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(54) **DISPLAY PANEL, ORGANIC LIGHT EMITTING DIODE DISPLAY DEVICE AND DISPLAY DEVICE**

(71) Applicant: **Boe Technology Group Co., Ltd.**, Beijing (CN)

(72) Inventors: **Liang Sun**, Beijing (CN); **Tuo Sun**, Beijing (CN); **Xiaodan Jin**, Beijing (CN); **Lintao Zhang**, Beijing (CN)

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(57) **ABSTRACT**

This disclosure relates to a display panel, an organic light emitting diode display and a display device comprising the display panel. The display panel according to one aspect of this disclosure comprises a plurality of pixels each comprising a first sub-pixel, a second sub-pixel and a third sub-pixel, wherein the first sub-pixel and the second sub-pixel are arranged in the row direction, the first sub-pixel in each pixel is adjacent to the first sub-pixel in a pixel adjacent in the row direction, the second sub-pixel in each pixel is adjacent to the second sub-pixel in another pixel adjacent in the row direction, the geometrical center of the third sub-pixel in each pixel is distributed uniformly on the display panel. By means of the display panel of this disclosure, the area of the light emitting area in the pixel can be increased, the aperture ratio can be improved, so as to realize high display quality.

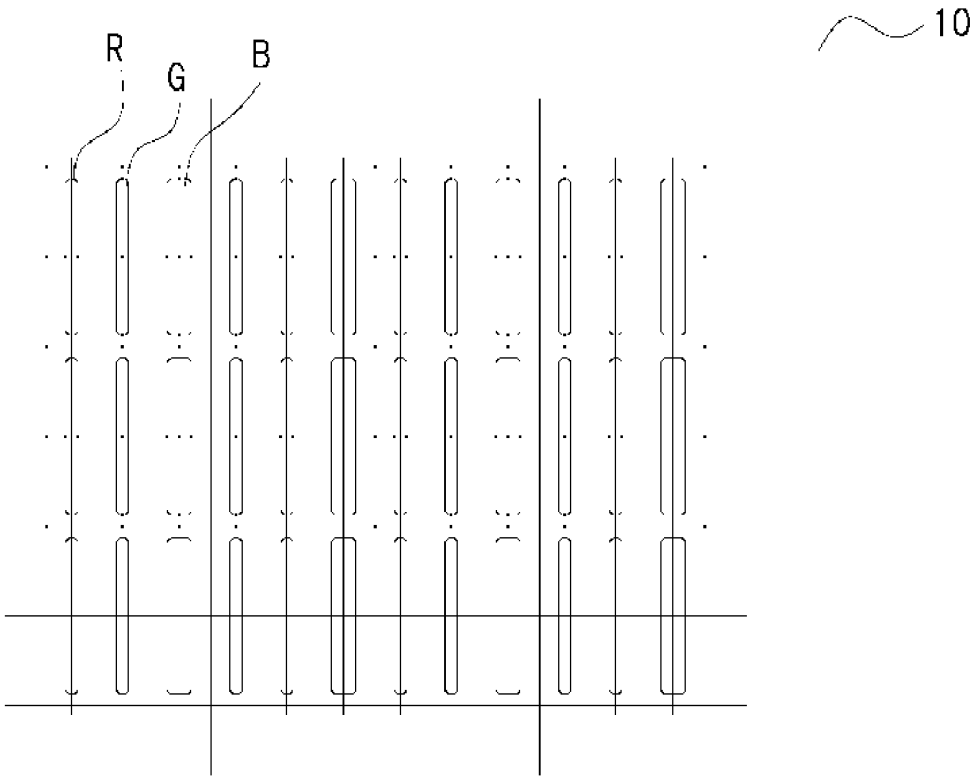


Fig.1

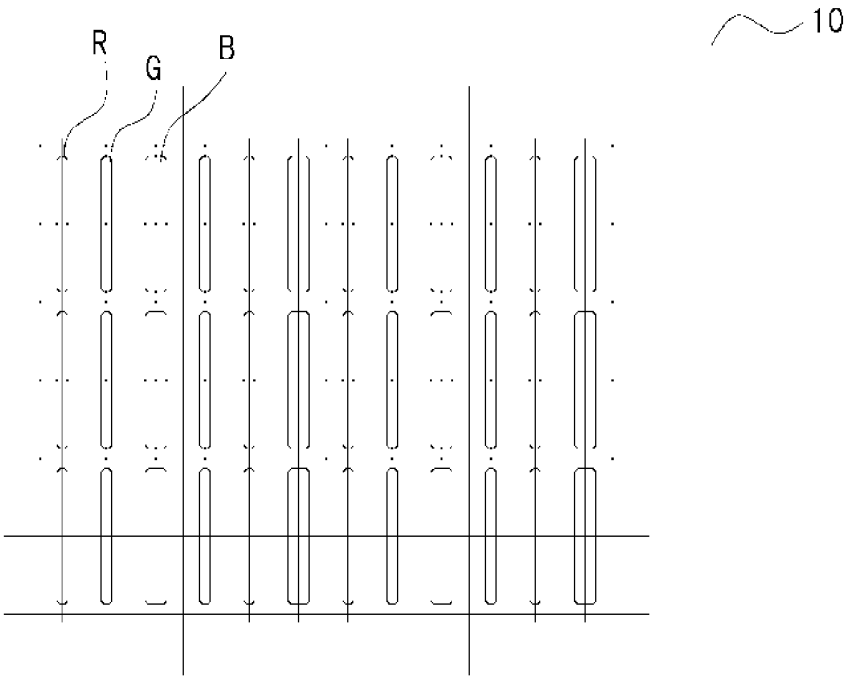


Fig.2

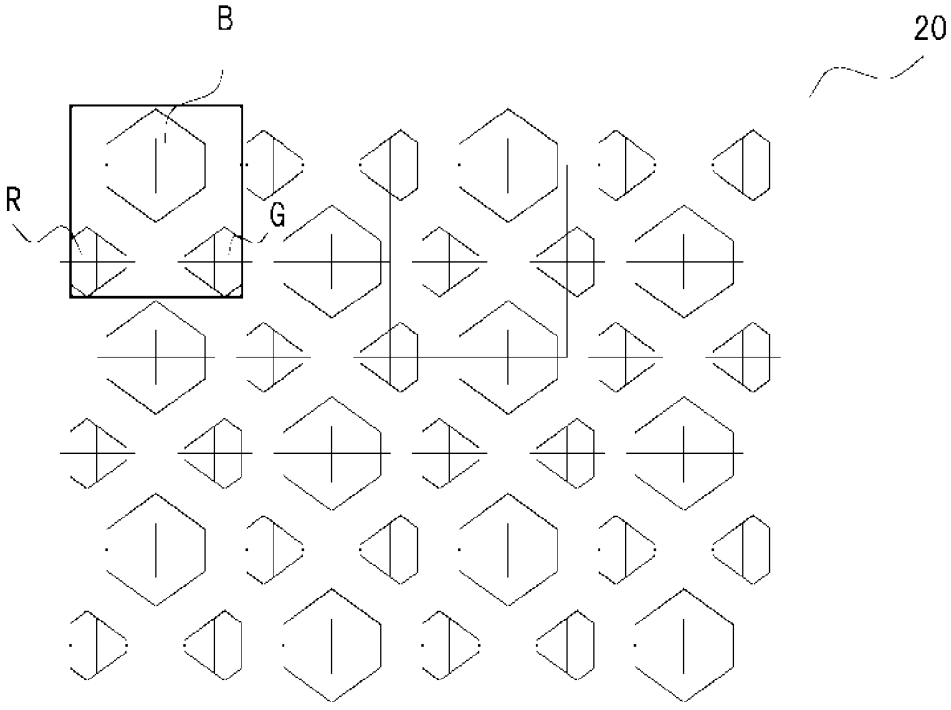


Fig.3

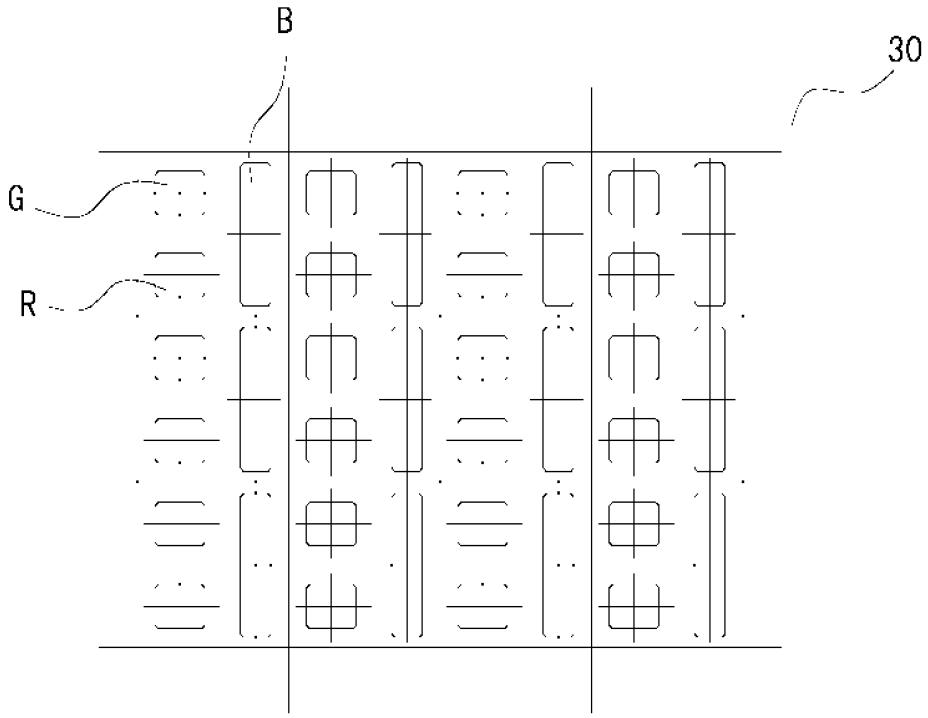


Fig.4

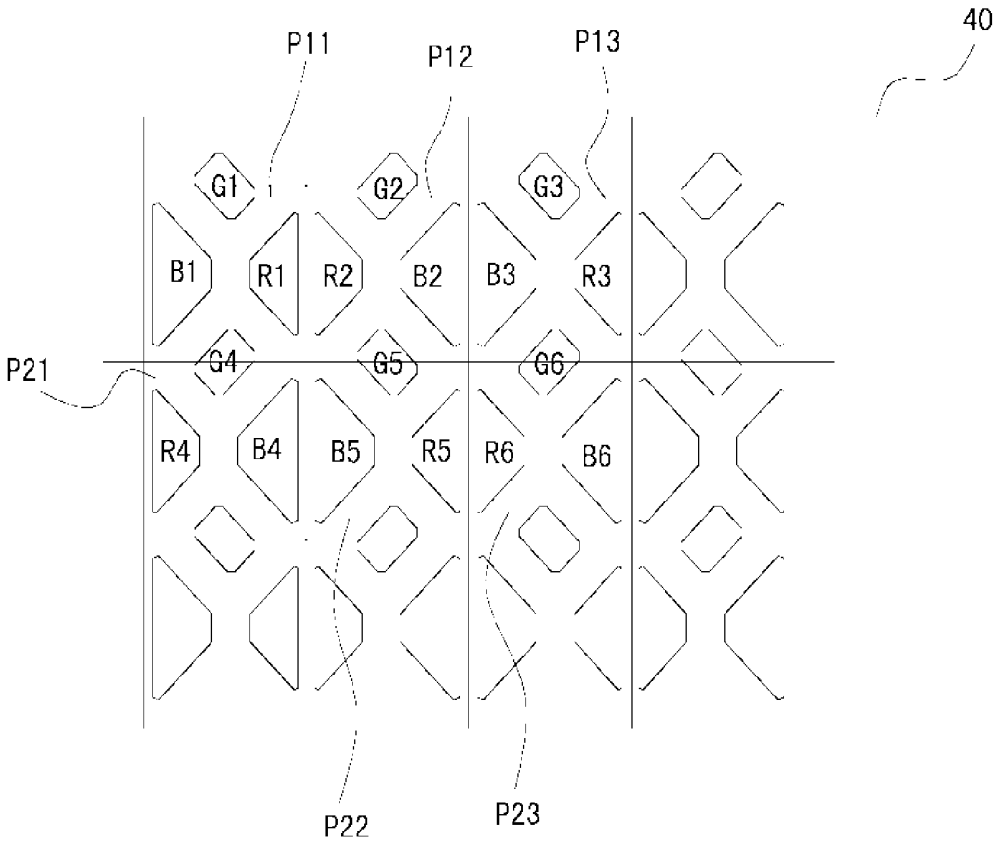
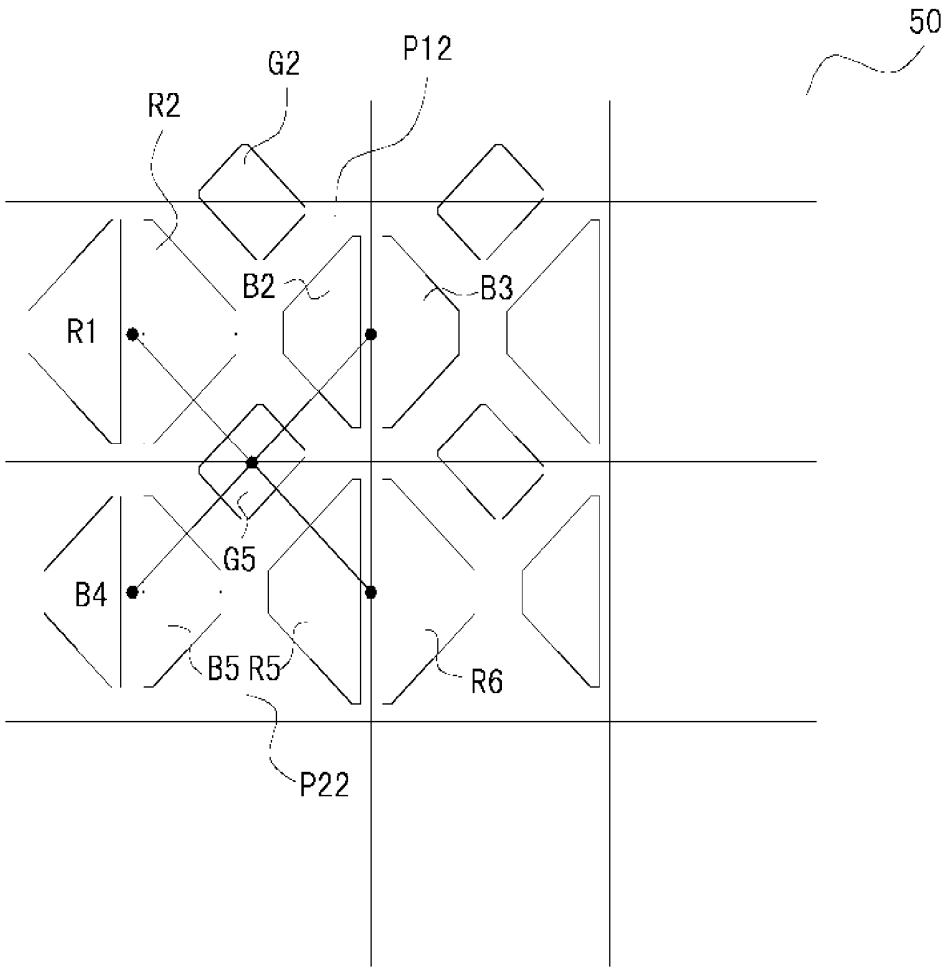

40
P11
P12
P13
G1
G2
G3
B1
R1
R2
B2
B3
R3
P21
G4
G5
G6
R4
B4
B5
R5
R6
B6
P22
P23

Fig.5



DISPLAY PANEL, ORGANIC LIGHT EMITTING DIODE DISPLAY DEVICE AND DISPLAY DEVICE

RELATED APPLICATIONS

[0001] The present application claims the benefit of Chinese application No. 201410459909.3 filed with the SIPO on Sep. 11, 2014, the entire disclosure of which is incorporated herein by reference.

FIELD OF THE DISCLOSURE

[0002] This disclosure relates to a display panel, an organic light emitting diode display and a display device comprising the display panel.

BACKGROUND OF THE DISCLOSURE

[0003] In the prior art of fabricating the top emission active matrix organic light emitting diode (AMOLED) panel, when the high precision metal mask plate (FMM) is used to evaporate pixels arranged side by side, it is inevitably limited by the aperture size of the high precision metal mask plate and the precision of the evaporation process, such that it is difficult to realize high resolution. Meanwhile, when the resolution is relatively high, it is difficult to ensure the aperture ratio (the aperture ratio in the present field generally refers to the proportion between the area of the light emitting area of the pixel area and the area of the repeatable pixel unit of the display area. The higher the aperture ratio is, the lower the brightness is required by each pixel light emitting area for achieving the same display brightness, and the lower the current density of the light emitting area brightness is) of the sub-pixel, thereby the properties, such as the life time, brightness etc., of the product might be influenced. Generally, the high precision metal mask plate has the limitation of the minimum aperture, in the evaporation process, the sub-pixels of different colors have the limitation of the distance between the apertures.

[0004] Therefore, how to realize high resolution, and at meantime, improve the aperture ratio of the sub-pixel, obtain a better brightness level, and prolong the life time of the produce is always a problem to be solved in the art.

SUMMARY OF THE DISCLOSURE

[0005] In view of this, this disclosure provides a display panel, an organic light emitting diode display and a display device comprising the display panel, which can solve or at least mitigate at least part of the defects existing in the prior art.

[0006] According to a first aspect of this disclosure, a display panel is provided, which may comprise a plurality of pixel units each comprising a first sub-pixel, a second sub-pixel and a third sub-pixel, wherein the first sub-pixel and the second sub-pixel are arranged in the row direction, and except for the first and the last pixel unit of each row, the first sub-pixel in each pixel unit is adjacent to the first sub-pixel in a pixel unit adjacent in the row direction, the second sub-pixel in each pixel unit is adjacent to the second sub-pixel in another pixel unit adjacent in the row direction, the third sub-pixel in each pixel unit is located in a row adjacent to the row where the first sub-pixel and the second sub-pixel in the pixel unit are located, and is adjacent to the first sub-pixel and the second sub-pixel in the pixel unit, the geometrical center of the third sub-pixel in each pixel unit is distributed uniformly on the display panel.

[0007] By means of the display panel according to one embodiment of this disclosure, the resolution is increased (i.e., the density of the sub-pixel is increased). Meanwhile, by enabling the first sub-pixel, the second sub-pixel to adjoin with each other, e.g., adjoining a B sub-pixel with an adjacent B sub-pixel, adjoining a R sub-pixel with an adjacent R sub-pixel, the area of not emitting light between the sub-pixels is reduced, and the aperture ratio is increased. In addition, the geometrical center of the G sub-pixels with a relatively high human recognition are distributed uniformly in the row direction and the column direction of the display panel, which ensures display quality in the row direction and the column direction.

[0008] In an embodiment of this disclosure, the first and the last pixel unit of each row are adjacent to the first sub-pixel or the second sub-pixel in a pixel unit adjacent to them in the row direction.

[0009] Alternatively, in each pixel unit and a pixel unit adjacent to it in the row direction, two adjacent first sub-pixels constitute a first sub-pixel group, two adjacent second sub-pixels constitute a second sub-pixel group, the geometrical centers of a first sub-pixel group and a second sub-pixel group adjacent in the row direction and the geometrical centers of another first sub-pixel group and another second sub-pixel group adjacent in the column direction to the first sub-pixel group and the second sub-pixel group adjacent in the row direction form a rectangle, the geometrical center of the third sub-pixel is on the diagonal intersection of the rectangle.

[0010] Alternatively, the geometrical centers of a first sub-pixel group and a second sub-pixel group adjacent in the row direction and the geometrical centers of another first sub-pixel group and another second sub-pixel group adjacent in the column direction to the first sub-pixel group and the second sub-pixel group adjacent in the row direction form a square, the geometrical center of the third sub-pixel is on the diagonal intersection of the square.

[0011] In another embodiment of this disclosure, the first sub-pixel and the second sub-pixel in each pixel unit are both polygons arranged in the row direction.

[0012] In a further embodiment of this disclosure, the first sub-pixel and the second sub-pixel in each pixel unit have the same shape.

[0013] Preferably, the first sub-pixel and the second sub-pixel in each pixel unit are both trapezoids in the row direction. Alternatively, the upper base of the trapezoidal first sub-pixel in each pixel unit is adjacent to the upper base of the trapezoidal second sub-pixel.

[0014] In a variant embodiment of this disclosure, the first sub-pixel and the second sub-pixel in each pixel unit are both rectangles arranged in the row direction.

[0015] In yet another embodiment of this disclosure, the geometrical center of the first sub-pixel group and the geometrical center of the second sub-pixel group are arranged alternately in the row direction and the column direction.

[0016] In respective embodiments of this disclosure, the first sub-pixel may be a R sub-pixel, the second sub-pixel may be a B sub-pixel, the third sub-pixel may be a G sub-pixel, or the first sub-pixel is a B sub-pixel, the second sub-pixel is a R sub-pixel, the third sub-pixel is a G sub-pixel, or the first sub-pixel is a G sub-pixel, the second sub-pixel is a B sub-pixel, the third sub-pixel is a R sub-pixel, or the first sub-pixel is a G sub-pixel, the second sub-pixel is a R sub-pixel, the third sub-pixel is a B sub-pixel, or the first sub-pixel is a R sub-pixel, the second sub-pixel is a G sub-pixel, the third

sub-pixel is a B sub-pixel, or the first sub-pixel is a B sub-pixel, the second sub-pixel is a G sub-pixel, the third sub-pixel is a R sub-pixel.

[0017] The G sub-pixel in each pixel unit is a quadrangle, and is arranged towards the same direction on the display panel. Alternatively, the G sub-pixel in each pixel unit is a quadrangle, and the G sub-pixel on the display panel is arranged alternately towards a different direction. Alternatively, the adjacent G sub-pixels are arranged in mirror symmetry.

[0018] According to a second aspect of this disclosure, an organic light emitting diode display is provided, which may comprise a display panel mentioned above.

[0019] According to a third aspect of this disclosure, a display device is provided, comprising a display panel mentioned above.

BRIEF DESCRIPTION OF DRAWINGS

[0020] By explaining in detail the embodiments in conjunction with the drawings, the above and other features of this disclosure will be more obvious, wherein:

[0021] FIG. **1** schematically shows a first arrangement of R sub-pixels, G sub-pixels, and B sub-pixels in the prior art.

[0022] FIG. **2** schematically shows a second arrangement of R sub-pixels, G sub-pixels, and B sub-pixels in the prior art.

[0023] FIG. **3** schematically shows a third arrangement of R sub-pixels, G sub-pixels, and B sub-pixels in the prior art.

[0024] FIG. **4** schematically shows an arrangement of R sub-pixels, G sub-pixels, and B sub-pixels according to an embodiment of this disclosure.

[0025] FIG. **5** schematically shows the relationship among R sub-pixels, G sub-pixels, and B sub-pixels in respective pixels according to another embodiment of this disclosure.

DETAILED DESCRIPTION OF THE DISCLOSURE

[0026] It should be indicated firstly that the terms such as "up", "low", "left", "right", "row direction", "column direction" etc., regarding positions and directions mentioned in this disclosure are directions viewed from the paper face of the drawings. Therefore, the terms such as "up", "low", "left", "right", "row direction", "column direction" etc., regarding positions and directions in this disclosure only represent relative position relationships as shown in the drawings, this is only given for the purpose of explanations, not intended to limit the scope of this disclosure. For example, in some cases, the embodiments concerning the "row direction" can be carried out in the case of the "column direction" etc., and vice versa. It also belongs to the category of this patent right to perform rotation of 90 degrees or mirror image to the solution of this patent.

[0027] Next, this disclosure will be described in detail with reference to FIGS. **1-5**.

[0028] FIG. **1** schematically shows a first arrangement **10** of R sub-pixels, G sub-pixels, and B sub-pixels in the prior art. FIG. **1** schematically shows an arrangement of R sub-pixels, G sub-pixels, and B sub-pixels in a pixel of the prior art, wherein the R sub-pixels, the G sub-pixels, and the B sub-pixels are distributed in the row direction. Due to the limitation of the minimum aperture of FMM and the distance limitation of different color apertures in the evaporation process, it is relatively difficult to compress the size in the row direction, meanwhile, it results in decrease of the aperture ratio of the R sub-pixels, the G sub-pixels, and the B sub-pixels. Generally, the arrangement of FIG. **1** can only realize a resolution about 200 ppi (pixel per inch), and an aperture ratio of 20~30%.

[0029] FIG. **2** schematically shows a second arrangement **20** of R sub-pixels, G sub-pixels, and B sub-pixels in the prior art, while FIG. **3** schematically shows a third arrangement **30** of R sub-pixels, G sub-pixels, and B sub-pixels in the prior art. It is schematically shown in FIG. **2** and FIG. **3** that R sub-pixels, G sub-pixels, and B sub-pixels in a pixel are distributed uniformly in the row direction and the column direction. Although relative to the arrangement of FIG. **1**, FIG. **2** and FIG. **3** increase some aperture ratios by transferring the size limitation in the row direction to the column direction, and compress the size of the sub-pixel to some extent, however, due to the limitation of the minimum aperture of FMM and the distance limitation of different color apertures in the evaporation process, the arrangement of FIG. **3** can only realize a resolution less than 300 ppi and an aperture ratio of 30~35% generally.

[0030] However, how to increase the resolution further, reduce the area of not emitting light between the sub-pixels, and increase the aperture ratio are still pursued diligently by the skilled person in the art for achieving higher display quality.

[0031] Based on such an assumption exactly, this disclosure proposes a display panel **40**, wherein the R sub-pixel in a pixel, e.g. the R**2** sub-pixel shown in in pixel P**12** of FIG. **4**, is adjacent to a R sub-pixel in a pixel adjacent to the pixel in the row direction, e.g. the R**1** sub-pixel shown in pixel P**11** of FIG. **4**. The B sub-pixel in the pixel, e.g. the B**2** sub-pixel shown in pixel P**13** of FIG. **4**, is adjacent to a B sub-pixel in another pixel adjacent to the pixel in the row direction, e.g., the B**3** sub-pixel shown in pixel P**13** of FIG. **4**. It can be seen in FIG. **4** that the R**2** sub-pixel in a pixel is adjacent to the R**1** sub-pixel in an adjacent pixel in the row direction, and the B**2** sub-pixel in the pixel is adjacent to the B**3** sub-pixel in another adjacent pixel in the row direction. The geometrical center of the G sub-pixel in each pixel is distributed uniformly on the display panel **40**. In the display panel **40** as shown in FIG. **4**, it can be seen that G**1**, G**2**, G**3** . . . are distributed uniformly on the whole display panel. As for how the geometrical centers of the G sub-pixels are distributed, it will be described in detail later. Since the G sub-pixels with relatively high human recognition are distributed uniformly in the transverse and column directions of the display panel, the display quality in the transverse and column directions is ensured. In respective pixels, the G sub-pixels may be in an approximate rectangular shape with four angles having smooth chamfers, for example, G**1**, G**2**, G**3** . . . as shown in FIG. **4** are exactly in such a shape. In respective embodiments of this disclosure, the G sub-pixels may be either in a center symmetric circular shape or in a non center symmetric ellipse shape etc. However, no matter the G sub-pixels are center symmetric or non center symmetric, the G sub-pixels have their own geometrical centers, this is not difficult for the skilled person in the art to understand.

[0032] The display panel **40** according to an embodiment of this disclosure may comprise a plurality of pixel units each comprising a first sub-pixel, a second sub-pixel and a third sub-pixel, wherein the first sub-pixel and the second sub-pixel are arranged in the row direction, and except for the first and the last pixel unit of each row , the first sub-pixel in each pixel unit is adjacent to the first sub-pixel in a pixel unit

adjacent in the row direction, the second sub-pixel in each pixel unit is adjacent to the second sub-pixel in another pixel unit adjacent in the row direction, the third sub-pixel in each pixel unit is located in a row adjacent to the row where the first sub-pixel and the second sub-pixel in the pixel unit are located, and is adjacent to the first sub-pixel and the second sub-pixel in the pixel unit, the geometrical center of the third sub-pixel in each pixel unit is distributed uniformly on the display panel. Preferably, the first and the last pixel unit of each row are adjacent to the first sub-pixel or the second sub-pixel in a pixel unit adjacent to them in the row direction.

[0033] In another embodiment of this disclosure, in each pixel unit and a pixel unit adjacent to it in the row direction, two adjacent first sub-pixels constitute a first sub-pixel group, two adjacent second sub-pixels constitute a second sub-pixel group, the geometrical centers of a first sub-pixel group and a second sub-pixel group adjacent in the row direction and the geometrical centers of another first sub-pixel group and another second sub-pixel group adjacent in the column direction to the first sub-pixel group and the second sub-pixel group adjacent in the row direction form a rectangle, the geometrical center of the third sub-pixel is on the diagonal intersection of the rectangle.

[0034] Alternatively, the geometrical centers of a first sub-pixel group and a second sub-pixel group adjacent in the row direction and the geometrical centers of another first sub-pixel group and another second sub-pixel group adjacent in the column direction to the first sub-pixel group and the second sub-pixel group adjacent in the row direction form a square, the geometrical center of the third sub-pixel is on the diagonal intersection of the square.

[0035] FIG. **4** schematically shows pixel P**11**, pixel P**12**, pixel P**13** . . . in the first row and pixel P**21**, pixel P**22**, pixel P**23** . . . in the second row, each pixel has corresponding sub-pixels R, G, B. For example, there are sub-pixels R**1**, G**1**, B**1** in pixel P**11**, sub-pixels R**2**, G**2**, B**2** in pixel P**12**, sub-pixels R**3**, G**3**, B**3** in pixel P**13** . . . . The pixel P**11**, pixel P**12**, Pixel P**13** . . . represented by the blocks as shown in FIG. **4** are arranged side by side in the first row along the row direction, the pixel P**21**, pixel P**22**, Pixel P**23** . . . are arranged side by side in the second row along the row direction. Since the row direction and the column direction are relative concepts, if the pixel P**11**, pixel P**12**, pixel P**13** . . . and the pixel P**21**, pixel P**22**, pixel P**23** . . . are arranged in the column direction, the technical effect of this disclosure can be also achieved. Although such a case is not shown in the drawings, it is not difficult for the skilled person in the art to understand.

[0036] By means of such an arrangement of sub-pixels, the resolution (which may be greater than 300 ppi) is improved, and the area of not emitting light between the sub-pixels is reduced, the aperture ratio reaches about 42%, moreover, the preparation process of the display panel can be simplified.

[0037] FIG. **5** schematically shows the arrangement of sub-pixels R, G, B according to an embodiment of this disclosure, FIG. **5** is for describing the arrangement of the sub-pixels R, G, B in FIG. **4** more clearly. FIG. **5** amplifies an entire pixel P**12**, an entire pixel P**22** and part or full of pixels P**11**, P**13**, P**21**, P**23** as shown in Fig, **4**. The geometrical centers of the G sub-pixels G**1**, G**2**, G**3** . . . in each pixel being distributed uniformly on the display panel **50** may comprise the following cases: the R sub-pixel R**2** in pixel P**12** and the R sub-pixel R**1** in a pixel P**11** adjacent to said pixel in the row direction constitute a R sub-pixel group R**1**, R**2**, the B sub-pixel B**2** in the pixel P**12** and the B sub-pixel B**3** in another pixel P**13** adjacent to the pixel P**12** in the row direction constitute a B sub-pixel group B**2**, B**3**, the geometrical center of the R sub-pixel group R**1**, R**2**, the geometrical center of the B sub-pixel group B**2**, B**3**, the geometrical center of another R sub-pixel group R**5**, R**6** adjacent to the B sub-pixel group B**2**, B**3** in the column direction, and the geometrical center of another B sub-pixel group B**4**, B**5** adjacent to the R sub-pixel group R**1**, R**2** in the column direction constitute a rectangle, the geometrical center of the G sub-pixel G**5** is on the diagonal intersection of the rectangle.

[0038] It needs to point out that as for the R sub-pixels and the B sub-pixels, the term "geometrical center" mentioned in this disclosure respectively refers to the center of the geometrical shape enclosed by two adjacent R sub-pixels that constitute a R sub-pixel group or two adjacent B sub-pixels that constitute a B sub-pixel group. As for the G sub-pixels, the term "geometrical center" refers to the center of the geometrical shape of a single G sub-pixel. For example, as shown in FIG. **5**, the geometrical center of the R sub-pixel group R**1**, R**2** refers to the center of the geometrical shape enclosed by two adjacent R sub-pixels R**1**, R**2**. Similarly, the geometrical center of the B sub-pixel group B**2**, B**3** refers to the center of the geometrical shape enclosed by two adjacent B sub-pixels B**2**, B**3**, and so on. The five black points in FIG. **5** show the geometrical center of the R sub-pixel group R**1**, R**2**, the geometrical center of the B sub-pixel group B**2**, B**3**, the geometrical center of the R sub-pixel group R**5**, R**6**, the geometrical center of the B sub-pixel group B**4**, B**5**, and the geometrical center of the sub-pixel of G**5**.

[0039] Alternatively, the geometrical center of the R sub-pixel group R**1**, R**2**, the geometrical center of the B sub-pixel group B**2**, B**3**, the geometrical center of another R sub-pixel group R**5**, R**6** adjacent to the B sub-pixel group B**2**, B**3** in the column direction, and the geometrical center of another B sub-pixel group B**4**, B**5** adjacent to the R sub-pixel group R**1**, R**2** in the column direction constitute a square, the geometrical center of the G sub-pixel G**5** is on the diagonal intersection of the square.

[0040] By means of such an arrangement of sub-pixels, the resolution (which may be greater than 300 ppi) is also increased, and the area of not emitting light between the sub-pixels is reduced, and the aperture ratio reaches about 42%.

[0041] In an embodiment of this disclosure, the display panel **40** comprises geometrical centers of a plurality of first sub-pixel groups and geometrical centers of a plurality of second sub-pixel groups, wherein the geometrical center of each first sub-pixel group is adjacent to the geometrical centers of the second sub-pixel groups in the row direction and the column direction, the geometrical center of each second sub-pixel group is adjacent to the geometrical centers of the first sub-pixel groups in the row direction and the column direction. For example, the B sub-pixel and the R sub-pixel in each pixel may be both polygons arranged in the row direction, the geometrical center of the B sub-pixel group B**2**, B**3**, the geometrical center of the R sub-pixel group R**1**, R**2**, the geometrical center of another R sub-pixel group R**5**, R**6** adjacent to the B sub-pixel group B**2**, B**3** in the column direction are adjacent in the column direction and the row direction. Alternatively, the first sub-pixel and the second sub-pixel in each pixel unit may have the same shape. The R sub-pixel group is constituted by two independently driven R sub-pixels, the B sub-pixel group is constituted by two independently driven B sub-pixels. Alternatively, the first sub-pixel

and the second sub-pixel in each pixel unit are both trapezoids arranged in the row direction. For example, the upper base of the trapezoidal first sub-pixel in each pixel unit is adjacent to the upper base of the trapezoidal second sub-pixel. Or, the first sub-pixel and the second sub-pixel in each pixel unit are both rectangles arranged in the row direction.

[0042] Alternatively, the B sub-pixel and the R sub-pixel in each pixel in each pixel can be both trapezoids arranged in the column direction. For example, the B**1** sub-pixel, R**1** sub-pixel, B**2** sub-pixel, R**2** sub-pixel, B**3** sub-pixel, R**3** sub-pixel . . . in FIG. **4** are all arranged in the column direction or vertically arranged. The upper base of the trapezoid shape of the B sub-pixel is adjacent to the upper base of the trapezoid shape of the R sub-pixel in the row direction, for example, the B**1** sub-pixel, the R**1** sub-pixel shown in pixel P**11** of FIG. **4** are exactly such cases. The lower base of the trapezoid shape of the R sub-pixel is adjacent to the lower base of the trapezoid shape of the R sub-pixel in a pixel adjacent to this pixel in the row direction, for example, the lower base of the trapezoid shape of the R**2** sub-pixel shown in the pixel P**12** of FIG. **4** is adjacent to the lower base of the trapezoid shape of the R**1** sub-pixel in a pixel e.g. pixel P**11** adjacent in the row direction. The lower base of the trapezoid shape of the B sub-pixel in this pixel is adjacent to the lower base of the trapezoid shape of the B sub-pixel in another pixel adjacent to this pixel in the row direction, for example, the lower base of the trapezoid shape of the B**2** sub-pixel shown in pixel P**12** of FIG. **4** is adjacent to the lower base of the trapezoid shape of the B**3** sub-pixel in a pixel e.g. pixel P**13** adjacent in the row direction. Similarly, since the row direction and the column direction are relative concepts, in a variant embodiment of this disclosure, the B sub-pixel and the R sub-pixel in each pixel can be both in a trapezoid shape arranged in the row direction, here the upper base of the trapezoid shape of the B sub-pixel is adjacent to the upper base of the trapezoid shape of the R sub-pixel in the column direction, the lower base of the trapezoid shape of the R sub-pixel is adjacent to the lower base of the trapezoid shape of the R sub-pixel in a pixel adjacent to this pixel in the column direction, the lower base of the trapezoid shape of the B sub-pixel in this pixel is adjacent to the lower base of the trapezoid shape of the B sub-pixel in another pixel adjacent to this pixel in the column direction. Although such cases are not shown in the drawings, it is not difficult for the skilled person in the art to understand. By means of such an arrangement of the sub-pixels, the resolution (which may be greater than 300 ppi) is also improved. Moreover, the area of not emitting light between the sub-pixels is reduced, and the aperture ratio reaches about 42%.

[0043] It should be pointed out that the upper base of the trapezoid shape refers to the relatively short base row in the trapezoid, the lower base refers to the relatively long base row in the trapezoid. The trapezoid shapes of the above R, B sub-pixels are only schematic, the shapes of the R, B sub-pixels in respective embodiments of this disclosure should not be limited to the trapezoid shape, instead, they may be in polygon shapes such as rectangle etc. In addition, in the above respective embodiments of this disclosure, although the G sub-pixels in respective pixels may be in an approximate rectangular shape with four angles having smooth chamfers, the G sub-pixels in this disclosure should not be limited to the approximate rectangular shape, which can also be in a rectangular shape without chamfer angles, or a square shape with four angles having chamfers or having no chamfers, or a triangle shape etc.

[0044] The gist of this disclosure does not lie in the shapes of the R sub-pixel, the G sub-pixel, and the B sub-pixel, but the position relationship between the R sub-pixel and the B sub-pixel. That is, the B sub-pixel in the same pixel is adjacent to the B sub-pixel in an adjacent pixel, the R sub-pixel in the same pixel is adjacent to the R sub-pixel in another adjacent pixel. The adjacent pixel and another adjacent pixel mentioned in respective embodiments of this disclosure may be either adjacent pixels in the row direction or adjacent pixels in the column direction, combined with the above depiction of the description, it is not difficult for the skilled person in the art to understand.

[0045] In respective embodiments of this disclosure, the geometrical center of the first sub-pixel group and the geometrical center of the second sub-pixel group are arranged alternately in the row direction and the column direction. For example, the geometrical center of the B sub-pixel group and the geometrical center of the R sub-pixel group are arranged alternately in the column direction and the row direction. For example, the four black points (the block point representing the geometrical center of G**5** is not considered) shown in FIG. **5** exactly show that the geometrical center of the B sub-pixel group and the geometrical center of the R sub-pixel group are adjacent in the column direction and the row direction. In respective embodiments of this disclosure, the R sub-pixel group is constituted by two independently driven R sub-pixels, the B sub-pixel group is constituted by two independently driven B sub-pixels.

[0046] In respective embodiments of this disclosure, wherein the first sub-pixel may be a R sub-pixel, the second sub-pixel may be a B sub-pixel, the third sub-pixel may be a G sub-pixel, or the first sub-pixel is a B sub-pixel, the second sub-pixel is a R sub-pixel, the third sub-pixel is a G sub-pixel, or the first sub-pixel is a G sub-pixel, the second sub-pixel is a B sub-pixel, the third sub-pixel is a R sub-pixel, or the first sub-pixel is a G sub-pixel, the second sub-pixel is a R sub-pixel, the third sub-pixel is a B sub-pixel, or the first sub-pixel is a R sub-pixel, the second sub-pixel is a G sub-pixel, the third sub-pixel is a B sub-pixel, or the first sub-pixel is a B sub-pixel, the second sub-pixel is a G sub-pixel, the third sub-pixel is a R sub-pixel.

[0047] In an embodiment of this disclosure, in each pixel unit and a pixel unit adjacent to it in the row direction, two adjacent first sub-pixels constitute a first sub-pixel group, two adjacent second sub-pixels constitute a second sub-pixel group, the geometrical centers of a first sub-pixel group and a second sub-pixel group adjacent in the row direction and the geometrical centers of another first sub-pixel group and another second sub-pixel group adjacent in the column direction to the first sub-pixel group and the second sub-pixel group adjacent in the row direction form a rectangle, the geometrical center of the third sub-pixel is on the diagonal intersection of the rectangle. Alternatively, wherein the geometrical centers of a first sub-pixel group and a second sub-pixel group adjacent in the row direction and the geometrical centers of another first sub-pixel group and another second sub-pixel group adjacent in the column direction to the first sub-pixel group and the second sub-pixel group adjacent in the row direction form a square, the geometrical center of the third sub-pixel is on the diagonal intersection of the square.

[0048] In an embodiment of this disclosure, the geometrical center of the G sub-pixel in each pixel being distributed uniformly on the display panel **40** comprises that the G sub-pixel in each pixel is arranged towards the same direction on

the display panel **40**. Although it is not shown in the drawings, it is not difficult for the skilled person in the art to understand.

[0049] In another embodiment of this disclosure, the geometrical center of the G sub-pixel in each pixel being distributed uniformly on the display panel **40** comprises that the G sub-pixel in each pixel unit is a quadrangle, and is arranged towards the same direction on the display panel. Or the G sub-pixel in each pixel unit is a quadrangle, and the G sub-pixel on the display panel is arranged alternately towards different directions. FIG. **4** shows that the G**3** sub-pixel is arranged towards the upper left direction tiltedly, the G**1** sub-pixel is arranged towards the upper right direction tiltedly, the G**2** sub-pixel is arranged towards the upper left direction tiltedly again . . . , and thus arranged orderly. It needs to point out that any arrangement manner of the G sub-pixels falls within the protection scope of this disclosure as long as the G sub-pixel can be distributed uniformly on the display panel **40**.

[0050] According to a second aspect of this disclosure, an organic light emitting diode display is provided, which may comprise a display panel mentioned above.

[0051] According to a third aspect of this disclosure, a display device is provided, which may comprise a display panel mentioned above.

[0052] Although this disclosure has been described with reference to the currently considered embodiments, it should be understood that this disclosure is not limited to the disclosed embodiments. On the contrary, this disclosure aims to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims. The scopes of the following claims are in row with the most extensive interpretation so as to cover each of such modifications as well as equivalent structures and functions.

1. A display panel comprising a plurality of pixel units each comprising a first sub-pixel, a second sub-pixel and a third sub-pixel, wherein the first sub-pixel and the second sub-pixel are arranged in the row direction, and except for the first and the last pixel unit of each row, the first sub-pixel in each pixel unit is adjacent to the first sub-pixel in a pixel unit adjacent in the row direction, the second sub-pixel in each pixel unit is adjacent to the second sub-pixel in another pixel unit adjacent in the row direction, the third sub-pixel in each pixel unit is located in a row adjacent to the row where the first sub-pixel and the second sub-pixel in the pixel unit are located, and is adjacent to the first sub-pixel and the second sub-pixel in the pixel unit, the geometrical center of the third sub-pixel in each pixel unit is distributed uniformly on the display panel.

2. The display panel according to claim **1**, wherein the first and the last pixel unit of each row are adjacent to the first sub-pixel or the second sub-pixel in a pixel unit adjacent to them in the row direction.

3. The display panel according to claim **1**, wherein

in each pixel unit and a pixel unit adjacent to it in the row direction, two adjacent first sub-pixels constitute a first sub-pixel group, two adjacent second sub-pixels constitute a second sub-pixel group, the geometrical centers of a first sub-pixel group and a second sub-pixel group adjacent in the row direction and the geometrical centers of another first sub-pixel group and another second sub-pixel group adjacent in the column direction to the first sub-pixel group and the second sub-pixel group adjacent in the row direction form a rectangle, the geometrical center of the third sub-pixel is on the diagonal intersection of the rectangle.

4. The display panel according to claim **3**, wherein the geometrical centers of a first sub-pixel group and a second sub-pixel group adjacent in the row direction and the geometrical centers of another first sub-pixel group and another second sub-pixel group adjacent in the column direction to the first sub-pixel group and the second sub-pixel group adjacent in the row direction form a square, the geometrical center of the third sub-pixel is on the diagonal intersection of the square.

5. The display panel according to claim **1**, wherein the first sub-pixel and the second sub-pixel in each pixel unit are both polygons arranged in the row direction.

6. The display panel according to claim **5**, wherein the first sub-pixel and the second sub-pixel in each pixel unit have the same shape.

7. The display panel according to claim **5**, wherein the first sub-pixel and the second sub-pixel in each pixel unit are both trapezoids in the row direction.

8. The display panel according to claim **7**, wherein the upper base of the trapezoidal first sub-pixel in each pixel unit is adjacent to the upper base of the trapezoidal second sub-pixel.

9. The display panel according to claim **5**, wherein the first sub-pixel and the second sub-pixel in each pixel unit are both rectangles arranged in the row direction.

10. The display panel according to claim **3**, wherein the geometrical center of the first sub-pixel group and the geometrical center of the second sub-pixel group are arranged alternately in the row direction and the column direction.

11. The display panel according to claim **1**, wherein the first sub-pixel is a R sub-pixel, the second sub-pixel is a B sub-pixel, the third sub-pixel is a G sub-pixel, or the first sub-pixel is a B sub-pixel, the second sub-pixel is a R sub-pixel, the third sub-pixel is a G sub-pixel, or the first sub-pixel is a G sub-pixel, the second sub-pixel is a B sub-pixel, the third sub-pixel is a R sub-pixel, or the first sub-pixel is a G sub-pixel, the second sub-pixel is a R sub-pixel, the third sub-pixel is a B sub-pixel, or the first sub-pixel is a R sub-pixel, the second sub-pixel is a G sub-pixel, the third sub-pixel is a B sub-pixel, or the first sub-pixel is a B sub-pixel, the second sub-pixel is a G sub-pixel, the third sub-pixel is a R sub-pixel.

12. The display panel according to claim **2**, wherein the first sub-pixel is a R sub-pixel, the second sub-pixel is a B sub-pixel, the third sub-pixel is a G sub-pixel, or the first sub-pixel is a B sub-pixel, the second sub-pixel is a R sub-pixel, the third sub-pixel is a G sub-pixel, or the first sub-pixel is a G sub-pixel, the second sub-pixel is a B sub-pixel, the third sub-pixel is a R sub-pixel, or the first sub-pixel is a G sub-pixel, the second sub-pixel is a R sub-pixel, the third sub-pixel is a B sub-pixel, or the first sub-pixel is a R sub-pixel, the second sub-pixel is a G sub-pixel, the third sub-pixel is a B sub-pixel, or the first sub-pixel is a B sub-pixel, the second sub-pixel is a G sub-pixel, the third sub-pixel is a R sub-pixel.

13. The display panel according to claim **3**, wherein the first sub-pixel is a R sub-pixel, the second sub-pixel is a B sub-pixel, the third sub-pixel is a G sub-pixel, or the first sub-pixel is a B sub-pixel, the second sub-pixel is a R sub-pixel, the third sub-pixel is a G sub-pixel, or the first sub-pixel is a G sub-pixel, the second sub-pixel is a B sub-pixel, the

third sub-pixel is a R sub-pixel, or the first sub-pixel is a G sub-pixel, the second sub-pixel is a R sub-pixel, the third sub-pixel is a B sub-pixel, or the first sub-pixel is a R sub-pixel, the second sub-pixel is a G sub-pixel, the third sub-pixel is a B sub-pixel, or the first sub-pixel is a B sub-pixel, the second sub-pixel is a G sub-pixel, the third sub-pixel is a R sub-pixel.

14. The display panel according to claim **4**, wherein the first sub-pixel is a R sub-pixel, the second sub-pixel is a B sub-pixel, the third sub-pixel is a G sub-pixel, or the first sub-pixel is a B sub-pixel, the second sub-pixel is a R sub-pixel, the third sub-pixel is a G sub-pixel, or the first sub-pixel is a G sub-pixel, the second sub-pixel is a B sub-pixel, the third sub-pixel is a R sub-pixel, or the first sub-pixel is a G sub-pixel, the second sub-pixel is a R sub-pixel, the third sub-pixel is a B sub-pixel, or the first sub-pixel is a R sub-pixel, the second sub-pixel is a G sub-pixel, the third sub-pixel is a B sub-pixel, or the first sub-pixel is a B sub-pixel, the second sub-pixel is a G sub-pixel, the third sub-pixel is a R sub-pixel.

15. The display panel according to claim **5**, wherein the first sub-pixel is a R sub-pixel, the second sub-pixel is a B sub-pixel, the third sub-pixel is a G sub-pixel, or the first sub-pixel is a B sub-pixel, the second sub-pixel is a R sub-pixel, the third sub-pixel is a G sub-pixel, or the first sub-pixel is a G sub-pixel, the second sub-pixel is a B sub-pixel, the third sub-pixel is a R sub-pixel, or the first sub-pixel is a G sub-pixel, the second sub-pixel is a R sub-pixel, the third sub-pixel is a B sub-pixel, or the first sub-pixel is a R sub-pixel, the second sub-pixel is a G sub-pixel, the third sub-pixel is a B sub-pixel, or the first sub-pixel is a B sub-pixel, the second sub-pixel is a G sub-pixel, the third sub-pixel is a R sub-pixel.

16. The display panel according to claim **6**, wherein the first sub-pixel is a R sub-pixel, the second sub-pixel is a B sub-pixel, the third sub-pixel is a G sub-pixel, or the first sub-pixel is a B sub-pixel, the second sub-pixel is a R sub-pixel, the third sub-pixel is a G sub-pixel, or the first sub-pixel is a G sub-pixel, the second sub-pixel is a B sub-pixel, the third sub-pixel is a R sub-pixel, or the first sub-pixel is a G sub-pixel, the second sub-pixel is a R sub-pixel, the third sub-pixel is a B sub-pixel, or the first sub-pixel is a R sub-pixel, the second sub-pixel is a G sub-pixel, the third sub-pixel is a B sub-pixel, or the first sub-pixel is a B sub-pixel, the second sub-pixel is a G sub-pixel, the third sub-pixel is a R sub-pixel.

17. The display panel according to claim **11**, wherein the G sub-pixel in each pixel unit is a quadrangle, and is arranged towards the same direction on the display panel.

18. The display panel according to claim **11**, wherein the G sub-pixel in each pixel unit is a quadrangle, and the G sub-pixel on the display panel is arranged alternately towards a different direction.

19. The display panel according to claim **18**, wherein the adjacent G sub-pixels are arranged in mirror symmetry.

20. A display device comprising a display panel according to claim **1**.

* * * * *

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当前申请(专利权)人(译)	京东方科技集团股份有限公司.		
[标]发明人	SUN LIANG SUN TUO JIN XIAODAN ZHANG LINTAO		
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摘要(译)

本公开涉及显示面板，有机发光二极管显示器和包括该显示面板的显示装置。根据本发明的一个方面的显示面板包括多个像素，每个像素包括第一子像素，第二子像素和第三子像素，其中第一子像素和第二子像素布置在在行方向上，每个像素中的第一子像素与行方向上相邻的像素中的第一子像素相邻，每个像素中的第二子像素与相邻的另一像素中的第二子像素相邻。在行方向上，每个像素中的第三子像素的几何中心均匀地分布在显示面板上。通过本发明的显示面板，可以增加像素中发光区域的面积，可以提高开口率，从而实现高显示质量。