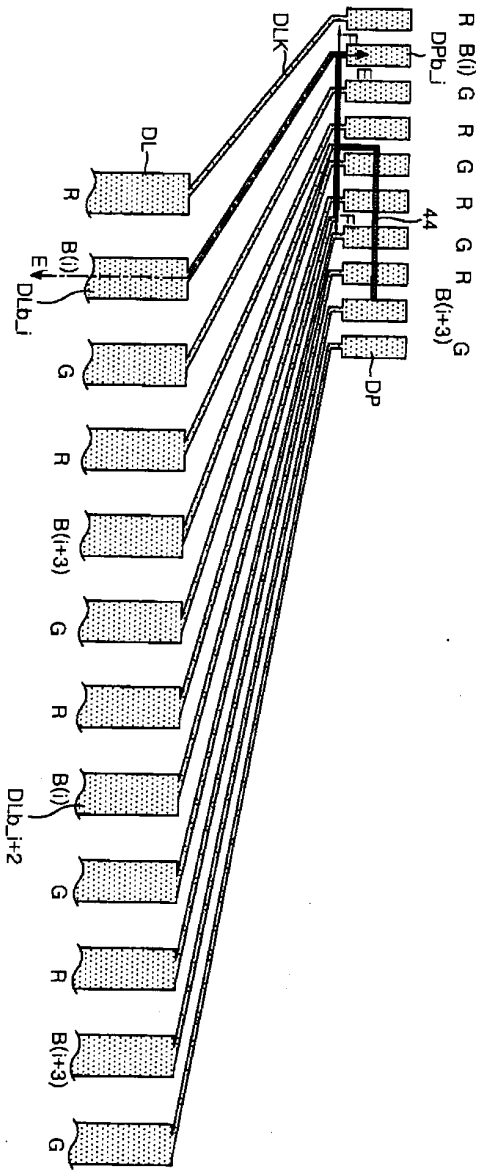

도면9






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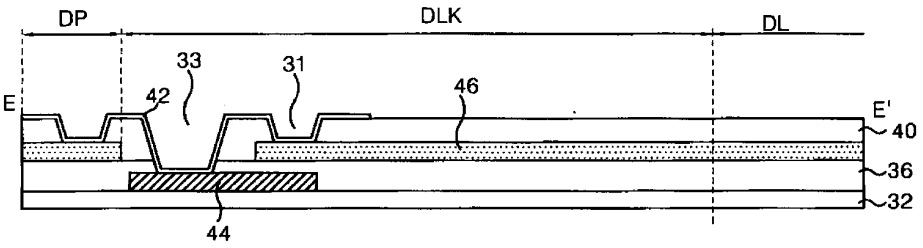
도면10



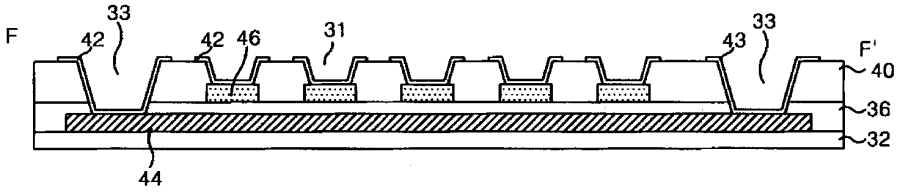



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도면11



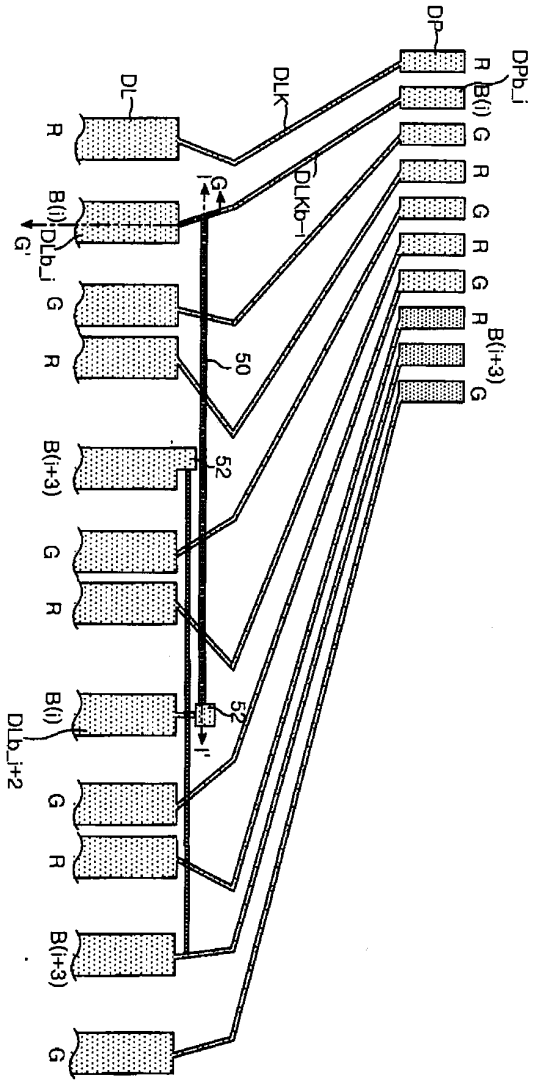

도면12



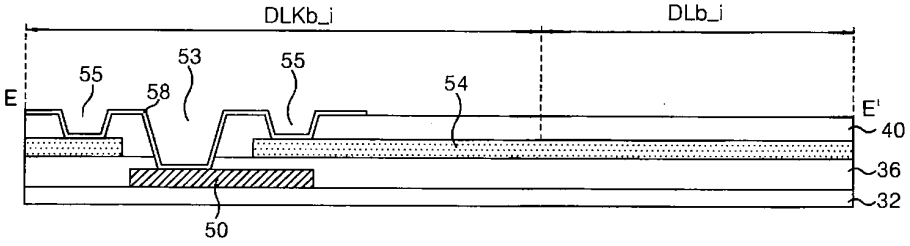



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도면13



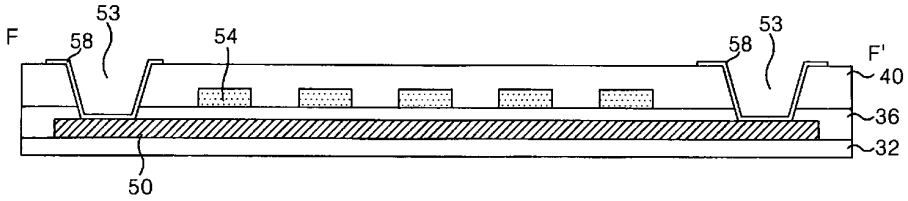

도면14






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도면15






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- SEO, SEONG MOH
- LEE, JAE YOON

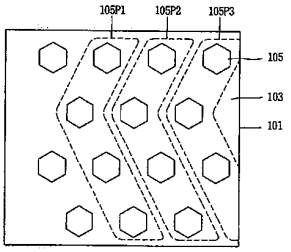
(54) SHADOW MASK AND METHOD OF FORMING ORGANIC ELECTROLUMINESCENCE DEVICE USING THE SAME, INCLUDING A PLURALITY OF PIXEL AREAS

(57) Abstract:

<SEC> PURPOSE: A shadow mask and method of forming organic electroluminescence device using the same is provided to realize high definition by reducing a diagonal distance between each organic layer patterns while handing shadowing effect.

CONSTITUTION: A shadow mask(101) includes a shielding unit and a plurality of transmission parts(105) which is opened to the hexagon form having the regular interval while corresponding to the pixels domain of the substrate. An organic thin film pattern includes a red, green, blue pattern and plurality of transmission parts corresponds to the organic thin film pattern.

Ò KIPO 2009 </SEC>




## Legal Status

| No. | Receipt/Delivery No. | Receipt/Delivery Date | Document Title (KOR.) | Status (KOR.) |
|---|---|---|---|---|
| 1 | 1-1-2007-0592381-98 | 2007.08.16 | [Patent Application] Patent Application ([특허출원]특허출원서) | Acceptance (수리) |



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| | | | | |
|---|---|---|---|---|
| 2 | 4-1-2008-5061241-15 | 2008.04.18 | Notification of change of applicant's information (출원인정보변경(경정)신고서) | Acceptance (수리) |
| 3 | 4-1-2010-5241074-12 | 2010.12.21 | Notification of change of applicant's information (출원인정보변경(경정)신고서) | Acceptance (수리) |
| 4 | 4-1-2011-5199065-15 | 2011.10.04 | Notification of change of applicant's information (출원인정보변경(경정)신고서) | Acceptance (수리) |
| 5 | 4-1-2011-5262372-95 | 2011.12.29 | Notification of change of applicant's information (출원인정보변경(경정)신고서) | Acceptance (수리) |



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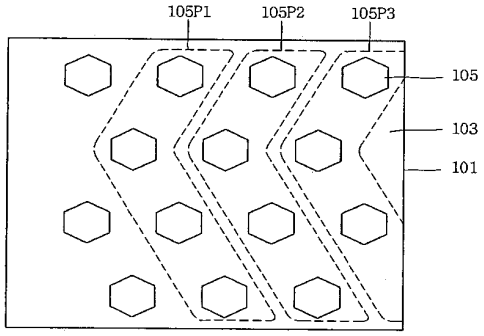
# (54) 쉐도우 마스크 및 이를 이용한 유기 전계발광소자의제조방법

## (57) 요 약

본 발명은 복수개의 화소영역을 가진 기판의 상부에 유기 박막 패턴을 형성하기 위한 쉐도우 마스크 및 이를 이용한 유기 전계발광소자의 제조방법에 관해 개시한다. 개시된 쉐도우 마스크는 차단부와, 상기 기판의 복수개의 화소영역에 각각 대응하며, 규칙적인 간격을 가지고 육각형 형태로 개구된 다수의 투과부를 포함한다.

따라서, 상기한 구성에 따르면, 본 발명은 기존의 사각형태의 쉐도우 마스크에서 쉐도잉 효과가 극대화된 각진 코너 부위를 제거하여 육각형 형태로 개구된 투과부를 형성할 수 있다. 이로써, 본 발명은 기존의 쉐도잉 효과를 억제할 뿐만 아니라 고해상도 쉐도우 마스크 제작이 가능한 이점이 있다.

*대 표 도* - 도5






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## *특허청구의 범위*

**청구항 1**

복수개의 화소영역을 가진 기판의 상부에 유기 박막 패턴을 형성하기 위한 쉐도우 마스크에 있어서,

차단부와,

상기 기판의 복수개의 화소영역에 각각 대응하며, 규칙적인 간격을 가지고 육각형 형태로 개구된 다수의 투과부를 포함하는 쉐도우 마스크.

**청구항 2**

제 1항에 있어서, 상기 차단부는 서스 재질인 것을 특징으로 하는 쉐도우 마스크.

**청구항 3**

제 1항에 있어서, 상기 유기 박막 패턴은 각각의 레드(R), 그린(G) 및 블루(B) 패턴을 포함한 것을 특징으로 하는 쉐도우 마스크.

**청구항 4**

제 1항에 있어서, 상기 각 투과부들은 상기 유기 박막 패턴과 대응되도록 형성된 것을 특징으로 하는 쉐도우 마스크.

**청구항 5**

제 4항에 있어서, 상기 각 투과부들은 상기 레드(R) 패턴 및 상기 레드(R) 패턴과 인접한 레드(R) 패턴들과 대응되도록 형성되되, "<"형태로 배열된 제 1투과부를 포함하는 쉐도우 마스크.

**청구항 6**

제 4항에 있어서, 상기 각 투과부들은 상기 그린(G) 패턴 및 상기 그린(G) 패턴과 인접한 그린(G) 패턴들과 대응되도록 형성되되, "<"형태로 배열된 제 2투과부를 포함하는 쉐도우 마스크.

**청구항 7**

제 4항에 있어서, 상기 각 투과부들은 상기 블루(B) 패턴 및 상기 블루(B) 패턴과 인접한 블루(B) 패턴들과 대응되도록 형성되되, "<"형태로 배열된 제 3투과부를 포함하는 쉐도우 마스크.

**청구항 8**

제 1항에 있어서, 상기 각 투과부들 간의 대각선 상의 거리는 적어도 50㎛ 인 것을 특징으로 하는 쉐도우 마스크.

**청구항 9**

화소영역이 정의된 기판을 준비하는 단계와,

상기 기판의 일면이 아래 방향으로 향하도록 배열하는 단계와,

상기 기판의 하부에 위치하되, 차단부 및 상기 각 화소영역에 각각 대응하며 규칙적인 간격을 가지고 육각형 형태로 개구된 다수의 투과부를 포함하는 쉐도우 마스크를 제공하는 단계와,

상기 쉐도우 마스크를 통해 상기 기판의 화소영역에 선택적으로 유기물질을 증착하여 유기 박막 패턴을 형성하는 단계를 포함하는 유기전계 발광소자의 제조방법.

**청구항 10**

제 9항에 있어서, 상기 각 투과부 간의 대각선 상의 거리는 적어도 50㎛ 인 것을 특징으로 하는 유기전계 발광소자의 제조방법.



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**청구항 11**

제 9항에 있어서, 상기 유기물질은 열증착법에 의해 형성하는 것을 특징으로 하는 유기전계 발광소자의 제조방법.

**청구항 12**

제 9항에 있어서, 상기 유기 박막 패턴은 다수개의 레드(R), 그린(G) 및 블루(B) 패턴을 갖도록 형성하는 것을 특징으로 하는 유기전계 발광소자의 제조방법.

**청구항 13**

제 12항에 있어서, 상기 유기 박막 패턴의 각 레드(R), 그린(G) 및 블루(B) 패턴은 상기 투과부들과 대응된 위치에 형성된 것을 특징으로 하는 유기전계 발광소자의 제조방법.

**청구항 14**

제 12항에 있어서, 상기 유기 박막 패턴의 각 레드(R) 패턴들은 인접한 레드 패턴들과 "<"형태로 배열된 것을 특징으로 하는 유기전계 발광소자의 제조방법.

**청구항 15**

제 12항에 있어서, 상기 유기 박막 패턴의 각 그린(G) 패턴들은 인접한 그린 (G)패턴들과 "<"형태로 배열된 것을 특징으로 하는 유기전계 발광소자의 제조방법.

**청구항 16**

제 12항에 있어서, 상기 유기 박막 패턴의 각 블루(B) 패턴들은 인접한 블루 (B)패턴들과 "<"형태로 배열된 것을 특징으로 하는 유기전계 발광소자의 제조방법.

# *명 세 서*

## *발명의 상세한 설명*

### *기 술 분 야*

<1> 본 발명은 쉐도우 마스크 및 이를 이용한 유기 전계발광소자(organic electroluminescence device : OELD, 이하, '유기 전계 발광소자'라 칭함)에 관한 것으로서, 보다 구체적으로는 고해상도를 구현할 수 있는 쉐도우 마스크 및 이를 이용한 유기 전계 발광소자의 제조방법에 관한 것이다.

### *배 경 기 술*

<2> 최근 표시장치(디스플레이)의 대형화에 따라 공간 점유가 적은 평면표시소자의 요구가 증대되고 있다. 이러한 문제를 해결할 가능성이 있는 디스플레이로서 최근 유기 발광 재료를 사용한 유기 전계 발광소자가 많은 주목을 받고 있다.

<3> 유기 전계 발광소자는 저전압구동, 자기발광, 높은 발광 효율, 경량박형, 넓은 시야각 및 빠른 응답속도 등의 장점을 가지고 있고, 발광물질을 선택하여 풀 칼라 발광이 가능하여 차세대 평판 디스플레이 기술 중의 하나로서 기술개발이 활발하게 진행되고 있다. 여기서, 상기 유기 전계 발광은 유기물(저분자 또는 고분자) 박막에 음극과 양극을 통하여 주입된 전자(electron)와 정공(hole)이 재결합(recombination)하여 여기자 (exition)를 형성하고, 형성된 여기자로부터의 에너지에 의해 특정한 파장의 빛이 발생되는 현상이다. 이러한 현상을 이용한 유기 전계 발광 소자는 도 1에 도시된 바와 같은 기본적인 구조를 가지고 있다.

<4> 도 1은 통상의 유기 전계 발광 소자를 나타내는 개략도이다.

<5> 도 1에 도시된 바와 같이, 통상적인 유기 전계 발광소자는 투명기판(1)과, 상기 투명기판(1) 상부에 스트라이프 형태로 일렬로 배열된 양극 전극(2)과, 상기 양극 전극(2) 상에 적층되어 형성된 유기 전계발광층인 유기 박막 패턴(3) 및 상기 유기 박막 패턴(3) 상에서 양극 전극(2)과 교차하고 띠 모양으로 형성된 음극 전극(4)인 금속 전극이 순차적으로 적층된 구조를 포함하여 구성된다.



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<6> 상기 유기 박막 패턴(3)은, 양극 전극(2)으로부터 주입된 정공을 발광층으로 수송하는 정공 수송층(3B, hole transport layer); 양극 전극(2)과 음극 전극(4)으로부터 공급된 정공과 전자의 재결합이 이루어지면서 발광이 일어나는 영역인 발광층(3C, emitting layer); 및 음극 전극(4)으로부터 공급되는 전자의 원활한 수송을 위한 전자 수송층(3D, electron transport layer)이 순차적으로 적층된 구조를 갖는다. 경우에 따라서는 소자 내에 정공 및 전자의 주입이 원활하게 하기 위한 정공 주입층(hole injection layer) 및 전자 주입층(electron injection layer)을 더 적층할 수 있다.

<7> 도 2는 상술한 유기 박막 패턴을 형성하기 위한 통상의 쉐도우 마스크를 도시한 단면도이다. 또한, 도 3는 도 2의 쉐도우 마스크를 사용하여 얻은 유기 박막 패턴의 평면도이다.

<8> 도 2 및 도 3에 도시된 바와 같이, 상술한 유기 박막 패턴(3)을 형성하기 위한 쉐도우 마스크(12)는 차단부(21)와, 기판(미도시)의 화소영역과 대응하는 투과부(20)으로 구성된다.

<9> 상기 쉐도우 마스크(12)의 투과부(20)는 사각 형태로서, 형성하고자 하는 유기 박막 패턴의 각 레드(R), 그린(G) 및 블루(B)패턴(3R)(3G)(3B)들과 대응된 부위가 개구되도록 형성된다. 보다 구체적으로는, 상기 쉐도우 마스크(12)의 투과부(20)은 직사각형 형태로 형성된다.

<10> 한편, 상기 쉐도우 마스크(12)는 서스 재질이 이용된다.

<11> 상기 쉐도우 마스크에 의해 형성된 유기 박막 패턴(3)은 각각의 레드(R), 그린(G) 및 블루(B)패턴(3R)(3G)(3B)들을 포함한다. 이때, 상기 쉐도우 마스크(12)를 이용하여 얻은 상기 유기 박막 패턴(3)들 간의 수직 또는 수평 거리(l1)는 50㎛ 이하, 바람직하게는 30~50㎛에 해당된다. 또한, 상기 유기 박막 패턴(3)들 간의 대각선 상의 거리(d1)은 50㎛ 이하, 바람직하게는 30~50㎛에 해당된다.

<12> 도 4는 도 2의 쉐도우 마스크를 사용하여 유기 전계 발광소자 중 유기 박막 패턴을 제조하는 방법을 설명하기 위한 단면도이다.

<13> 이하, 도 4를 참고로 하여 상술한 쉐도우 마스크(12)를 이용하여 상기 유기 전계 발광소자에서의 유기박막 패턴을 형성하는 방법에 대해 알아보면 다음과 같다.

<14> 도 4에서 나타낸 것과 같이, 먼저, 유기 박막 패턴 형성을 위해 스트라이프 형태의 양극이 형성된 기판(10)에 상술한 통상의 쉐도우 마스크(12)를 제공한다. 그런 다음, 유기물 소스(16)에 열을 가하여 상기 유기물 소스(16)를 증기화시켜 상기 쉐도우 마스크(12)의 투과부(20)을 통해 상기 양극이 형성된 기판(10) 위에 레드(R), 그린(G), 블루(B)을 발광하는 유기 박막 패턴(3)을 형성한다.

<15> 그러나, 상기 새도우 마스크(12)는 실제로는 투과부의 측면 프로파일이 오목하게 형성된 구조를 가지고 있다. 따라서, 상기 유기 박막 패턴을 형성하는 과정에서 투과부의 모서리 부위가 중앙부위에 비해 유기물 증착 두께가 상대적으로 얇게 되는 쉐도잉 현상(shadowing effect)이 발생된다. 또한, 이러한 쉐도우 마스크(12)는 서스(sus)재질로 되어 있어, 유기물 소스에서 유기물을 증착함과 동시에 열에 의해 마스크가 팽창하게 되며, 특히 풀컬러 마스크의 경우 열을 받는 면적이 대면적이기 때문에 열팽창이 쉽게 일어난다.

<16> 이와 같이, 종래의 유기 전계 발광소자의 제조에 있어 문제점은 한 개의 쉐도우 마스크를 사용하여 유기물을 증착하기 때문에, 유기물 소스에 의해 풀컬러 마스크의 열 팽창으로 인한 마스크의 처짐 현상이 발생하고, 레드(R), 그린(G), 블루(B) 화소 구현시 정 위치가 아닌 인접 셀에 쉐도잉 현상이 발생하는 문제가 있다. 또한 열팽창이 심하게 되면 열에 의한 쉐도우 마스크의 변형이 발생하게 된다.

<17> 이외에도, 레드(R), 그린(G), 블루(B) 패턴을 가진 유기 박막 패턴(3)에 있어서, 상기 각 레드(R), 그린(G), 블루(B) 패턴 간의 수직 또는 수평 거리(l1)는 현 기술로는 50㎛ 이하로 줄이기는 어렵다. 따라서, 고해상도를 구현하기 위해, 상기 각 유기 박막 패턴 간의 대각선 상의 거리(d1)를 감소시킴으로써 각 유기 박막 패턴(3R,3G,3B) 간의 간격을 조밀하게 하는 방법을 제안할 수 있다. 그러나, 통상적인 사각형태의 투과부를 가진 쉐도우 마스크 구조에서는 이러한 거리(d1)를 줄이는 데에는 한계가 있다.

## *발명의 내용*

### *해결 하고자하는 과제*

<18> 상기 문제점을 해결하고자, 본 발명의 목적은 쉐도잉 효과에 대처가능하면서 각 유기 박막 패턴들 간의 대각선 상의 거리를 줄여 고해상도를 실현할 수 있는 쉐도우 마스크 및 이를 이용한 유기전계 발광소자의 제조방법을



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제공하려는 것이다.

### *과제 해결수단*

<19> 상기 목적을 달성하고자, 복수개의 화소영역을 가진 기판의 상부에 유기 박막 패턴을 형성하기 위한 쉐도우 마스크에 있어서, 본 발명은 차단부와, 상기 기판의 복수개의 화소영역에 각각 대응하며, 규칙적인 간격을 가지고 육각형 형태로 개구된 다수의 투과부를 포함한다.

<20> 상기 차단부는 서스 재질인 것이 바람직하다.

<21> 상기 유기 박막 패턴은 각각의 레드(R), 그린(G) 및 블루(B) 패턴을 포함한 다. 이때, 상기 각 투과부들은 상기 유기 박막 패턴과 대응되도록 형성된 것이 바람직하다.

<22> 상기 각 투과부들은 상기 레드(R) 패턴 및 상기 레드(R) 패턴과 인접한 레드 (R) 패턴들과 대응되도록 형성되되 "<"형태로 배열되고, 상기 각 투과부들은 상기 그린(G) 패턴 및 상기 그린(G) 패턴과 인접한 그린(G) 패턴들과 대응되도록 형성되되 "<"형태로 배열되고, 상기 각 투과부들은 상기 블루(B) 패턴 및 상기 블루(B) 패턴과 인접한 블루(B) 패턴들과 대응되도록 형성되되, "<"형태로 배열된 것이 바람직하다.

<23> 상기 각 투과부들 간의 대각선 상의 거리는 적어도 50㎛ 인 것이 바람직하다.

<24> 본 발명에 따른 유기전계 발광소자의 제조방법은 화소영역이 정의된 기판을 준비하는 단계와, 상기 기판의 일면이 아래 방향으로 향하도록 배열하는 단계와, 상기 기판의 하부에 위치하되, 차단부 및 상기 각 화소영역에 각각 대응하며 규칙적인 간격을 가지고 육각형 형태로 개구된 다수의 투과부를 포함하는 쉐도우 마스크를 제공하는 단계와, 상기 쉐도우 마스크를 통해 상기 기판의 화소영역에 선택적으로 유기물질을 증착하여 유기 박막 패턴을 형성하는 단계를 포함한다.

<25> 상기 각 투과부 간의 대각선 상의 거리는 적어도 50㎛ 인 것이 바람직하다.

<26> 상기 유기물질은 열증착법에 의해 형성하는 것이 바람직하다.

<27> 상기 유기 박막 패턴은 다수개의 레드(R), 그린(G) 및 블루(B) 패턴을 갖도록 형성하는 것이 바람직하다.

<28> 상기 유기 박막 패턴의 각 레드(R), 그린(G) 및 블루(B) 패턴은 상기 투과부들과 대응된 위치에 형성된 것이 바람직하다.

<29> 상기 유기 박막 패턴의 각 레드(R) 패턴들은 인접한 레드 패턴들과 "<"형태로 길게 배열되고, 상기 유기 박막 패턴의 각 그린(G) 패턴들은 인접한 그린 (G)패턴들과 "<"형태로 길게 배열되고, 상기 유기 박막 패턴의 각 블루(B) 패턴들은 인접한 블루 (B)패턴들과는 "<"형태로 길게 배열된 것이 바람직하다.

### *효 과*

<30> 본 발명에 따르면, 기판의 복수개의 화소영역에 각각 대응하며, 규칙적인 간격을 가지고 육각형 형태로 개구된 다수의 투과부를 포함하는 쉐도우 마스크를 제공한다. 즉, 본 발명은 기존의 사각형태의 쉐도우 마스크에서 쉐도잉 효과가 극대화된 각진 코너 부위를 제거하여 육각형 형태로 개구된 투과부를 얻을 수 있다.

<31> 따라서, 본 발명은 기존의 쉐도잉 효과를 억제할 뿐만 아니라 각 유기층 패턴 간의 대각선 상의 거리(d2)를 줄일 수 있다. 이로써, 고해상도 쉐도우 마스크 제작이 가능한 이점이 있다.

### *발명의 실시를 위한 구체적인 내용*

<32> 이하, 첨부된 도면을 참고로 하여 본 발명에 따른 쉐도우 마스크 및 이를 이용한 유기전계 발광소자의 제조방법에 대해 상세하게 설명하기로 한다.

<33> 도 5는 본 발명에 따른 쉐도우 마스크의 평면도이다. 또한, 도 6은 도 5의 쉐도우 마스크를 이용하여 형성한 유기 전계발광소자의 유기 박막 패턴의 평면도이다.

<34> 도 5 및 도 6에 도시된 바와 같이, 본 발명에 따른 쉐도우 마스크(101)는 복수개의 화소영역을 가진 기판(111)의 상부에 유기 박막 패턴((113)을 형성하기 위한 것으로서, 차단부(103) 및 상기 기판의 화소영역과 대응하는 부위를 개구시키는 다수개의 투과부(105)로 구성된다.



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<35> 이때, 상기 유기 박막 패턴(113)은 각각의 레드(R), 그린(G) 및 블루(B) 패턴(113R)(113G)(113B)을 포함한다.

<36> 상기 투과부(105)들은 규칙적인 간격을 가지면서 기존의 사각 형태와는 달리 육각형 형태로 개구된 형상을 가진다. 즉, 본 발명에 따른 쉐도우 마스크의 투과부(105)는 쉐도잉 효과가 극대화되던 기존의 사각 형태의 투과부 에지부위를 없애어 육각형 형태로 형성된다.

<37> 상기 투과부(105)들은 상기 유기 박막 패턴(113)들과 대응된 부위에 형성되며, 제 1투과부(105P1), 제 2투과부(105P2) 및 제 3투과부(105P3)로 이루어진다. 이때, 상기 제 1투과부(105P1)는 상기 레드(R) 패턴(113R) 및 상기 레드(R) 패턴(113R)과 인접한 레드(R) 패턴들과 대응된 부위가 개구되도록 형성된다. 또한, 상기 제 2투과부(105P2)는 그린(G) 패턴(113G) 및 상기 그린(G) 패턴(113G)과 인접한 그린(G) 패턴들과 대응된 부위가 개구되도록 형성된다. 그리고, 상기 제 3투과부(105P3)는 블루(B) 패턴(113B) 및 상기 블루(B) 패턴(113B)과 인접한 블루(B) 패턴들과 대응된 부위가 개구되도록 형성된다.

<38> 한편, 도 5에 도시된 바와 같이, 상기 본 발명에 따른 쉐도우 마스크(101)의 제 1투과부(105P1), 제 2투과부(105P2) 및 제 3투과부(105P3)는 각각 "<" 형태로 배열된 구조를 가진다. 따라서, 상기 레드(R) 패턴(113R) 및 상기 레드(R) 패턴(113R)과 인접한 레드(R) 패턴들, 그린(G) 패턴(113G) 및 상기 그린(G) 패턴(113G)과 인접한 그린(G) 패턴들, 및 블루(B) 패턴(113B) 및 상기 블루(B) 패턴(113B)과 인접한 블루(B) 패턴들도 "<" 형태로 배열된 구조를 가진다.

<39> 동일 크기의 쉐도우 마스크를 사용한 경우, 본 발명에서는 상기 각 유기 박막 패턴(113R,113G,113B:113) 간의 수직 또는 수평 거리(12)는 50㎛ 이하, 바람직하게는 30~50㎛를 가진다. 또한, 본 발명에 따른 상기 각 유기 박막 패턴(113R,113G,113B:113) 간의 대각선 상의 거리(d2)는 기존의 거리(d1)보다도 넓게 된다. 따라서, 본 발명에서는 각 유기 박막 패턴(113R,113G,113B:113) 간의 대각선 상의 거리(d2)를 기존과 동일한 50㎛ 로 할 경우, 기존 쉐도우 마스크보다도 조밀하게 투과부들을 제작할 수 있다.

<40> 상기 차단부(103)를 가지는 쉐도우 마스크(101)는 서스(sus)재질 또는 서스와 다른 금속을 혼합한 물질을 이용할 수 있다.

<41> 도 7a 내지 도 7e는 본 발명에 따른 쉐도우 마스크를 이용한 유기전계 발광소자의 제조 방법을 나타낸 공정별 단면도이다.

<42> 이하에서는 도 7a 내지 도 7e를 참고로 하여 상기와 같은 구성을 가진 본 발명에 따른 쉐도우 마스크를 이용하여 유기전계 발광소자를 제조하는 방법에 대해 상세하게 설명하기로 한다.

<43> 도 7a에 도시된 바와 같이, 화소영역이 정의된 기판(111)을 준비한다. 이때, 상기 기판(111)에는 어레이배선(미도시) 및 박막 트랜지스터(미도시) 등이 형성되어 있다.

<44> 이어, 도 7b에 도시된 바와 같이, 상기 기판(111)의 일면이 아래 방향으로 향하도록 배열한다.

<45> 그 다음, 도 7c에 도시된 바와 같이, 상기 기판(111)의 하부에 본 발명에 따른 쉐도우 마스크(111)를 제공한다. 이때, 상기 쉐도우 마스크(111)는 차단부(103) 상기 각 화소영역에 각각 대응하며 규칙적인 간격을 가지고 육각형 형태로 개구된 다수의 투과부(105)를 포함하여 구성된다. 여기서, 상기 각 투과부(105)는 형성하고자 하는 상기 유기 박막 패턴의 각 레드(R), 그린(G) 및 블루(B) 패턴들과 대응된 부위에 형성된다. 또한, 상기 쉐도우 마스크(111)는 상기 각 투과부(105) 간의 대각선 상의 거리가 적어도 50㎛ 이내가 되도록 패터닝된다.

<46> 이 후, 상기 쉐도우 마스크(101)를 통해 상기 기판의 화소영역에 선택적으로 레드 유기물질을 증착하여 레드(R) 패턴(113R)들을 형성한다. 이때, 상기 쉐도우 마스크(101)는 상기 레드 패턴(113R)들이 형성될 부위는 개구되어 있고 상기 그린 및 블루 패턴들이 형성될 부위는 덮여져 있다. 여기서, 상기 레드(R) 패턴(113R)들은 상기 레드 유기물질을 열증착하여 형성할 수 있다. 또한, 레드(R) 패턴(113R)들은 인접한 레드 패턴들과는 "<" 형태로 길게 배열된다.

<47> 이어, 도 7d에 도시된 바와 같이, 상기 레드(R) 패턴(113R)들이 형성된 기판 위에 상기 쉐도우 마스크(101)를 일정 간격만큼 쉬프트한 다음, 선택적으로 그린 유기물질을 증착하여 그린(G) 패턴(113G)들을 형성한다. 이때, 상기 쉐도우 마스크(101)는 상기 그린(G)(113R)들이 형성될 부위는 개구되어 있고 상기 레드 패턴(113R)들 및 상기 블루 패턴들이 형성될 부위는 덮여져 있다. 여기서, 상기 그린(G) 패턴(113G)들은 열증착법에 의해 형성할 수 있다. 또한, 상기 그린(G) 패턴(113G)들은 인접한 그린 패턴들과는 "<" 형태로 길게 배열



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된다.

<48> 그 다음, 도 7e에 도시된 바와 같이, 상기 그린(G) 패턴(113G)들이 형성된 기판 위에 상기 쉐도우 마스크(101)를 다시 일정 간격만큼 쉬프트한 다음, 선택적으로 블루 유기물질을 증착하여 블루(B) 패턴(113B)들을 형성한다. 이때, 상기 쉐도우 마스크(101)는 상기 블루(B)(113B)들이 형성될 부위는 개구되어 있고 상기 레드 패턴(113R)들 및 그린(G) 패턴(113G)들은 덮여져 있다.

<49> 그 결과, 상기 기판(111) 상에 레드(R) 패턴(113R)들, 그린(G) 패턴(113G)들 및 블루(B) 패턴(113B)들로 이루어진 유기 박막 패턴(113) 제조가 완료된다. 여기서, 상기 블루(B) 패턴(113B)들도 상기 레드(R) 패턴(113R)들 및 그린(G) 패턴(113G)들과 마찬가지로 열증착법에 의해 형성할 수 있다. 또한, 상기 블루(B) 패턴(113B)들은 상기 레드(R) 패턴(113R)들 및 그린(G) 패턴(113G)들과 마찬가지로 인접한 블루 패턴들과 "<" 형태로 길게 배열된다.

<50> 상술한 바와 같이, 상기 유기 박막 패턴(113)을 이루는 각각의 레드(R) 패턴(113R), 그린(G) 패턴(113G) 및 블루(B) 패턴(113B)은 육각형 형태로 제작되며, 이들 각각의 레드(R) 패턴(113R)들로 이루어진 레드(R) 패턴(113R)군(113RG), 그린(G) 패턴(113G)들로 이루어진 그린(G) 패턴(113G)군(113RG) 및 블루(B) 패턴(113B)들로 이루어진 블루(B) 패턴(113B)군(113BG)는 "<" 형태로 길게 배열된다.

## *도면의 간단한 설명*

<51> 도 1은 일반적인 유기 전계발광소자를 나타내는 개략도이다.

<52> 도 2는 통상의 쉐도우 마스크를 도시한 단면도이다.

<53> 도 3는 도 2의 쉐도우 마스크를 사용하여 얻은 유기 박막 패턴의 평면도이다.

<54> 도 4는 도 2의 쉐도우 마스크를 사용하여 유기 전계 발광소자 중 유기 박막 패턴을 제조하는 방법을 설명하기 위한 단면도이다.

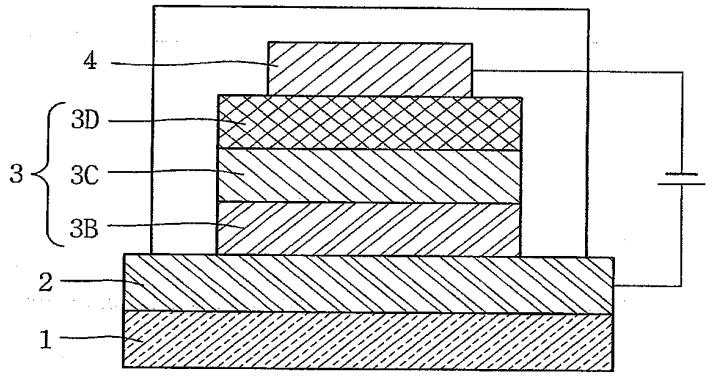
<55> 도 5는 본 발명에 따른 쉐도우 마스크의 평면도이다.

<56> 도 6은 도 5의 쉐도우 마스크를 이용하여 형성한 유기 전계발광소자의 유기 박막 패턴의 평면도이다.

<57> 도 7a 내지 도 7e는 본 발명에 따른 쉐도우 마스크를 이용한 유기전계 발광소자의 제조 방법을 나타낸 공정별 단면도이다.

## *도면*

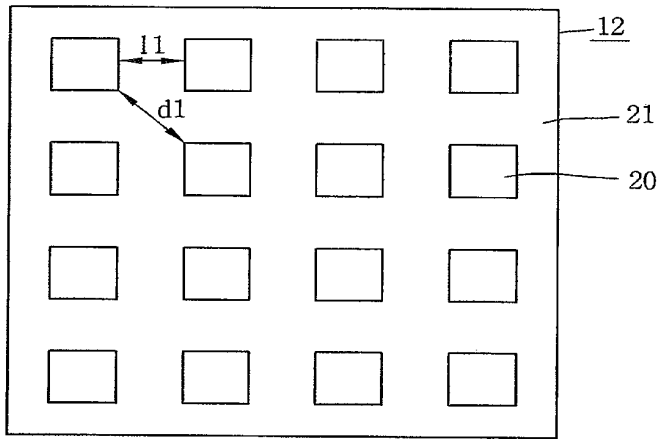
### *도면1*



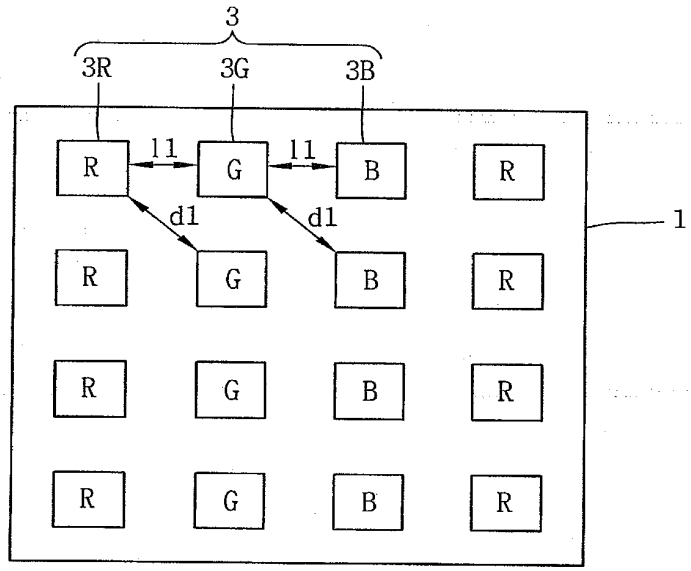



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도면2



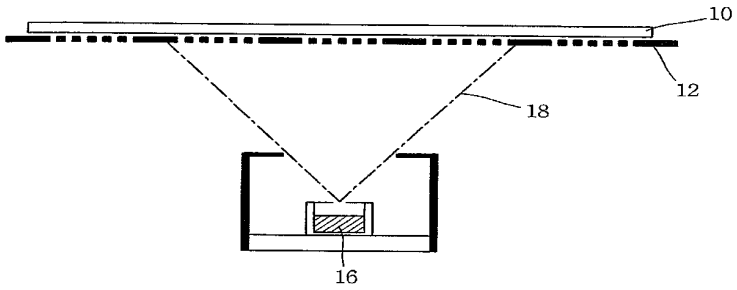

도면3



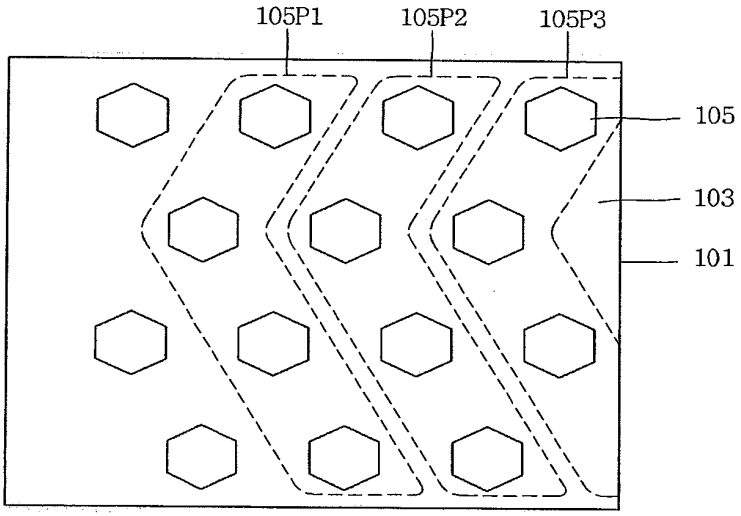



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도면4



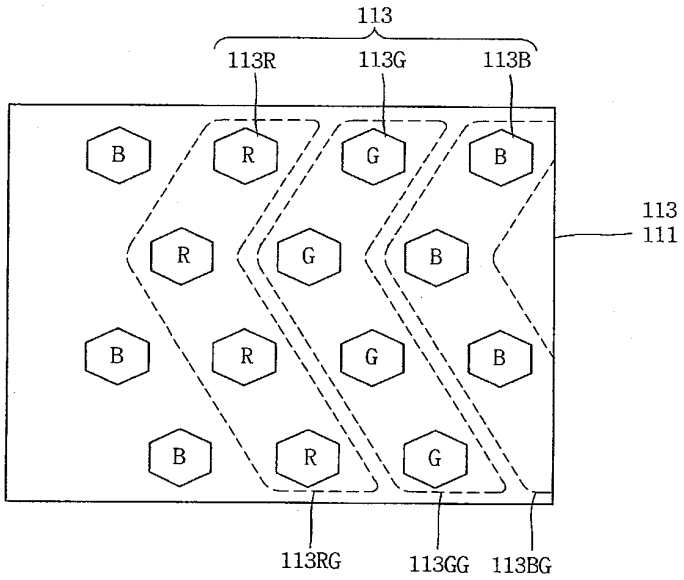

도면5



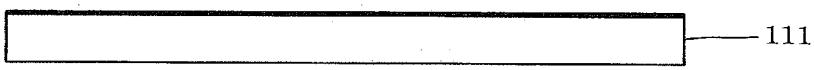



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도면6




도면7a



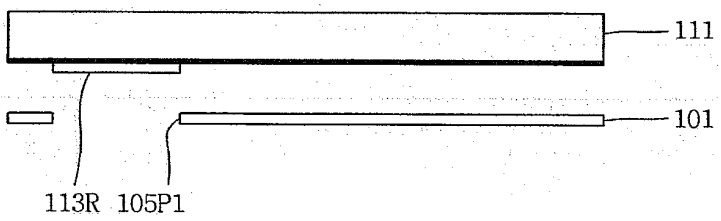

도면7b



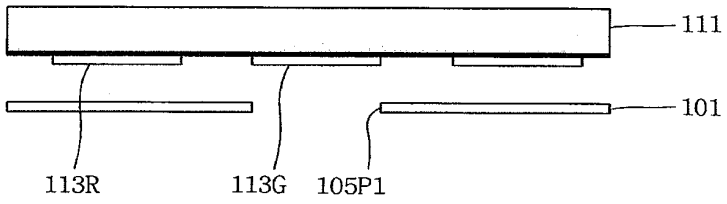



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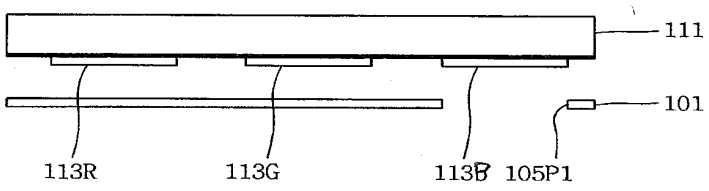
도면7c




도면7d




도면7e






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- LG DISPLAY CO., LTD.

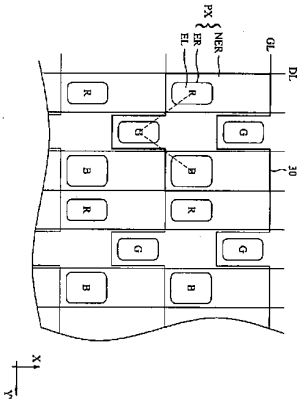
(72) Inventor:
- KIM, SANG JUN
- LEE, SEUNG HWAN

(54) ORGANIC ELECTROLUMINESCENT DISPLAY DEVICE CAPABLE OF PREVENTING DISCOLORATION BY CHANGING THE POSITION OF A GREEN SUB PIXEL

(57) Abstract:

PURPOSE: An organic electroluminescent display device is provided to reduce a defect due to misalignment errors of a mask by securing the deposition margin of a light emitting material.

CONSTITUTION: A plurality of red(R) sub pixels are vertically arranged in a row. A plurality of green(G) sub pixels are adjacent to the plurality of red sub pixels. A plurality of blue(B) sub pixels are adjacent to the plurality of green sub pixels. The red sub pixel and the blue sub pixel are horizontally arranged on the same line. The green sub pixel, the red sub pixel, and the blue sub pixel horizontally cross each other.




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(74) 대리인
**박영복, 김용인**

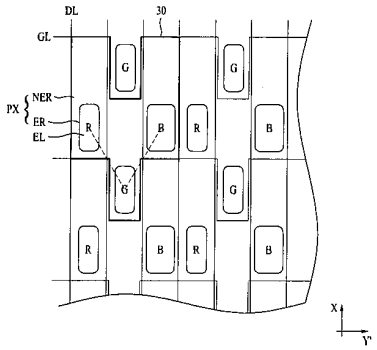
전체 청구항 수 : 총 9 항

## (54) 유기전계발광 표시장치

### *(57) 요 약*

본 발명은 발광층의 증착 마진을 확보하여 고해상도 구현이 용이한 유기전계발광 표시장치에 관한 것으로, 본 발명에 따른 유기전계발광 표시장치는 수직 방향으로 일렬로 배치되는 다수의 적색 서브 화소와, 상기 다수의 적색 서브 화소의 이웃에 배치되는 다수의 녹색 서브 화소 및 상기 다수의 녹색 서브 화소의 이웃에 배치되는 다수의 청색 서브 화소를 포함하고, 상기 적색 서브 화소와 상기 청색 서브 화소는 수평 방향으로 동일한 선 상에 배치되고, 상기 녹색 서브 화소는 상기 적색 서브 화소 및 상기 청색 서브 화소와 수평 방향으로 어긋나도록 배치되는 것을 특징으로 한다.

***대 표 도*** - 도3






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## *특허청구의 범위*

**청구항 1**

수직 방향으로 일렬로 배치되는 다수의 적색 서브 화소;

상기 다수의 적색 서브 화소의 이웃에 배치되는 다수의 녹색 서브 화소; 및

상기 다수의 녹색 서브 화소의 이웃에 배치되는 다수의 청색 서브 화소를 포함하고,

상기 적색 서브 화소와 상기 청색 서브 화소는 수평 방향으로 동일한 선 상에 배치되고, 상기 녹색 서브 화소는 상기 적색 서브 화소 및 상기 청색 서브 화소와 수평 방향으로 어긋나도록 배치되는 것을 특징으로 하는 유기전계발광 표시장치.

**청구항 2**

제 1 항에 있어서, 상기 서브 화소는 비발광 영역과 발광 영역으로 정의되며,

상기 비발광 영역에는 셀 구동부가 형성되고,

상기 발광 영역에는 적색, 녹색 또는 청색을 발하는 발광층이 형성되는 것을 특징으로 하는 유기전계발광 표시장치.

**청구항 3**

제 2 항에 있어서, 상기 적색 서브 화소의 적색 발광 영역은 상기 녹색 서브 화소를 사이에 두고 상기 청색 서브 화소의 청색 발광 영역과 중첩되고,

상기 적색 서브 화소의 상기 비발광 영역은 상기 녹색 서브 화소의 녹색 발광 영역 및 상기 청색 서브 화소의 상기 비발광 영역과 중첩되는 것을 특징으로 하는 유기전계발광 표시장치.

**청구항 4**

제 2 항에 있어서, 상기 녹색 서브 화소의 발광 영역은 상기 적색 서브 화소 및 상기 청색 서브 화소의 비발광 영역에만 중첩되는 것을 특징으로 하는 유기전계발광 표시장치.

**청구항 5**

제 2 항에 있어서, 상기 청색 서브 화소의 발광 영역은 상기 적색 서브 화소 및 상기 녹색 서브 화소의 발광 영역보다 넓은 것을 특징으로 하는 유기전계발광 표시장치.

**청구항 6**

제 2 항에 있어서, 상기 녹색 서브 화소의 발광 영역은 상기 적색 서브 화소의 발과 영역보다 좁고,

상기 적색 서브 화소의 발광 영역은 상기 청색 서브 화소의 발광 영역보다 좁은 것을 특징으로 하는 유기전계발광 표시장치.

**청구항 7**

제 1 항에 있어서, 하나의 상기 적색 서브 화소 및 하나의 상기 청색 서브 화소는 두 개의 상기 녹색 서브 화소와 중첩되도록 배치되고,

하나의 상기 녹색 서브 화소는 두 개의 상기 적색 서브 화소 및 두 개의 상기 청색 서브 화소와 중첩되도록 배치되는 것을 특징으로 하는 유기전계발광 표시장치.

**청구항 8**

제 1 항에 있어서, 상기 적색 서브 화소, 상기 녹색 서브 화소 및 상기 청색 서브 화소는 동일한 게이트 라인에 연결되어 구동되는 것을 특징으로 하는 유기전계발광 표시장치.

**청구항 9**



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제 2 항에 있어서, 상기 셀 구동부는 다수 개의 트랜지스터 및 커패시터를 포함하는 것을 특징으로 하는 유기전계발광 표시장치.

# 명 세 서

## 발명의 상세한 설명

### 기 술 분 야

[0001] 본 발명은 유기전계발광 표시장치에 관한 것으로, 특히 발광층의 증착 마진을 확보하여 고해상도 구현이 용이한 유기전계발광 표시장치에 관한 것이다.

### 배 경 기 술

[0002] 다양한 정보를 화면으로 구현해 주는 영상 표시 장치는 정보 통신 시대의 핵심 기술로 더 얇고 더 가볍고 휴대가 가능하면서도 고성능의 방향으로 발전하고 있다. 근래 정보화 사회의 발전과 더불어, 표시장치에 대한 다양한 형태의 요구가 증대되면서, LCD(Liquid Crystalline Display), PDP(Plasma Display Panel), ELD(Electro Luminescent Display), FED(Field Emission Display) 등 평판표시장치에 대한 연구가 활발히 진행되고 있다. 그 중 음극선관(CRT)의 단점인 무게와 부피를 줄일 수 있는 평판 표시 장치로 유기 발광층의 발광량을 제어하여 영상을 표시하는 유기전계발광 표시장치 등이 각광받고 있다.

[0003] 유기전계발광 표시장치는 전극 사이의 얇은 발광층을 이용한 자발광 소자로 종이와 같이 박막화가 가능하다는 장점이 있다. 유기전계발광 표시장치는 빛이 방출되는 방향에 따라 전면발광(Top-Emission) 방식과 배면발광(Bottom-Emission) 방식 등이 있고, 구동방식에 따라 수동 매트릭스형(Passive Matrix)과 능동 매트릭스형(Active Matrix) 등으로 나눌 수 있다.

[0004] 능동 매트릭스형 유기전계발광 표시장치(AMOLED)는 도 1에 도시된 바와 같이 3색(R, G, B) 서브 화소(PX)로 구성된 단위 화소들이 매트릭스 형태로 배열되어 화상을 표시하게 된다. 각 서브 화소(PX)는 게이트 라인($GL_1$, $GL_2$, $GL_3$,...,$GL_{n-1}$, $GL_n$)과 데이터 라인($DL_1$, $DL_2$, $DL_3$,...,$DL_m$)의 교차에 의해 정의되며, 유기전계 발광소자와, 그 유기전계 발광소자를 독립적으로 구동하는 셀 구동부를 구비한다.

[0005] 일반적으로 유기전계발광 표시장치에 포함된 단위 화소는 서로 다른 R, G, B 색상을 발광하는 3개의 서브 화소(PX)가 일정 순서로 반복 배치되는 구조를 가지는데, 각 서브 화소(PX)마다 동일 면적으로 동일 선상에 배열되어 R, G, B 색상을 나타내는 발광층(EL)이 형성된다. 선택된 서브 화소(PX)의 발광층(EL)은 셀 구동부로부터 제공되는 전류량에 따라 발광하여 영상을 나타낸다.

[0006] 이러한 유기전계발광 표시장치가 고집적화 됨에 따라 서브 화소(PX) 간의 증착 마진이 감소한다. 증착 마진의 감소는 도 2a와 같이 인접한 발광층(EL)이 중첩되어 타색불량이 일어나거나, 마스크의 새도우(shadow)현상에 의하여 도 2b와 같이 인접한 서브 화소(PX) 내 발광층(EL)이 간섭되어 결색불량이 일어나 유기전계발광 표시장치의 신뢰성을 저하시킨다.

### 발명의 내용

#### 해결 하고자하는 과제

[0007] 본 발명은 상기와 같은 문제점을 해결하기 위한 것으로, 발광층의 증착 마진을 확보하여 고해상도 구현이 용이한 유기전계발광 표시장치를 제공하는데 목적이 있다.

#### 과제 해결수단

[0008] 본 발명에 따른 유기전계발광 표시장치는 수직 방향으로 일렬로 배치되는 다수의 적색 서브 화소와, 상기 다수의 적색 서브 화소의 이웃에 배치되는 다수의 녹색 서브 화소 및 상기 다수의 녹색 서브 화소의 이웃에 배치되는 다수의 청색 서브 화소를 포함하고, 상기 적색 서브 화소와 상기 청색 서브 화소는 수평 방향으로 동일한 선상에 배치되고, 상기 녹색 서브 화소는 상기 적색 서브 화소 및 상기 청색 서브 화소와 수평 방향으로 어긋나도록 배치된다.

[0009] 이때, 상기 서브 화소는 비발광 영역과 발광 영역으로 정의되며, 상기 비발광 영역에는 셀 구동부가 형성되고,



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상기 발광 영역에는 적색, 녹색 또는 청색을 발하는 발광층이 형성된다.

[0010] 여기서, 상기 적색 서브 화소의 적색 발광 영역은 상기 녹색 서브 화소를 사이에 두고 상기 청색 서브 화소의 청색 발광 영역과 중첩되고, 상기 적색 서브 화소의 상기 비발광 영역은 상기 녹색 서브 화소의 녹색 발광 영역 및 상기 청색 서브 화소의 상기 비발광 영역과 중첩된다.

[0011] 상기 녹색 서브 화소의 발광 영역은 상기 적색 서브 화소 및 상기 청색 서브 화소의 비발광 영역에만 중첩된다.

[0012] 상기 청색 서브 화소의 발광 영역은 상기 적색 서브 화소 및 상기 녹색 서브 화소의 발광 영역보다 넓다.

[0013] 상기 녹색 서브 화소의 발광 영역은 상기 적색 서브 화소의 발과 영역보다 좁고, 상기 적색 서브 화소의 발광 영역은 상기 청색 서브 화소의 발광 영역보다 좁다.

[0014] 하나의 상기 적색 서브 화소 및 하나의 상기 청색 서브 화소는 두 개의 상기 녹색 서브 화소와 중첩되도록 배치되고, 하나의 상기 녹색 서브 화소는 두 개의 상기 적색 서브 화소 및 두 개의 상기 청색 서브 화소와 중첩되도록 배치된다.

[0015] 상기 적색 서브 화소, 상기 녹색 서브 화소 및 상기 청색 서브 화소는 동일한 게이트 라인에 연결되어 구동된다.

[0016] 한편, 상기 셀 구동부는 다수 개의 트랜지스터 및 커패시터를 포함한다.

### *효 과*

[0017] 본 발명은 서브 화소의 배열을 어긋나게 함으로써, 발광 물질의 증착마진을 확보하여 마스크의 얼라인 오류에 따른 불량을 감소할 수 있다.

[0018] 특히, 녹색 서브 화소의 위치를 변경함으로써, 발광 효율은 유지하면서 타색 및 결색 불량을 감소시켜 유기전계 발광 표시장치의 신뢰성을 향상시킬 수 있다.

### *발명의 실시를 위한 구체적인 내용*

[0019] 이하, 첨부된 도면을 통해 본 발명에 따른 유기전계발광 표시장치를 구체적으로 살펴보면 다음과 같다.

[0020] 도 3은 본 발명에 따른 유기전계발광 표시장치의 서브 화소들의 배열을 나타내는 도면이다. 본 발명에 따른 유기전계발광 표시장치는 기판(미도시) 상에 형성된 전원 라인(미도시)의 신호에 의해 구동되는 다수의 게이트 라인(GL) 및 다수의 데이터 라인(DL)의 수직 교차로 정의되는 다수의 적색(R), 녹색(G), 청색(B)의 서브 화소(PX)들로 구성된다. 적색(R), 녹색(G), 청색(B)의 서브 화소(PX)가 모여 하나의 단위 화소(30)를 이루며, 하나의 서브 화소(PX)는 비발광 영역(NER)과 발광 영역(ER)으로 정의될 수 있다.

[0021] 비발광 영역(NER)에는 주로 셀 구동부가 형성되는데, 셀 구동부는 스위치용 트랜지스터(미도시)와, 구동용 트랜지스터(미도시) 및 스토리지 커패시터(미도시)를 포함한다.

[0022] 스위치용 트랜지스터(미도시)는 게이트 라인(GL)의 스캔 신호에 응답하여 데이터 라인(DL)으로부터의 데이터 신호를 공급하고, 구동용 트랜지스터(미도시)는 스위치용 트랜지스터로부터의 데이터 신호에 응답하여 유기전계 발광소자에 흐르는 전류량을 제어한다. 스토리지 커패시터(미도시)는 스위치용 트랜지스터가 턴-오프되더라도 구동용 트랜지스터(미도시)를 통해 일정한 전류가 흐르게 하는 역할을 한다. 셀 구동부는 샘플링 트랜지스터 또는 프로그래밍 트랜지스터를 더 포함할 수 있다.

[0023] 한편, 도면에서는 하나의 서브 화소(PX)를 이루는 신호 라인으로 하나의 게이트 라인(GL)과 하나의 데이터 라인(DL)만을 도시하고 있지만, 이에 한정되는 것은 아니며 구동방식에 따라 샘플링 신호 또는 프로그래밍 신호를 전달하는 샘플링 라인(미도시) 또는 프로그래밍 라인(미도시) 등을 더 포함할 수도 있다. 또한, 하나의 데이터 라인(DL)을 사이에 두고 두 개의 서브 화소(PX)가 형성되는 것으로 도시되고 있지만, 이에 한정되는 것은 아니며, 두 개의 서브 화소(PX) 사이에 두 개의 데이터 라인(DL)이 형성되거나, 구동 전원 라인(미도시)이 더 형성될 수 있다.

[0024] 상술한 구동용 트랜지스터는 유기전계 발광소자의 제 1 전극과 전기적으로 접속되어 유기전계 발광소자에 전계를 인가한다. 유기전계 발광소자는 전류의 흐름에 따라 발광하여 소정의 화상 정보를 표시하는 것으로, 각 서브 화소(PX)마다 적(R), 녹(G) 및 청색(B)의 빛을 발광한다.



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[0025] 유기전계 발광소자는 제 1 전극(미도시)과, 대향 전극인 제 2 전극(미도시)과, 이들 사이에 배치되어 발광하는 유기 발광층(미도시)을 포함한다. 제 1 전극과 제 2 전극은 서로 절연되어 있으며, 유기 발광층에 서로 다른 극성의 전압을 가해 발광이 이뤄지도록 한다.

[0026] 제 1 전극(미도시)은 구동용 트랜지스터와 전기적으로 연결되며, 발광 영역(ER)에 형성된다. 제 2 전극(미도시)은 유기 발광층(미도시)을 사이에 두고 제 1 전극(미도시) 상에 판형으로 서브 화소(PX) 내에 전면적으로 형성된다.

[0027] 이때, 유기전계발광 표시장치를 배면 발광으로 설계할 경우 제 1 전극은 유기 발광층으로부터 발광된 빛이 기판을 향하여 소자 밖으로 나올 수 있도록 투명 도전층으로 형성되고, 제 2 전극은 금속층으로 형성된다. 유기전계발광 표시장치를 전면 발광으로 설계할 경우 제 1 전극은 금속층으로 형성되고, 제 2 전극은 투명 도전층으로 형성될 수 있다.

[0028] 이때, 투명 도전층으로는 인듐주석산화물(Indium Tin Oxide: ITO), 주석산화물(Tin Oxide: TO), 인듐아연산화물(Indium Zinc Oxide: IZO), 인듐주석아연산화물(Indium Tin Zinc Oxide: ITZO) 또는 이들의 조합으로 형성된다. 금속층으로는 Cr, Al, AlNd, Mo, Cu, W, Au, Ni, Ag 등으로 형성될 수 있고, 이들의 합금이나 산화물로도 형성 가능하다.

[0029] 유기 발광층(미도시)은 제 1 전극과 제 2 전극에서 각기 주입된 정공과 전자가 결합하여 형성된 액시톤이 기저상태로 떨어지면서 빛이 발광되는 층이다. 이러한 유기 발광층(미도시)은 정공 주입층(hole injection layer), 정공 수송층(hole transporting layer), 발광층(emission layer: EL), 전자 수송층(electron transporting layer), 전자 주입층(electron injection layer)을 포함한다.

[0030] 발광층(EL)은 각 서브 화소(PX)마다 적색(R), 녹색(G) 및 청색(B)을 발하는 유기물질로 이루어지는 층으로, 서브 화소(PX) 내의 발광 영역(ER)에 형성된다. 적색(R), 녹색(G) 및 청색(B)의 발광층(EL)은 뱅크 절연층(미도시)에 의하여 서브 화소(PX) 단위로 분리되도록 제 1 전극(미도시) 상에 형성된다.

[0031] X축 방향으로 동일 색의 서브 화소(PX)가 일렬로 배열되고, Y축 방향으로 적색(R), 녹색(G), 청색(B)의 서브 화소(PX)가 반복적으로 배열된다. 여기서, X축 방향을 수직 방향으로, Y축 방향을 수평 방향으로 정의할 수 있다.

[0032] 이때, 단위 화소(30)를 이루는 적색(R), 녹색(G) 및 청색(B)의 서브 화소(PX)는 Y축 방향으로 동일한 라인에 배열되지 않는다. 구체적으로, 적색(R) 및 청색(B)의 서브 화소(PX)는 Y축 방향으로 동일한 라인에 배열되고 녹색(G)의 서브 화소(PX)는 적색(R) 및 청색(B)의 서브 화소(PX)와 어긋나도록 배열된다.

[0033] 녹색(G)의 발광 영역(ER)은 Y축 방향으로 적색(R) 및 청색(B)의 발광 영역(ER)과 중첩되지 않고, 적색(R) 및 청색(B)의 서브 화소(PX)의 비발광 영역(NER)과 중첩되도록 형성된다. 그 결과, 하나의 적색(R) 및 청색(B)의 서브 화소(PX)는 두 개의 녹색(G)의 서브 화소(PX)과 중첩된다. 또는, 하나의 녹색(G) 서브 화소(PX)는 두 개의 적색(R) 서브 화소(PX) 및 두 개의 청색 서브 화소(PX)와 중첩될 수 있다.

[0034] 하나의 단위 화소(30)를 이루는 적색(R), 녹색(G) 및 청색(B)의 서브 화소(PX)는 동일한 게이트 라인(GL)에 의해 구동된다. 이를 위해, 적색(R) 및 청색(B)의 서브 화소(PX)와 어긋나도록 형성되는 녹색(G)의 서브 화소(PX)를 구동시키기 위한 게이트 라인(GL)은 'ㄷ'자를 왼쪽으로 90도 전환시킨 형태로 형성된다.

[0035] 한편, 적색(R), 녹색(G) 및 청색(B)의 서브 화소(PX)의 발광 영역(ER)은 면적이 서로 다른 크기로 형성된다. 구체적으로, 상대적으로 발광 효율이 낮은 청색(B)의 발광 영역(ER)은 다른 색의 발광 영역(ER)보다 넓고, 상대적으로 발광 효율이 높은 녹색(G)의 발광 영역(ER)은 다른 색의 발광 영역(ER)보다 좁게 형성된다.

[0036] 즉, 청색(B) 서브 화소(PX)의 발광 영역(ER)이 가장 넓고, 적색(B) 서브 화소(PX)의 발광 영역(ER)은 청색(B) 서브 화소(PX)의 발광 영역(ER)보다 좁고, 녹색(G) 서브 화소(PX)의 발광 영역(ER)은 적색(B) 서브 화소(PX)의 발광 영역(ER)보다 좁게 형성된다. 발광 효율이 낮은 청색(B) 서브 화소(PX)의 발광 영역(ER)을 타 색 서브 화소(PX)의 발광 영역(ER)보다 넓게 형성함으로써, 발광 효율이 낮은 청색(B)의 발광 효율을 적색(R) 및 녹색(G)의 발광 효율과 유사한 수준으로 향상시킬 수 있다.

[0037] 더욱이, 본 발명은 적색(R) 및 청색(B) 서브 화소(PX)의 발광 영역(ER)과 녹색(G) 서브 화소(PX)의 발광 영역(ER)은 서로 겹쳐지지 않도록 형성함으로써, 발광 영역(ER)에 형성되는 발광층(EL)의 증착 마진을 확보하여 마스크의 얼라인 오류 및 세도우에 따른 타색 및 결색 불량을 감소할 수 있다.



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[0038] 일 실험예로 도 4a에 도시된 바와 같이, 적색(R) 및 녹색(G)의 발광 영역(ER)의 면적보다 청색(B)의 발광 영역(ER)의 면적을 넓게 형성할 경우 발광 효율이 낮은 청색(B)의 발광 효율을 적색(R) 및 녹색(G)의 발광 효율과 유사한 수준으로 향상시킬 수 있다. 그러나, 각 발광 영역(ER) 사이의 거리가 24㎛로, 극히 인접되어 있다. 즉, 각 발광 영역(ER)의 증착 마진이 적어 마스크로(50)를 이용하여 발광 물질 증착시 인접된 발광 영역에서 타색 및 결색 불량이 나타날 수 있다.

[0039] 그러나, 도 4b에 도시된 바와 같이, 녹색(G)의 발광 영역(ER)과 적색(R) 및 청색(B)의 발광 영역(ER)과 중첩되지 않도록 형성할 경우 녹색(G)의 발광 영역(ER)과 적색(R) 또는 청색(B)의 발광 영역(ER) 사이의 거리가 최소 35㎛로 각 발광 영역(ER)의 증착 마진이 46%가 향상됨을 알 수 있다.

[0040] 더욱이, 녹색(G) 발광 영역(ER)을 적색(R) 및 청색(B)의 발광 영역(ER)과 중첩되지 않도록 하기 위하여 별도의 새로운 증착 장비 필요없이 마스크(50)를 세로 방향에서 가로 방향으로 회전시킴으로써 달성할 수 있다.

[0041] 이상에서 설명한 기술들은 현재 바람직한 실시예를 나타내는 것이고, 본 발명은 상술한 실시 예 및 첨부된 도면에 한정되는 것은 아니다. 실시예의 변경 및 다른 용도는 당업자들에게는 알 수 있을 것이며, 상기 변경 및 다른 용도는 본 발명의 취지 내에 포함되거나 또는 첨부된 청구범위의 범위에 의해 정의된다.

## *도면의 간단한 설명*

[0042] 도 1은 종래의 유기전계발광 표시장치의 서브 화소들의 배열을 나타내는 도면이다.

[0043] 도 2a 및 도 2b는 종래의 유기전계발광 표시장치의 서브 화소들의 배열에 따른 문제점을 설명하기 위한 사진이다.

[0044] 도 3은 본 발명에 따른 유기전계발광 표시장치의 서브 화소들의 배열을 나타내는 도면이다.

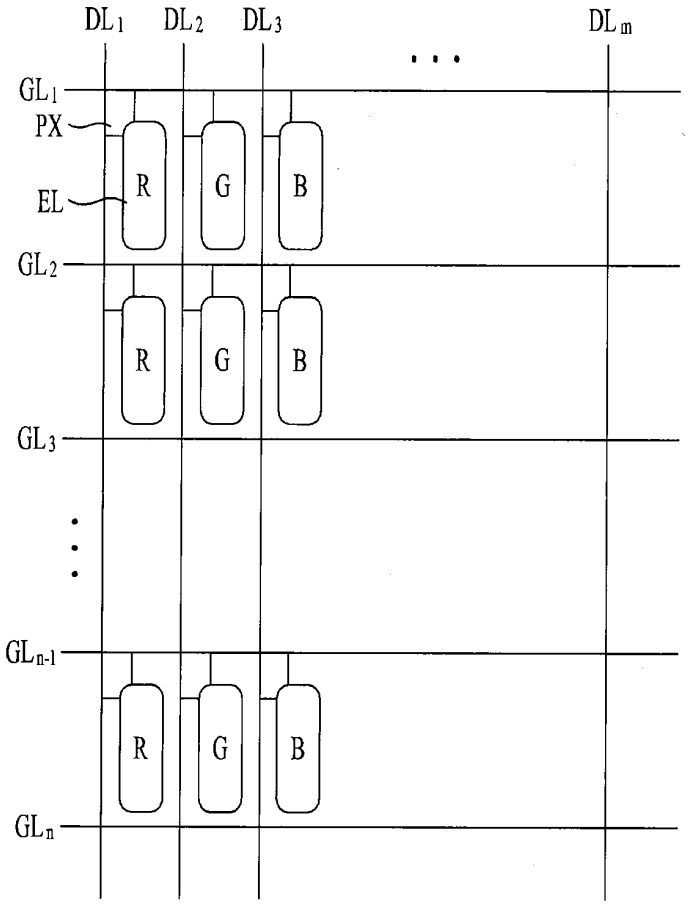
[0045] 도 4a 및 도 4b는 본 발명에 따른 서브 화소들의 증착 마진을 비교 설명하기 위한 도면이다.



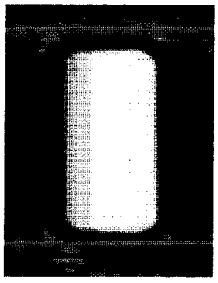
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도면

도면1



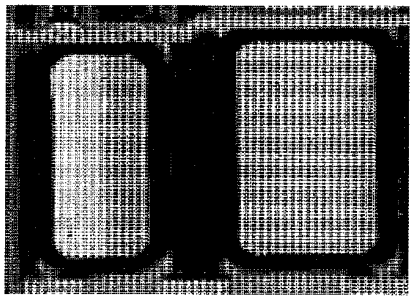

도면2a



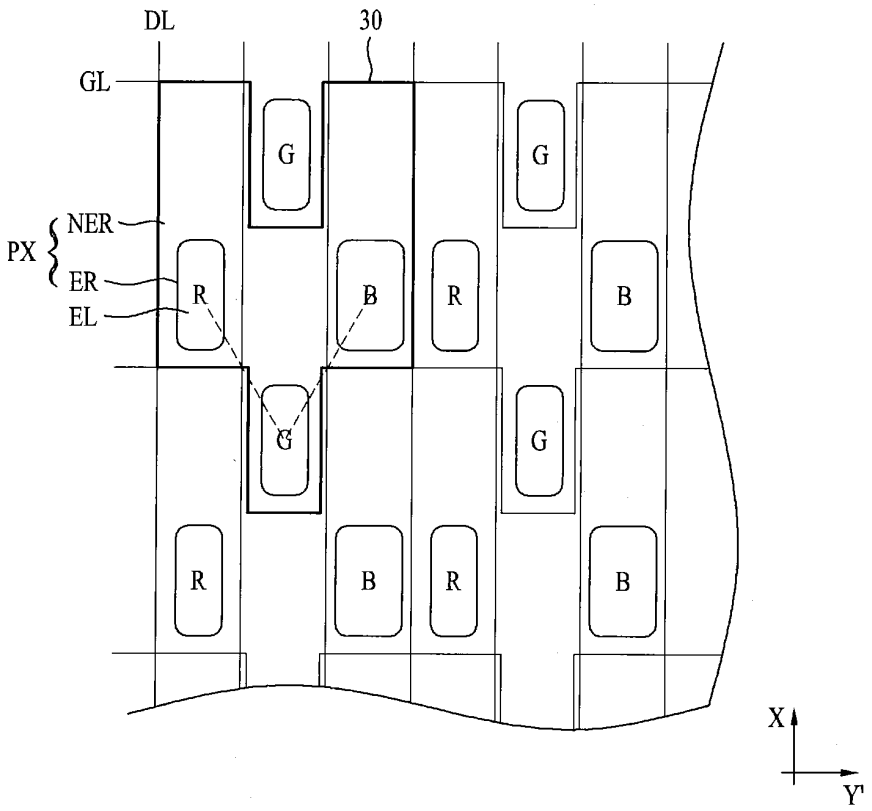


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도면2b



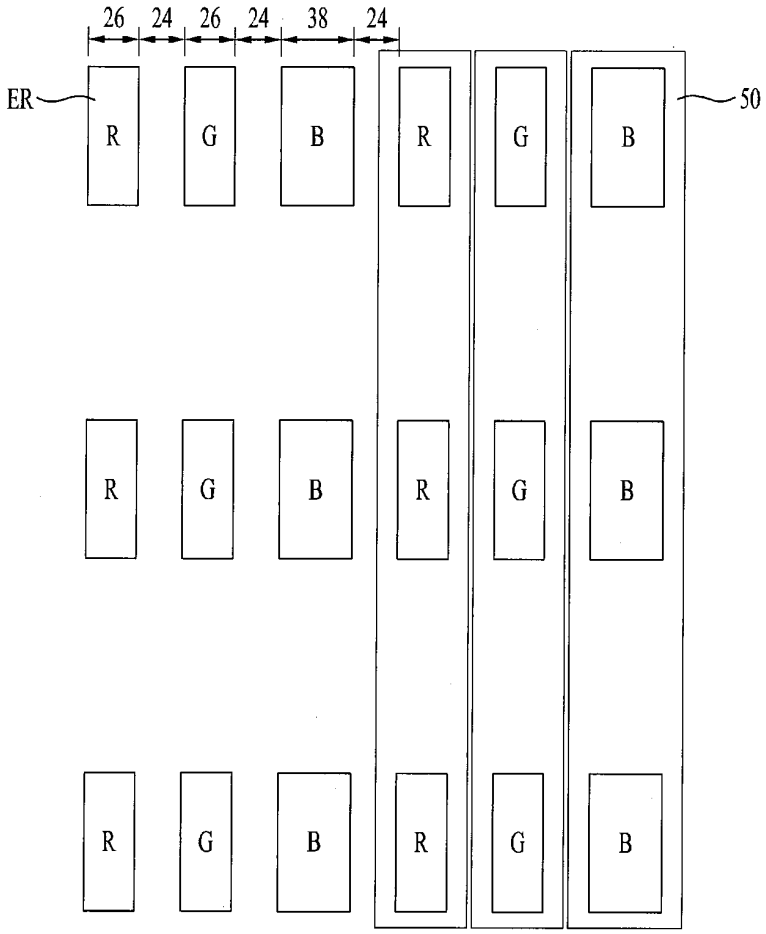
도면3






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도면4a

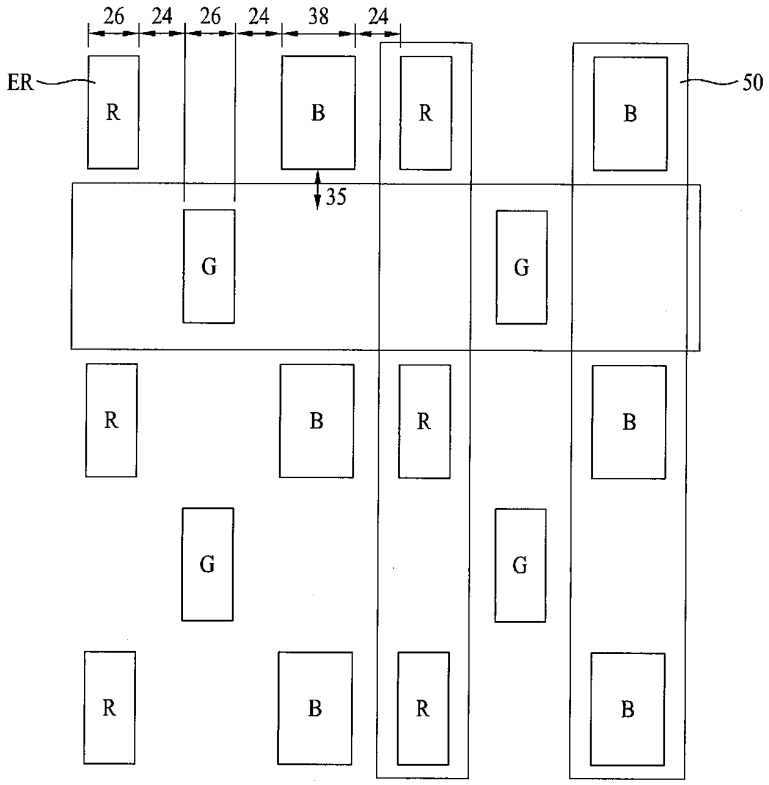



단위 : μm



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도면4b




단위 : μm



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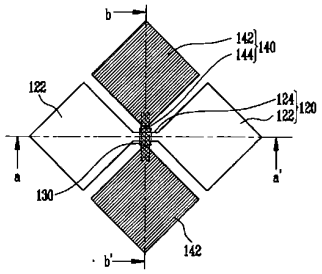
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- JANG, BRENT

# (54) TOUCH SCREEN PANEL CAPABLE OF IMPROVING THE STATIC ELECTRICITY VULNERABILITY OF A CONNECTIVITY PATTERN

(57) Abstract:

PURPOSE: A touch screen panel is provided to improve visibility by minimizing light emitting area that a light emitting area of a specific pixel is blocked.

CONSTITUTION: A flat display panel includes pixels arranged on a display space of a lower plate to stripe-like form. A first detection cell(122) is multiply arranged on the upper plate of the flat display panel to a first direction. A first concatenated pattern(124) play a role to electrically connect first detection cells. The first concatenated pattern characterizes to embody into a form which inclines not to be completely overlapped with pixels.




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For more registration information

## Legal Status

| No. | Receipt/Delivery No. | Receipt/Delivery Date | Document Title (KOR.) | Status (KOR.) |
|---|---|---|---|---|
| 1 | 1-1-2010-0182457-02 | 2010.03.23 | [Patent Application] Patent Application | Acceptance |



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| | | | | |
|---|---|---|---|---|
| | | | ([특허출원]특허출원서) | (수리) |
| 2 | 9-5-2011-0280285-03 | 2011.05.25 | Notification of reason for refusal<br>(의견제출통지서) | Dispatched<br>(발송처리완료) |
| 3 | 1-1-2011-0551064-52 | 2011.07.18 | [Opinion according to the Notification of Reasons for Refusal] Written Opinion(Written Reply, Written Substantiation)<br>([거절이유 등 통지에 따른 의견]의견(답변, 소명)서) | Acceptance<br>(수리) |
| 4 | 1-1-2011-0551062-61 | 2011.07.18 | [Amendment to Description, etc.] Amendment<br>([명세서등 보정]보정서) | Regarded as an acceptance of amendment<br>(보정승인간주) |
| 5 | 9-5-2011-0705667-32 | 2011.11.30 | Decision to grant<br>(등록결정서) | Dispatched<br>(발송처리완료) |



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**신영무**

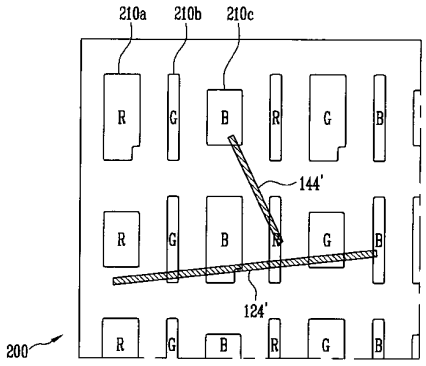
전체 청구항 수 : 총 13 항

# (54) 터치 스크린 패널

## (57) 요 약

본 발명의 실시예에 의한 터치 스크린 패널은, 상부기판 및 하부기판으로 구성되며, 상기 하부기판의 표시영역 상에 스트라이프 형태로 배열된 화소들을 포함하는 평판표시패널과; 상기 평판표시패널의 상부 기판 상에 제 1방향으로 다수 배열된 제 1감지셀들 및 제 2방향으로 다수 배열된 제 2감지셀들과; 상기 제 1감지셀들을 서로 전기적으로 연결하는 제 1연결패턴들 및 상기 제 2감지셀들을 서로 전기적으로 연결하는 제 2연결패턴들이 포함되며, 상기 제 1연결패턴들 및 제 2연결패턴들 중 적어도 하나의 연결패턴들은 상기 화소들과 완전히 중첩되지 않도록 기울어진 형태로 구현된다.

***대 표 도*** - 도6






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*특허청구의 범위*

**청구항 1**

상부기판 및 하부기판으로 구성되며, 상기 하부기판의 표시영역 상에 스트라이프 형태로 배열된 화소들을 포함하는 평판표시패널과;

상기 평판표시패널의 상부 기판 상에 제 1방향으로 다수 배열된 제 1감지셀들 및 제 2방향으로 다수 배열된 제 2감지셀들과;

상기 제 1감지셀들을 서로 전기적으로 연결하는 제 1연결패턴들 및 상기 제 2감지셀들을 서로 전기적으로 연결하는 제 2연결패턴들이 포함되며,

상기 제 1연결패턴들 및 제 2연결패턴들 중 적어도 하나의 연결패턴들은 상기 화소들과 완전히 중첩되지 않도록 기울어진 형태로 구현됨을 특징으로 하는 터치 스크린 패널.

**청구항 2**

제 1항에 있어서,

상기 기울어진 형태로 구현되는 연결패턴들은 저저항의 불투명 금속으로 구현됨을 특징으로 하는 터치 스크린 패널.

**청구항 3**

제 1항에 있어서,

상기 제 1 및 제 2감지셀들은 상기 하부기판의 표시영역과 중첩되는 상부기판의 표시영역 상에 형성됨을 특징으로 하는 터치 스크린 패널.

**청구항 4**

투명 기판 상에 제 1방향으로 다수 배열된 제 1연결패턴들과;

제 2방향으로 상기 제 1연결패턴들과 소정 간격 이격되어 다수 배열된 제 2연결패턴들과;

상기 제 1연결패턴들과 접촉되어 서로 전기적으로 연결되며, 상기 제1 방향으로 다수 배열된 제 1감지셀들과;

상기 제 2연결패턴들과 접촉되어 서로 전기적으로 연결되며, 상기 제2 방향으로 다수 배열된 제 2감지셀들이 포함됨을 특징으로 하는 터치 스크린 패널.

**청구항 5**

제 4항에 있어서,

상기 제 2연결패턴은 이에 의해 연결되는 제 2감지셀들과 인접한 제 1감지셀과 일부 중첩되며, 상기 중첩되는 제 2연결패턴과 제 1감지셀의 사이에 절연층이 형성됨을 특징으로 하는 터치 스크린 패널.

**청구항 6**

제 5항에 있어서,

상기 절연층은 서로 이격된 다수의 섬(island) 형태로 구현됨을 특징으로 하는 터치 스크린 패널.

**청구항 7**

제 5항에 있어서,

상기 절연층은 투명 재질의 무기 절연막으로서, 산화실리콘막(SiO2) 또는 질화실리콘막(SiNx)로 구현됨을 특징으로 하는 터치 스크린 패널.



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**청구항 8**

제 4항에 있어서,

상기 제 1, 2 감지셀들이 형성되는 표시영역의 가장자리에 배치되어 상기 하나의 열 또는 행 단위의 감지셀들과 전기적으로 연결되는 다수의 금속패턴들이 더 포함되어 구성됨을 특징으로 하는 터치 스크린 패널.

**청구항 9**

제 8항에 있어서,

상기 제 1, 2연결패턴들 및 금속패턴들은 동일한 레이어 상에 형성되며, 상기 제 1, 2 감지셀들을 구현하는 물질보다 낮은 저항값을 갖는 금속으로 구현됨을 특징으로 하는 터치 스크린 패널.

**청구항 10**

제 4항에 있어서,

상기 제 2감지셀들은 상기 제 1감지셀들과 중첩되지 않도록 상기 제 1감지셀들과 교호적으로 배치됨을 특징으로 하는 터치 스크린 패널.

**청구항 11**

제 4항에 있어서,

상기 제 2연결패턴은 인접한 상기 제 2감지셀을 전기적으로 연결함에 있어 적어도 하나 이상의 패턴으로 구성됨을 특징으로 하는 터치 스크린 패널.

**청구항 12**

제 4항에 있어서,

상기 제 1, 2연결패턴은 직사각형 바(bar) 형태로 구현됨을 특징으로 하는 터치 스크린 패널.

**청구항 13**

제 4항에 있어서,

상기 투명 전극물질은 인듐-틴 옥사이드(ITO)임을 특징으로 하는 터치 스크린 패널.

## *명 세 서*

### *기 술 분 야*

[0001] 본 발명은 터치 스크린 패널에 관한 것으로, 특히 평판표시장치의 상부기판에 일체형으로 형성되는 터치 스크린 패널에 관한 것이다.

### *배 경 기 술*

[0002] 터치 스크린 패널은 영상표시장치 등의 화면에 나타난 지시 내용을 사람의 손 또는 물체로 선택하여 사용자의 명령을 입력할 수 있도록 한 입력장치이다.

[0003] 이를 위해, 터치 스크린 패널은 영상표시장치의 전면(front face)에 구비되어 사람의 손 또는 물체에 직접 접촉된 접촉위치를 전기적 신호로 변환한다. 이에 따라, 접촉위치에서 선택된 지시 내용이 입력신호로 받아들여진다. 이와 같은 터치 스크린 패널은 키보드 및 마우스와 같이 영상표시장치에 연결되어 동작하는 별도의 입력장치를 대체할 수 있기 때문에 그 이용범위가 점차 확장되고 있는 추세이다.

[0004] 터치 스크린 패널을 구현하는 방식으로는 저항막 방식, 광감지 방식 및 정전용량 방식 등이 알려져 있다.

[0005] 이 중 정전용량 방식의 터치 스크린 패널은, 사람의 손 또는 물체가 접촉될 때 도전성 감지패턴이 주변의 다른 감지패턴 또는 접지전극 등과 형성하는 정전용량의 변화를 감지함으로써, 접촉위치를 전기적 신호로 변환한다.

[0006] 여기서, 접촉면에서의 접촉위치를 명확히 판단하기 위해, 감지패턴은 제 1방향을 따라 연결되도록 형성된 제 1



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감지패턴들(X 패턴들)과, 제 2방향을 따라 연결되도록 형성된 제 2감지패턴들(Y 패턴들)을 포함하여 구성된다.

[0007] 종래의 경우 상기 제 1 및 제 2감지패턴들은 각각 서로 다른 레이어(layer)에 배치된다. 즉, 일 예로 상기 제 1 감지패턴들은 하부 레이어에 위치되고, 제 2감지패턴들은 상부 레이어에 위치되며, 이들 사이에 절연막이 개재된다.

[0008] 단, 이와 같이 서로 다른 레이어에 각각의 감지패턴들을 형성할 경우 상기감지패턴들로 사용되는 투명 도전성 물질(일 예로 ITO)의 면저항이 크므로 이를 줄이기 위해 상기 동일 레이어에 위치한 감지패턴을 연결하는 연결부의 폭을 넓게 구현하나, 이는 상, 하 레이어에 위치한 각 연결부의 중첩(overlap) 면적이 커져 이에 대한 기생 캐패시턴스의 용량이 크게 되어 각 감지패턴에 의한 센싱 감도가 저하되는 단점이 있다.

## *발명의 내용*

### *해결하려는 과제*

[0009] 본 발명은 동일 레이어 상에 제 1방향으로 배열되는 제 1감지셀들과 제 2방향으로 배열되는 제 2감지셀들이 형성되고, 상기 제 1감지셀들을 서로 연결하는 제 1연결패턴들 및/또는 제 2감지셀들을 서로 연결하는 제 2연결패턴들을 터치 스크린 패널 외곽에 형성되는 금속패턴과 동일 재질로 구현하여 상기 연결패턴의 정전기 취약성을 개선하는 터치 스크린 패널을 제공함에 목적이 있다.

[0010] 또한, 상기 터치 스크린 패널이 평판표시장치의 표시패널을 구성하는 상부기판에 형성됨에 있어서, 상기 터치 스크린 패널에 형성되는 연결패턴들이 상기 평판표시패널의 표시영역 상에 스트라이프 형태로 배열된 화소들과 완전히 중첩되는 것을 방지하기 위해 소정 각도로 기울어져 형성됨으로써, 시인성을 개선하는 터치 스크린 패널을 제공함에 목적이 있다.

### *과제의 해결 수단*

[0011] 상기 목적을 달성하기 위하여 본 발명의 실시예에 의한 터치 스크린 패널은, 상부기판 및 하부기판으로 구성되며, 상기 하부기판의 표시영역 상에 스트라이프 형태로 배열된 화소들을 포함하는 평판표시패널과; 상기 평판표시패널의 상부 기판 상에 제 1방향으로 다수 배열된 제 1감지셀들 및 제 2방향으로 다수 배열된 제 2감지셀들과; 상기 제 1감지셀들을 서로 전기적으로 연결하는 제 1연결패턴들 및 상기 제 2감지셀들을 서로 전기적으로 연결하는 제 2연결패턴들이 포함되며, 상기 제 1연결패턴들 및 제 2연결패턴들 중 적어도 하나의 연결패턴들은 상기 화소들과 완전히 중첩되지 않도록 기울어진 형태로 구현된다.

[0012] 또한, 상기 기울어진 형태로 구현되는 연결패턴들은 저저항의 불투명 금속으로 구현되며, 상기 제 1 및 제 2감지셀들은 상기 하부기판의 표시영역과 중첩되는 상부기판의 표시영역 상에 형성된다.

[0013] 또한, 본 발명의 다른 실시예에 의한 터치 스크린 패널은, 투명 기판 상에 제 1방향으로 다수 배열된 제 1연결패턴들과; 제 2방향으로 상기 제 1연결패턴들과 소정 간격 이격되어 다수 배열된 제 2연결패턴들과; 상기 제 1연결패턴들과 접촉되어 서로 전기적으로 연결되며, 상기 제1 방향으로 다수 배열된 제 1감지셀들과; 상기 제 2연결패턴들과 접촉되어 서로 전기적으로 연결되며, 상기 제2 방향으로 다수 배열된 제 2감지셀들이 포함된다.

[0014] 이 때, 상기 제 2연결패턴은 이에 의해 연결되는 제 2감지셀들과 인접한 제 1감지셀과 일부 중첩되며, 상기 중첩되는 제 2연결패턴과 제 1감지셀의 사이에 절연층이 형성된다.

[0015] 여기서, 상기 절연층은 서로 이격된 다수의 섬(island) 형태로 구현되며, 이는 투명 재질의 무기 절연막으로서, 산화실리콘막(SiO2) 또는 질화실리콘막(SiNx)로 구현된다.

[0016] 또한, 상기 제 1, 2 감지셀들이 형성되는 표시영역의 가장자리에 배치되어 상기 하나의 열 또는 행 단위의 감지셀들과 전기적으로 연결되는 다수의 금속패턴들이 더 포함된다.

[0017] 또한, 상기 제 1, 2연결패턴들 및 금속패턴들은 동일한 레이어 상에 형성되며, 상기 제 1, 2 감지셀들을 구현하는 물질보다 낮은 저항값을 갖는 금속으로 구현된다.

[0018] 또한, 상기 제 2감지셀들은 상기 제 1감지셀들과 중첩되지 않도록 상기 제 1감지셀들과 교호적으로 배치된다.

[0019] 또한, 상기 제 2연결패턴은 인접한 상기 제 2감지셀을 전기적으로 연결함에 있어 적어도 하나 이상의 패턴으로



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구성되며, 상기 제 1, 2연결패턴은 직사각형 바(bar) 형태로 구현된다.

### *발명의 효과*

[0020] 이와 같은 본 발명에 의하면, 인접한 제 1감지셀들 및 인접한 제 2감지셀들을 각각 서로 연결하는 연결패턴을 각각 터치 스크린 패널 외곽에 형성되는 금속패턴과 동일한 저저항의 금속 재질로 구현하고, 상기 각 연결패턴이 서로 교차되지 않도록 배치하여 상기 연결패턴의 정전기 취약성을 개선함으로써, ESD(Electrostatic discharge) 문제를 극복할 수 있다는 장점이 있다.

[0021] 또한, 상기 터치 스크린 패널이 평판표시장치의 표시패널을 구성하는 상부기판에 형성됨에 있어서, 상기 터치 스크린 패널에 형성되는 연결패턴들이 상기 표시패널의 표시영역 상에 스트라이프 형태로 배열된 화소들과 완전히 중첩되지 않도록 소정 각도로 기울어져 형성됨으로써, 특정 화소의 발광 영역이 차단되는 것을 최소화하여 시인성을 개선하는 장점이 있다.

### *도면의 간단한 설명*

[0022] 도 1a는 본 발명의 제 1실시예에 의한 터치 스크린 패널에 형성된 감지패턴들의 배치를 나타내는 평면도.

도 1b는 도 1a의 특정 부분(a-a', b-b')에 대한 단면도.

도 2a는 본 발명의 제 2실시예에 의한 터치 스크린 패널에 형성된 감지패턴들의 배치를 나타내는 평면도.

도 2b는 도 2a의 특정 부분(A-A', B-B')에 대한 단면도.

도 3a는 본 발명의 제 3실시예에 의한 터치 스크린 패널에 형성된 감지패턴들의 배치를 나타내는 평면도.

도 3b는 도 3a의 특정 부분(I-I', II-II')에 대한 단면도.

도 4은 도 2에 도시된 본 발명의 제 2실시예에 의한 터치 스크린 패널의 분해평면도.

도 5a 내지 도 5c는 본 발명의 제 4실시예에 의한 터치 스크린 패널에 형성되는 감지패턴들의 배치를 나타낸 평면도.

도 6은 도 5b의 실시예에 의한 제 1, 2연결패턴과 표시패널에 형성된 화소들의 배열 상태를 나타내는 평면도.

### *발명을 실시하기 위한 구체적인 내용*

[0023] 이하, 첨부된 도면을 참조하여 본 발명의 실시예를 보다 상세히 설명하도록 한다.

[0024] 도 1a는 본 발명의 제 1실시예에 의한 터치 스크린 패널에 형성된 감지패턴들의 배치를 나타내는 평면도이고, 도 1b는 도 1a의 특정 부분(A-A', B-B')에 대한 단면도이다.

[0025] 도 1a 및 도 1b를 참조하면, 본 발명의 제 1실시예에 의한 감지패턴들은, 서로 교호적으로 배치되며 X 좌표가 동일한 하나의 열 또는 Y 좌표가 동일한 하나의 행 단위로 서로 연결되도록 형성된 제 1 및 제 2감지패턴들(120, 140)을 포함한다.

[0026] 즉, 제 1감지패턴들(120)은 제 1방향(열 방향)을 따라 X 좌표가 동일한 하나의 열에 배치된 제 1감지셀(122)들과, 인접한 상기 제 1감지셀(122)들을 서로 연결하는 제 1연결패턴(124)으로 구성되고, 제 2감지패턴들(140)은 제 2방향(행 방향)을 따라 Y 좌표가 동일한 하나의 행에 배치된 제 2감지셀(142)들과, 인접한 상기 제 2감지셀(142)들을 서로 연결하는 제 2연결패턴(144)으로 구성된다.

[0027] 이 때, 상기 제 1감지셀들(122) 및 제 2감지셀들(142)은 동일 레이어(layer)에 투명 도전성 물질로 형성되며, 상기 제 1감지셀들(122)은 상기 동일한 레이어 상에 동일물질로 구현되는 제 1연결패턴(124)를 통해 서로 전기적으로 연결된다.

[0028] 단, 상기 제 2감지셀들(142)을 서로 전기적으로 연결하는 제 2연결패턴(144)은 상기 제 1연결패턴(124)과의 단락을 피하기 위해 상기 제 1, 2감지셀(122, 142)과 동일 레이어에 형성될 수 없다.

[0029] 이에 본 발명의 제 1실시예에서는 상기 제 2연결패턴(144)이 상기 제 1연결패턴(124)의 하부 레이어에 형성되고, 서로간의 단락 방지를 위해 그 사이에 절연층(130)이 형성된다.

[0030] 이 때, 상기 절연층(130)은 제 1, 2연결패턴의 교차영역에만 형성되는 섬(island) 형태로 구현될 수 있다.



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[0031] 또한, 상기 제 2연결패턴(144)은 저항이 낮은 금속으로 형성하는 것으로, 특히 제 1, 2감지셀(122, 142)들이 형성되는 표시영역의 끝단에 형성되어 상기 감지셀들에 의해 감지된 신호를 구동회로(미도시) 측으로 공급하는 금속패턴(미도시)과 동일한 재질로 형성됨을 특징으로 한다.

[0032] 이와 같은 도 1의 실시예에 의한 구조에 의하면, 상기 제 2연결패턴(144)을 저저항의 금속 물질로 구현함으로써, 연결패턴의 폭을 최소화하여 제 1, 2연결패턴의 교차 영역에서 발생되는 기생 캐패시턴스 영향을 줄일 수 있게 된다.

[0033] 단, 이 경우에도 상기 제 1연결패턴(124)은 여전히 저항값이 높은 투명 도전성 물질로 형성되며, 상기 교차영역의 중첩 면적이 줄어들고, 상기 제 1연결패턴이 절연막 상부에 위치하기 때문에 외부에서 인가되는 정전기에 취약할 수 있는 단점이 있다.

[0034] 이에 본 발명의 다른 실시예에 의한 구조는 이와 같은 단점을 극복하기 위해 도출된 것으로, 인접한 제 1감지셀들 및 인접한 제 2감지셀들을 각각 서로 연결하는 연결패턴을 터치 스크린 패널 외곽에 형성되는 금속패턴과 동일한 저저항의 금속 재질로 구현하고, 상기 각 연결패턴이 서로 교차되지 않도록 배치하여 상기 연결패턴의 정전기 취약성을 개선하고자 한다.

[0035] 도 2a는 본 발명의 제 2실시예에 의한 터치 스크린 패널에 형성된 감지패턴들의 배치를 나타내는 평면도이고, 도 2b는 도 2a의 특정 부분(A-A', B-B')에 대한 단면도이다.

[0036] 도 2a 및 도 2b를 참조하면, 본 발명의 실시예에 의한 감지패턴들은, 서로 교호적으로 배치되며 X 좌표가 동일한 하나의 열 또는 Y 좌표가 동일한 하나의 행 단위로 서로 연결되도록 형성된 제 1 및 제 2감지패턴들(120, 140)을 포함한다.

[0037] 즉, 제 1감지패턴들(120)은 제 1방향(열 방향)을 따라 X 좌표가 동일한 하나의 열에 배치된 제 1감지셀(122)들과, 인접한 상기 제 1감지셀(122)들을 서로 연결하는 제 1연결패턴(124)으로 구성되고, 제 2감지패턴들(140)은 제 2방향(행 방향)을 따라 Y 좌표가 동일한 하나의 행에 배치된 제 2감지셀(142)들과, 인접한 상기 제 2감지셀(142)들을 서로 연결하는 제 2연결패턴(144)으로 구성된다.

[0038] 이 때, 본 발명의 실시예의 경우 상기 제 1감지셀들(122) 및 제 2감지셀들(142)은 동일 레이어(layer)에 형성되고, 상기 제 1 및 제 2감지셀들(122, 142)는 터치 스크린 패널의 동작 구현을 위해 투명 재질로 구현되어야 하며, 이에 상기 제 1 및 제 2감지셀들(122, 142)은 투명 도전성 물질 즉, 일 예로 인듐-틴 옥사이드(이하, ITO)로 구현됨이 바람직하다.

[0039] 또한, 상기 제 1감지셀들(122) 및 제 2감지셀들(142)이 감지 전극으로서의 역할을 수행하기 위해서는 제 1방향 및 제 2방향으로 배열된 각각의 감지셀들이 전기적으로 연결되어야 한다.

[0040] 이에 상기 제 1감지셀(122)들은 제 1연결패턴(124)에 의해 서로 전기적으로 연결되고, 상기 제 2감지셀(142)들은 제 2연결패턴(134)에 의해 서로 전기적으로 연결된다.

[0041] 이 때, 상기 제 1감지셀(122) 및 제 2감지셀(142)는 동일 레이어에 형성되기 때문에 상기 제 1연결패턴(124) 및 제 2연결패턴(144)는 단락을 피하기 위해 상기 제 1, 2감지셀(122, 124)과 동일 레이어에 형성될 수 없다.

[0042] 이에 본 발명의 제 1실시예에서는 상기 제 1, 2연결패턴(124, 144)이 상기 제 1, 2감지셀들(122, 142)의 하부 레이어에 형성됨을 특징으로 한다.

[0043] 도 2a 및 도 2b를 참조하면, 투명 기판(110) 상에 제 1, 2연결패턴(124, 144)들이 먼저 형성되고, 상기 제 1, 2연결패턴(124, 144)의 각 끝단에 접촉되도록 각각 제 1, 2감지셀들(122, 142)이 형성된다.

[0044] 즉, 상기 제 1연결패턴(124)에 의해 인접한 상기 제 1감지셀(122)들이 전기적으로 연결되고, 제 2연결패턴(144)에 의해 인접한 상기 제 2감지셀(142)들이 전기적으로 연결된다.

[0045] 또한, 상기 제 1, 2연결패턴(124, 144)이 동일 레이어에 형성되기 때문에 서로간의 단락을 피하기 위하여 소정 간격 이격되어 형성된다.

[0046] 단, 도 2에 도시된 실시예의 경우 제 2연결패턴(144)은 제 1감지셀(122)와 일정부분 중첩되게 되는데, 상기 제



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2연결패턴(144)과 제 1감지셀(122)이 전기적으로 연결되는 것을 방지하기 위해 상기 중첩되는 제 2연결패턴(144)과 제 1감지셀(122)의 사이에 절연층(130)이 형성된다.

[0047] 이 때, 상기 절연층(130)은 투명 재질의 무기 절연막으로서, 산화실리콘막(SiO2) 또는 질화실리콘막(SiNx)로 구현됨이 바람직하다.

[0048] 즉, 도 2a에 도시된 바와 같이, 상기 제 1연결패턴(124)은 제 1방향(열 방향)으로 배열되어 인접한 제 1감지셀(122)들을 전기적으로 연결시키고, 상기 제 2연결패턴(144)은 상기 제 1연결패턴(124)와 이격되어 위치하며, 제 2방향(행 방향)으로 배열되어 인접한 제 2감지셀(142)들을 전기적으로 연결시킨다.

[0049] 단, 도 2a에서는 상기 제 2연결패턴(144)이 인접한 제 2감지셀(142)을 연결함에 있어 한 쌍으로 구현됨을 도시하고 있으나, 반드시 이에 한정되는 것은 아니며, 이는 하나로 구현되어도 무방하다.

[0050] 또한, 상기 제 1, 2연결패턴(142, 144)은 도시된 바와 같이 직사각형 바(bar) 형태로 이루어질 수 있으나, 이는 하나의 실시예로서 반드시 이러한 형상에 한정되지 않는다.

[0051] 그리고, 본 발명의 실시예에서는 상기 제 1, 2연결패턴(124, 144)은 저항이 낮은 금속으로 형성하는 것으로, 특히 제 1, 2감지셀(122, 142)들이 형성되는 표시영역의 끝단에 형성되어 상기 감지셀들에 의해 감지된 신호를 구동회로(미도시) 측으로 공급하는 금속패턴(미도시)과 동일한 재질로 형성됨을 특징으로 한다.

[0052] 이 경우 상기 제 1, 2연결패턴(124, 144)들이 상기 금속패턴과 동일한 레이어에 동일 공정을 통해 형성되므로 상기 1, 2연결패턴들을 형성하기 위한 추가의 마스크 공정이 필요하지 않아 공정 수 및 시간을 단축할 수 있다는 장점이 있다.

[0053] 또한, 상기 감지셀들을 서로 연결하는 연결패턴(124, 144)을 상기 감지셀과 같은 투명 도전성 물질이 아닌 저저항의 금속으로 구현함으로써, 상기 감지셀의 연결부분에서의 전하(charge) 흐름을 원할히 할 수 있게 되어 상기 감지셀의 센싱 감도를 향상시킬 수 있게 된다.

[0054] 또한, 상기 각 연결패턴이 서로 교차되지 않도록 배치하여 상기 연결패턴의 정전기 취약성을 개선함으로써, ESD(Electrostatic discharge) 문제를 극복할 수 있으며, 도 2a에 도시된 바와 같이 상기 제 2연결패턴(144)의 경우 이에 의해 연결되는 제 2감지셀들(142)과 인접한 제 1감지셀(122)과 중첩되는 면적이 발생됨으로써, 상기 제 2연결패턴(144)을 통과하는 전하(charge)들이 좁은 공간에 집중됨을 방지하는 효과도 얻을 수 있게 된다.

[0055] 단, 앞서 언급한 바와 같이 상기 중첩되는 제 2연결패턴들(144)과 제 1감지셀(122)의 사이의 영역에는 상기 제 2연결패턴들(144)과 제 1감지셀(122)의 단락을 방지하기 위해 섬(island) 형태의 절연층(130)이 형성된다.

[0056] 도 3a는 본 발명의 제 3실시예에 의한 터치 스크린 패널에 형성된 감지패턴들의 배치를 나타내는 평면도이고, 도 3b는 도 3a의 특정 부분(I-I', II-II')에 대한 단면도이다.

[0057] 앞서 도 2를 통해 설명한 본 발명의 제 2실시예의 경우 제 1, 2연결패턴(124, 144)이 제 1, 2감지셀(122, 142)의 하부 레이어에 형성됨을 그 예로 설명하였으나, 본 발명의 실시예가 반드시 이에 한정되는 것은 아니다.

[0058] 즉, 도 3a 및 도 3b에 도시된 바와 같이, 상기 제 1, 2연결패턴(124, 144)이 제 1, 2감지셀(122, 142)의 상부 레이어에 형성되도록 구현될 수도 있으며, 이 경우 투명 기판(110) 상에 먼저 감지셀들(122, 142)이 형성되고, 그 위에 제 1, 2연결패턴(124, 144)이 형성되도록 구현될 수도 있는 것이다.

[0059] 보다 구체적으로, 본 발명의 제 3실시예에 의하면, 상기 투명 기판(110) 상에 제1 방향을 따라 X 좌표가 동일한 하나의 열에 배치된 제 1감지셀들(122) 및 제 2방향을 따라 Y 좌표가 동일한 하나의 행에 배치된 제 2감지셀들(142)이 형성된다.

[0060] 이 후 상기 인접한 제 1감지셀들(122)을 전기적으로 연결하도록 상기 제 1감지셀들(122)의 끝단부와 접촉되는 제 1연결패턴(124)이 형성되고, 인접한 제 2감지셀들(142)을 전기적으로 연결하도록 상기 제 2감지셀들(142)의 끝단부와 접촉되는 제 2연결패턴(144)이 형성된다.

[0061] 단, 이 경우에도 상기 제 2연결패턴(144)이 제 1감지셀(122)과 일정부분 중첩되게 되는데, 상기 제 2연결패턴(144)과 제 1감지셀(122)이 전기적으로 연결되는 것을 방지하기 위해 상기 중첩되는 제 2연결패턴(144)과 제 1감지셀(122)의 사이에 절연층(130)이 형성된다.

[0062] 이 때, 상기 절연층(130)은 투명 재질의 무기 절연막으로서, 산화실리콘막(SiO2) 또는 질화실리콘막(SiNx)로 구



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현됨이 바람직하다.

[0063] 또한, 도시된 바와 같이 상기 제 2연결패턴(144)은 상기 제 1연결패턴(124)과 단락을 회피하기 위해 소정 간격 이격되어 배열됨을 특징으로 한다.

[0064] 단, 이 경우 각 레이어의 순서만 변경될 뿐 구체적인 구성 및 그 효과는 앞서 설명한 제 2실시예와 동일하므로 상세한 설명은 생략 한다.

[0065] 도 4는 도 2에 도시된 본 발명의 제 2실시예에 의한 터치 스크린 패널의 분해평면도이다.

[0066] 도 4를 참조하면, 본 발명의 실시예에 의한 터치 스크린 패널(100)은, 투명기판(110)과; 상기 투명기판(110) 상에 제 1방향으로 다수 배열된 제 1연결패턴(124)과; 상기 투명기판(110) 상에 제 2방향으로 상기 제 1연결패턴(124)과 소정 간격 이격되어 다수 배열된 제 2연결패턴(144)과; 상기 제 1, 2연결패턴(142, 144)이 배열된 기판 상에 형성된 제 1 및 제 2감지셀들(122, 142)이 포함된다.

[0067] 이 때, 상기 제 1감지셀(122)들은 끝단이 각각 상기 제 1연결패턴(124)의 끝단부에 접촉되도록 형성되며, 상기 제 1감지셀(122)들 및 이를 연결하는 제 1연결패턴(124)은 제 1감지패턴(120)을 구성한다.

[0068] 이와 마찬가지로 상기 제 2감지셀(142)들은 끝단이 각각 상기 제 2연결패턴(144)의 끝단부에 접촉되도록 형성되며, 상기 제 2감지셀(142)들 및 이를 연결하는 제 2연결패턴(144)은 제 2감지패턴(140)을 구성한다.

[0069] 이 때, 상기 제 2연결패턴(144)은 제 1감지셀(122)과 일정부분 중첩되게 되는데, 상기 제 2연결패턴(144)과 제 1감지셀(122)이 전기적으로 연결되는 것을 방지하기 위해 상기 중첩되는 제 2연결패턴(144)과 제 1감지셀(122)의 사이에 도시된 바와 같이 섬(island) 형태의 절연층(130)이 형성된다.

[0070] 이 때, 상기 절연층(130)은 투명 재질의 무기 절연막으로서, 산화실리콘막(SiO2) 또는 질화실리콘막(SiNx)으로 구현됨이 바람직하다.

[0071] 또한, 상기 제1 및 제2 감지패턴들(120, 140)이 형성되는 표시영역의 가장자리에 배치되어 상기 하나의 열 또는 행 단위의 감지패턴들을 위치 검출라인과 전기적으로 연결하는 다수의 금속패턴들(150)이 더 포함되어 구성된다.

[0072] 즉, 상기 금속패턴들(150)은 제1 및 제2 감지패턴들(120, 140)이 형성되는 영역 즉, 표시영역의 외곽에 위치한 비표시영역으로, 제 1 및 제 2감지패턴들(120, 140)의 패드(120a, 140a)와 대응되는 영역에 배치된다.

[0073] 이와 같은 금속패턴들(150)은 하나의 열 또는 행 단위의 감지패턴들(120, 140)을 각각 위치 검출라인(미도시)과 전기적으로 연결하여 도시되지 않은 구동회로 등으로 접촉위치 검출신호가 공급되도록 한다.

[0074] 상기 다수의 금속패턴들(150)은 상기 제 1, 2연결패턴들(124, 144)와 동일 공정을 통해 형성됨이 바람직하며, 이에 따라 상기 금속패턴들(150)은 상기 투명기판(110) 상에 형성되며, 저 저항의 금속으로 구현된다.

[0075] 또한, 제 1감지셀들(122)은 상기 제 1, 2연결패턴들(124, 144)이 배열된 투명 기판(110) 상에 제1 방향을 따라 연결되도록 형성된다. 예컨대, 제1 감지셀들(122)은 다이아몬드 패턴과 같이 규칙적인 패턴들이 밀접되도록 형성될 수 있다.

[0076] 여기서, 제1 감지셀들(122)의 형상은 다이아몬드 형상에 한정되는 것은 아니며, 제 1감지셀들(122)이 밀접될 수 있는 다양한 형상으로 구현될 수 있다.

[0077] 그리고, 제 1감지패턴들(120)은 열 단위로 상기 금속패턴들(150)과 전기적으로 연결될 수 있도록 패드(120a)를 구비한다. 제 1감지패턴들(120)의 패드(120a)는 열 단위로 상, 하측에 교번적으로 구비되거나, 혹은 상, 하측 모두에 구비될 수 있다.

[0078] 또한, 상기 제 2감지셀들(142)은 상기 제 1, 2연결패턴들(124, 144)이 배열된 투명 기판(110) 상에 제2 방향을 따라 형성되면서, 제 1감지셀들(122)과 중첩되지 않도록 상기 제 1감지셀들(122)과 교호적으로 배치된다.

[0079] 이 경우 상기 제 2감지셀들(142)은 제 1감지셀들(122)과 동일하게 다이아몬드 패턴으로 밀접되도록 형성될 수 있다.

[0080] 그리고, 제 2감지패턴들(140)은 행 단위로 금속패턴들(150)과 전기적으로 연결될 수 있도록 패드(140a)를 구비한다. 제 2감지패턴들(140)의 패드(140a)는 행 단위로 좌, 우측에 교번적으로 구비되거나, 혹은 좌, 우측 모두



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에 구비될 수 있다.

[0081] 이 때, 상기 제 1감지셀들(122)은 제 2감지셀들(142)과 중첩되는 영역에는 형성되지 않는다. 즉, 상기 제 1감지셀들(122)과 제 2감지셀들(142)은 서로 어긋나도록 교호적으로 배치된다.

[0082] 이와 같은 본 발명의 실시예에 의하면 상기 제 1, 2연결패턴(122, 144)이 터치 스크린 패널(100)의 가장 아래 레이어에 형성되고, 서로 교차되지 않도록 배열됨으로써, 외부에서 입력되는 정전기에 대한 취약성을 개선할 수 있으며, 상기 절연막(130)과의 밀착 안정성을 확보할 수 있게 된다.

[0083] 또한, 본 발명의 실시예의 경우 상기 투명기판(100)은 평판표시장치를 구성하는 표시패널(미도시)의 상부기판으로 구현될 수 있으며, 이에 상기 제 1, 2감지셀들(122, 142)은 터치 스크린 패널(100)의 하부에 배치되는 표시패널에서 방출되는 빛이 터치 스크린 패널(100)을 투과할 수 있도록 투명물질로 형성된다.

[0084] 즉, 제 1, 2감지셀들(122, 142)은 인듐-틴 옥사이드(이하, ITO)와 같은 투명 전극물질로 형성된다.

[0085] 또한, 상기 제 1, 2감지셀들(122, 142) 상에는 이들을 커버하도록 보호층(160)이 형성될 수 있다. 예를 들어, 보호층(160)은 상기 제 1, 2감지셀들(122, 142) 에 400 내지 1000 Å 두께의 투명 절연물질로 형성될 수 있다. 단, 상기 보호층(160)은 제품 설계에 따라 생략될 수도 있다.

[0086] 도 3에 도시된 제 3실시예의 경우 상기 제 1, 2연결패턴(124, 144)이 제 1, 2감지셀(122, 142)의 상부 레이어에 형성된다는 점 이외에는 제 1실시예의 구성과 동일하므로 이에 대한 분해 평면 및 그 상세한 설명은 생략하도록 한다.

[0087] 도 5a 내지 도 5c는 본 발명의 제 4실시예에 의한 터치 스크린 패널에 형성되는 감지패턴들의 배치를 나타낸 평면도이고, 도 6은 도 5b의 실시예에 의한 제 1, 2연결패턴과 표시패널에 형성된 화소들의 배열 상태를 나타내는 평면도이다.

[0088] 단, 본 발명의 제 4실시예는 앞서 설명한 제 1 내지 제 3실시예와 비교할 때, 터치 스크린 패널이 평판표시장치의 표시패널을 구성하는 상부기판에 형성됨에 있어서, 상기 터치 스크린 패널에 형성되는 제 1 및/또는 2연결패턴들(124', 144')이 상기 표시패널을 구성하는 하부기판의 표시영역(200) 상에 스트라이프 형태로 배열된 화소들(210a, 210b, 210c)과 완전히 중첩되지 않도록 소정 각도로 기울어져 형성되는 점에서 그 차이가 있으므로, 상기 제 1 내지 제 3실시예와 동일한 구성요소에 대해서는 동일한 도면부호를 사용하고 그에 대한 상세한 설명은 생략한다.

[0089] 이 때, 상기 터치 스크린 패널에 형성되는 제 1, 2감지셀들(122, 142) 및 제 1, 2연결패턴들(124', 144')은 상기 하부기판의 표시영역(200)에 대응되는 표시영역에 형성된다.

[0090] 단, 설명의 편의를 위해 도 5b 및 도 5c에 도시된 실시예의 경우 상기 제 1, 2연결패턴(124', 144')이 제 1, 2감지셀(122, 142)의 하부 레이어에 형성되는 것을 그 예로 설명하나, 본 발명의 실시예가 반드시 이에 한정되는 것은 아니다. 즉, 상기 제 1, 2연결패턴(124', 144')이 제 1, 2감지셀(122, 142)의 상부 레이어에 형성될 수 있다.

[0091] 앞서 언급한 바와 같이 본 발명의 실시예에 의한 터치 스크린 패널의 투명기판(100)은 평판표시장치를 구성하는 표시패널(미도시)의 상부기판으로 구현될 수 있다.

[0092] 먼저 도 5a를 참조하면, 이는 앞서 도 1을 통해 설명한 구조에 대하여, 저저항 금속으로 구현되는 제 2연결패턴(144')이 수평 및 수직 방향이 아닌 소정 각도 기울어진 형태로 구현됨을 특징으로 한다.

[0093] 또한, 도 5b, 5c 및 도 6을 참조하면, 이는 앞서 도 2, 3을 통해 설명한 구조에 대하여, 제 1감지패턴들(120)은 제 1방향(열 방향)을 따라 X 좌표가 동일한 하나의 열에 배치된 제 1감지셀(122)들과, 인접한 상기 제 1감지셀(122)들을 서로 연결하는 제 1연결패턴(124')으로 구성되고, 제 2감지패턴들(140)은 제 2방향(행 방향)을 따라 Y 좌표가 동일한 하나의 행에 배치된 제 2감지셀(142)들과, 인접한 상기 제 2감지셀(142)들을 서로 연결하는 제 2연결패턴(144')으로 구성되며, 상기 제 1, 2연결패턴(124', 144')은 수평 및 수직 방향이 아닌 소정 각도 기울어진 형태로 구현됨을 특징으로 한다.

[0094] 여기서, 상기 제 1연결패턴(124') 또는 제 2연결패턴(144')는 적어도 하나 이상의 패턴으로 구현될 수 있으며,



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도 5c의 경우 상기 제 1연결패턴(124')이 한 쌍의 패턴으로 구현되는 실시예를 나타내고 있다.

[0095] 이는 상기 터치 스크린 패널이 평판표시장치의 표시패널을 구성하는 상부기판에 형성되는 경우, 상기 터치 스크린 패널에 형성되는 제 1, 2연결패턴들(124', 144')이 상기 표시패널의 표시영역(200) 상에 스트라이프 형태로 배열된 화소들(210a, 210b, 210c)과 완전히 중첩되지 않도록 하기 위함이다.

[0096] 즉, 도 1 내지 도 3에 도시된 실시예에서와 같이 상기 제 1 및/또는 2연결패턴들이 수평 또는 수직으로 배열되는 경우에는 이에 대응되는 표시패널의 표시영역 상에 스트라이프 형태로 배열된 화소들(210a, 210b, 210c)과 완전히 중첩될 여지가 있다.

[0097] 여기서, 저저항의 금속 재질로 구현되는 상기 연결패턴은 불투명한 특성이 있으므로, 상기 표시패널에서 출사되는 영상을 차단하게 되는데, 상기 연결패턴이 상기 화소들(210a, 210b, 210c)과 동일 또는 수직 방향으로 배열됨에 따라 일부 연결패턴이 이에 대응되는 영역에 형성된 화소와 완전히 중첩되면, 상기 중첩된 화소에서 출사되는 광이 상기 연결패턴에 의해 차단되어 암점으로 발현되는 문제가 발생된다.

[0098] 이에 본 발명의 실시예에서는 이와 같은 문제를 극복하기 위해 도 5, 6에 도시된 바와 같이 상기 제 1 및/또는 2연결패턴(124', 144')을 비스듬히 배치함으로써, 상기 연결패턴(124', 144')과 대응되는 영역에 형성된 화소들(210a, 210b, 210c)와 완전히 중첩되는 경우를 최소화함으로써, 이를 통해 앞서 언급한 바와 같은 암점이 발현되는 단점은 극복할 수 있게 되는 것이다.

[0099] 본 발명의 기술 사상은 상기 바람직한 실시예에 따라 구체적으로 기술되었으나, 상기한 실시예는 그 설명을 위한 것이며 그 제한을 위한 것이 아님을 주의하여야 한다. 또한, 본 발명의 기술 분야의 통상의 지식을 가진 자라면 본 발명의 기술 사상의 범위 내에서 다양한 변형예가 가능함을 이해할 수 있을 것이다.

### *부호의 설명*

[0100] 100: 터치 스크린 패널 110: 투명 기판

120: 제 1감지패턴 122: 제 1감지셀

124, 124': 제 1연결패턴 130: 절연막

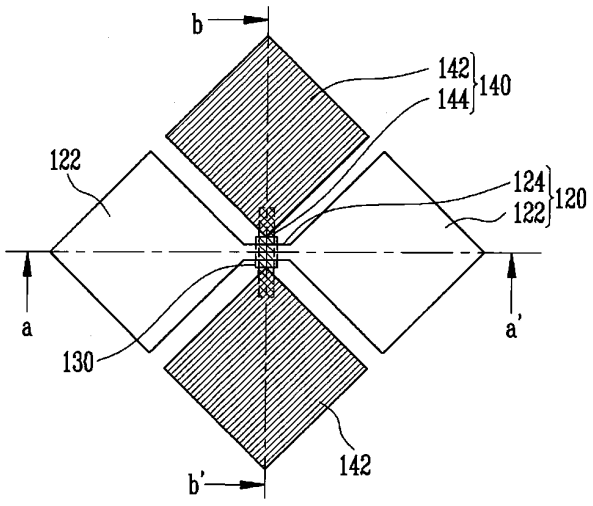
140: 제 2감지패턴 142: 제 2감지셀

144, 144': 제 2연결패턴 200: 표시패널의 표시영역

210a, 210b, 210c: 화소들

### *도면*

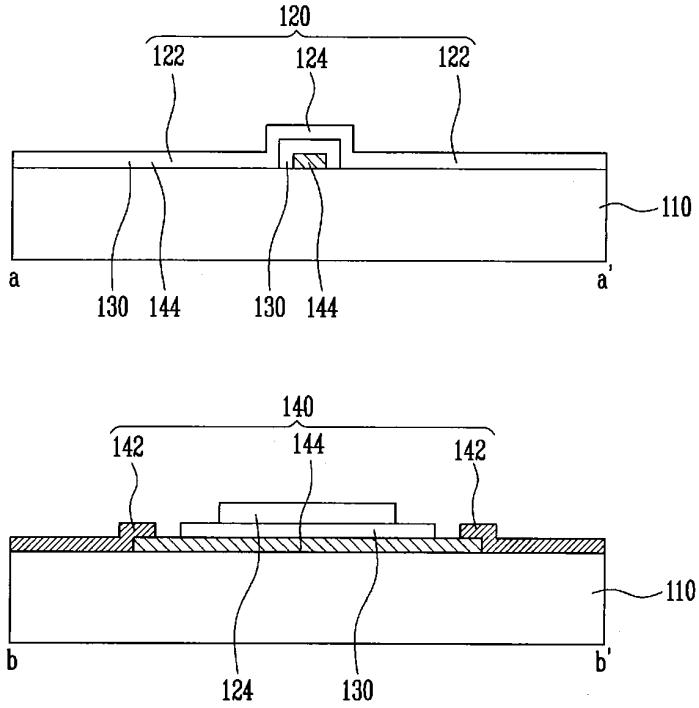
#### *도면1a*



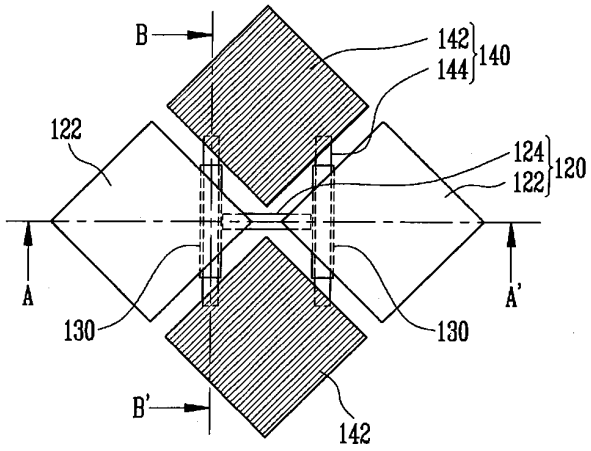



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도면1b



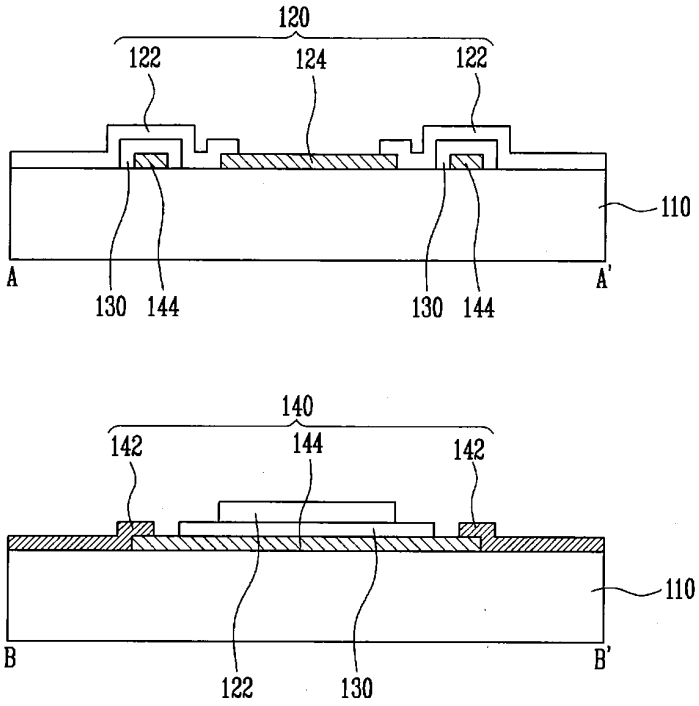

도면2a



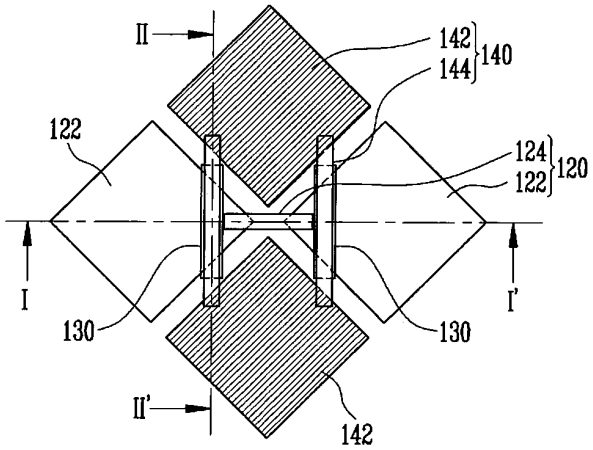



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BOE et al. v. Samsung, IPR2023-00988

도면2b



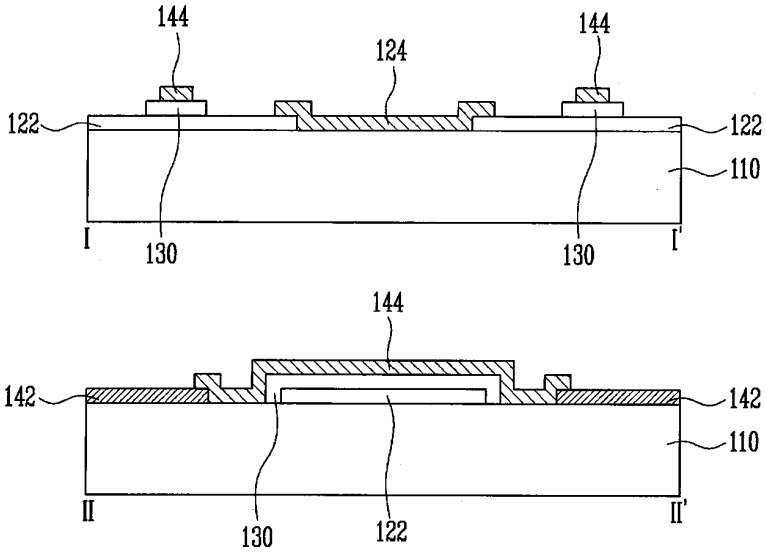

도면3a






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BOE et al. v. Samsung, IPR2023-00988

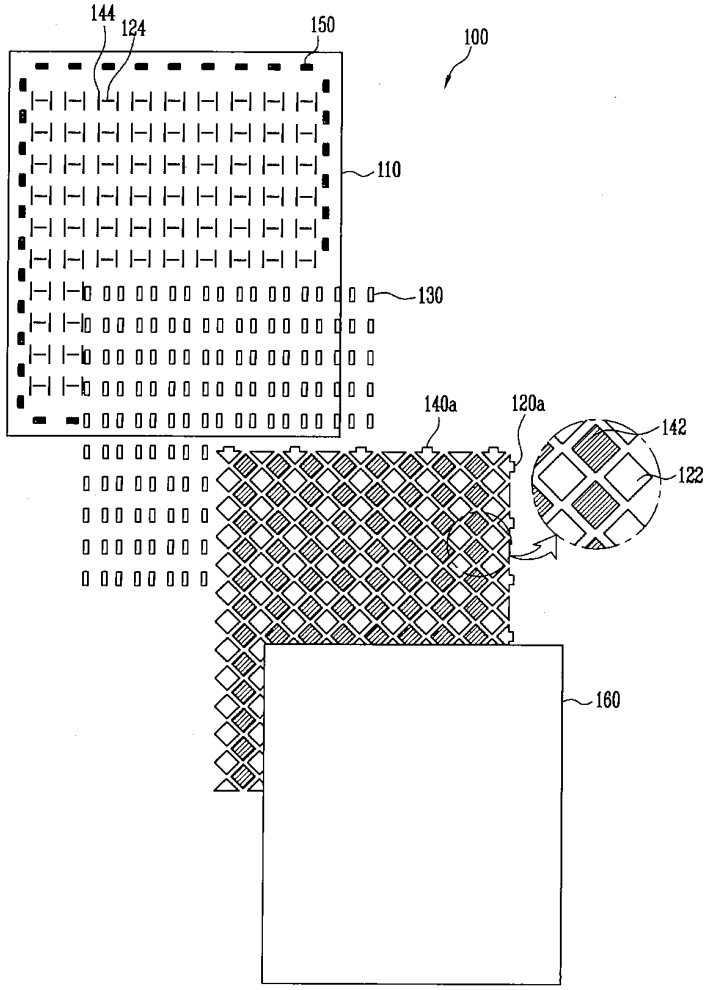
도면3b



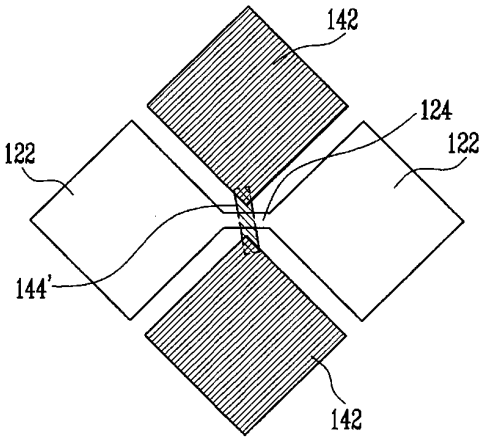



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BOE et al. v. Samsung, IPR2023-00988

도면4



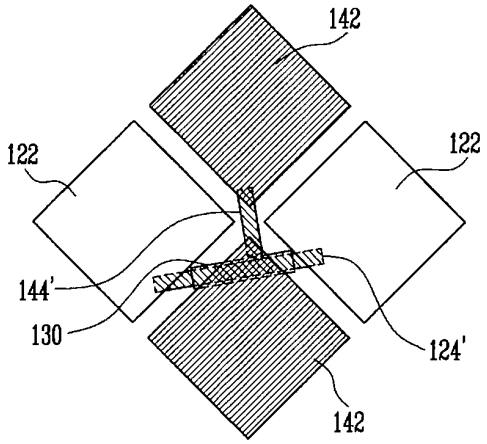

도면5a



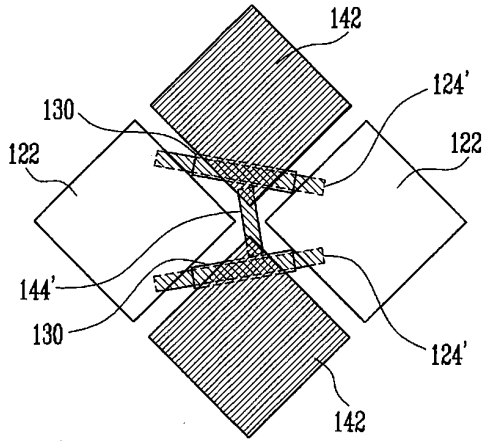



Petitioner Ex 1015, p. 996
BOE et al. v. Samsung, IPR2023-00988

도면5b



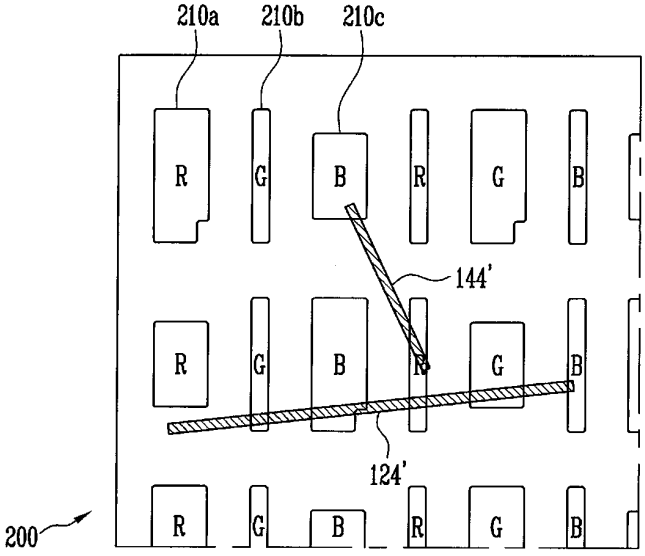

도면5c






Petitioner Ex 1015, p. 997
BOE et al. v. Samsung, IPR2023-00988

도면6






Petitioner Ex 1015, p. 998
BOE et al. v. Samsung, IPR2023-00988

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

*I hereby certify that this correspondence is being electronically filed with the United States Patent and Trademark Office on September 13, 2012 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.*

Sandra Medina
Signature

| | | |
|---|---|---|
| Applicant | : Sang-Shin Lee | Confirmation No. To Be Determined |
| Application No. | : To Be Determined | |
| Filed | : September 12, 2012 | |
| Title | : PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE | |
| Grp./Div. | : To Be Determined | |
| Examiner | : To Be Determined | |
| Docket No. | : 69657/P849 | |

**INFORMATION DISCLOSURE STATEMENT**
**37 CFR § 1.97(b)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
September 13, 2012

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is FORM PTO/SB/08A/B listing the references that are known to applicant. Copies of each of the listed references are enclosed. This filing is timely because it is made during one of the periods described in 37 CFR § 1.97(b).

It is respectfully requested that the listed references be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of FORM PTO/SB/08A/B be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

**Docket No.: 69657/P849**

The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
CHRISTIE, PARKER & HALE, LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/smm
Enclosures: PTO/SB/08A/B, w/references

SMM PAS1193587.1-*-09/12/12 10:43 AM



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BOE et al. v. Samsung, IPR2023-00988

| FORM PTO/SB/08A/B (10-01)<br>Substitute for PTO-1449A/B<br><br>**INFORMATION DISCLOSURE**<br><br>**STATEMENT BY APPLICANT**<br><br>(use as many sheets as necessary) | **Attorney Docket Number** | 69657/P849 |
|---|---|---|
| | **Application Number** | To Be Determined |
| | **Filing Date** | September 12, 2012 |
| | **Applicant(s)** | Sang-Shin Lee |
| | **Group Art Unit** | To Be Determined |
| | **Examiner Name** | To Be Determined |

**U.S. PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | DOCUMENT NUMBER<br>Number - Kind Code[2] (If Known) | PUBLICATION DATE<br>MM-DD-YYYY | NAME OF PATENTEE |
|---|---|---|---|---|
| | | | | |
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| | | | | |

**FOREIGN PATENT DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Foreign Patent Document<br>Country Code[3] - Number[4] - Kind Code[5] (If Known) | Publication Date<br>MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | T[6] (✓) |
|---|---|---|---|---|---|
| | | KR 10-0807524 | 02-26-2008 | Choo et al. | Korean Patent Abstracts |
| | | KR 10-2009-0017910 | 02-19-2009 | Park et al. | Korean Patent Abstracts |
| | | KR 10-2011-0023996 | 03-09-2011 | Kim et al. | Korean Patent Abstracts |
| | | KR 10-2011-0106565 | 09-29-2011 | Kim et al. | Korean Patent Abstracts |
| | | | | | |

**OTHER DOCUMENTS**

| EXAMINER INITIALS | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |
|---|---|---|
| | | Korean Patent Abstracts, Publication Number 1020030031207A, dated April 21, 2003 for corresponding Korean Patent 10-0807524 listed above. |
| | | |
| | | |
| | | |

SMM PAS1193589.1-*-09/12/12 10:53 AM

| EXAMINER SIGNATURE | | DATE CONSIDERED | |
|---|---|---|---|

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. [1]Applicant's unique citation designation number (optional). [2]See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. [3]Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). [4]For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6]Applicant is to place a check mark here if English Language Translation is attached.

Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

JEJ/smm



Petitioner Ex 1015, p. 1001
BOE et al. v. Samsung, IPR2023-00988

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | |
| **Filing Date:** | |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Filer:** | Jun-Youg E. Jeon/Sandra Medina |
| **Attorney Docket Number:** | 69657/P849 |

Filed as Large Entity

## Utility under 35 USC 111(a) Filing Fees

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| Utility application filing | 1011 | 1 | 380 | 380 |
| Utility Search Fee | 1111 | 1 | 620 | 620 |
| Utility Examination Fee | 1311 | 1 | 250 | 250 |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |
| **Miscellaneous:** | | | | |
| | | **Total in USD ($)** | | **1250** |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 13731861 |
| **Application Number:** | 13614197 |
| **International Application Number:** | |
| **Confirmation Number:** | 4264 |
| **Title of Invention:** | PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE |
| **First Named Inventor/Applicant Name:** | Sang-Shin Lee |
| **Customer Number:** | 23363 |
| **Filer:** | Jun-Youg E. Jeon/Sandra Medina |
| **Filer Authorized By:** | Jun-Youg E. Jeon |
| **Attorney Docket Number:** | 69657/P849 |
| **Receipt Date:** | 13-SEP-2012 |
| **Filing Date:** | |
| **Time Stamp:** | 16:06:02 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | $1250 |
| RAM confirmation Number | 3627 |
| Deposit Account | |
| Authorized User | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| 1 | Transmittal of New Application | 69657_Application_Transmittal.pdf | 86661<br>92b98597bf5399514e9f6826f96ff7e46ed29e0f | no | 3 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Application Data Sheet | sb0014.pdf | 1027554<br>f67eda1c73393861b48f937ddff77980e82acf45 | no | 4 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | | 69657_Specification.pdf | 160601<br>e4fac80a7514f2235d0fc3e37d154a7f54070f0e | yes | 20 |

| Multipart Description/PDF files in .zip description | | |
|---|---|---|
| **Document Description** | **Start** | **End** |
| Specification | 1 | 15 |
| Claims | 16 | 19 |
| Abstract | 20 | 20 |

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|---|---|---|---|---|---|
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 4 | Drawings-only black and white line drawings | 69657_Drawings.pdf | 45181<br>bae4b256484ef4cf824ec316605695ccefdecdd1 | no | 5 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 5 | Oath or Declaration filed | 69657_Dec.pdf | 80045<br>0f653b61d1d29f30c077e94c27a24a320d3b0dfb | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 6 | Power of Attorney | 69657_POA.pdf | 80045<br>0c06a292c6613f655dbb44b4c1546e98b0388b9e | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 7 | Foreign Reference | 69657_KR_207.pdf | 333779<br>f450cd7d60d2b8b86887313f14472e3775a30727 | no | 21 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |

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|---|---|---|---|---|---|
| 8 | Foreign Reference | 69657_KR_910.pdf | 195895<br>719434d70f29542d9f5549b9208fa5c183acba98 | no | 13 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 9 | Foreign Reference | 69657_KR_996.pdf | 183574<br>fb2537a78fe5d8dd36dd2841de43ccad721a532a | no | 12 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 10 | Foreign Reference | 69657_KR_565.pdf | 283141<br>556ff503cf243fc84a54b4ce10d8f2459a36a2d4 | no | 18 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 11 | | 69657_IDS.pdf | 51099<br>19b952eeaddfd2659b5c8e17371b05cd12bfaf9c | yes | 3 |

| | **Multipart Description/PDF files in .zip description** | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Transmittal Letter | 1 | 2 |
| | Information Disclosure Statement (IDS) Form (SB08) | 3 | 3 |

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|---|---|---|---|---|---|
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 12 | Fee Worksheet (SB06) | fee-info.pdf | 33237<br>749032502b30bb6ecef198d0f1cf36a4a9abbe99 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 2560812 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

x

**DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION** PATENT

Docket No. : 69657/P849

As a below named inventor, I hereby declare that:

My residence, mailing address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **PIXEL ARRANGEMENT STRUCTURE FOR ORGANIC LIGHT EMITTING DISPLAY DEVICE**, the specification of which is attached hereto unless the following is checked:

_____ was filed on _____ as United States Application Number or PCT International Application Number _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of the foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States of America, listed below and have also identified below, any foreign application for patent or inventor's certificate, or any PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

| Application Number | Country | Filing Date (day/month/year) | Priority Claimed |
|---|---|---|---|
| 10-2012-0022967 | KR | 6 March 2012 | YES |

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below.

| Application Number | Filing Date |
|---|---|

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

| Application Number | Filing Date | Patented/Pending/Abandoned |
|---|---|---|



Petitioner Ex 1015, p. 1008
BOE et al. v. Samsung, IPR2023-00988

DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION

Docket No. : 69657/P849

**POWER OF ATTORNEY:** I hereby appoint the practitioners associated with the law firm of Christie, Parker & Hale, LLP,

## CUSTOMER NUMBER 23363

to prosecute this application and any U.S. continuation or divisional application based on it, and to prosecute any international application under the Patent Cooperation Treaty based on it, and to transact all business in the U.S. Patent and Trademark Office connected with either of them in accordance with instructions from the assignee of the entire interest in this application; or from the first or sole inventor named below in the event the application is not assigned; or from **PanKorea Patent & Law Firm** in the event the power granted herein is for an application filed on behalf of a foreign attorney or agent.

The authority under this Power of Attorney of each person associated with the law firm of Christie, Parker & Hale, LLP, Customer Number 23363, shall automatically terminate and be revoked upon such person ceasing to be a member or associate of or of counsel to that law firm.

**DIRECT ALL CORRESPONDENCE TO: CUSTOMER NUMBER 23363**

**DIRECT TELEPHONE CALLS TO: Jun-Young E. Jeon, 626/795-9900**
**CHRISTIE, PARKER & HALE, LLP**
**P.O. Box 29001**
**Glendale, CA 91209-9001**

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

| NAME OF SOLE OR FIRST INVENTOR<br>Sang-Shin Lee | | | |
|---|---|---|---|
| Inventor's Signature Sang-Shin Lee | | | Date<br>September 10, 2012 |
| Residence: City<br>Yongin-city | State | Country<br>Republic of Korea | Citizenship<br>Korean |
| Mailing Address: | 95, Samsung 2 Ro, Giheung-Gu, Yongin-City, Gyeonggi-Do, Korea | | |



Petitioner Ex 1015, p. 1009
BOE et al. v. Samsung, IPR2023-00988