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(54) **Oled panel with broadened color spectral components**

OLED-Anzeige mit erweiterten Farbspektrumskomponenten

Panneau à affichage électroluminescent organique (DELO) avec des composants spectraux à couleur élargis

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## Description

### Field of the Invention

**[0001]** The present invention relates generally to an organic light-emitting device and, more particularly, to an active-matrix display panel having a plurality of color pixels composed of the organic light-emitting devices.

### Background of the Invention

**[0002]** An active matrix display device, such as an active-matrix organic light-emitting display panel, has a two-dimensional pixel array comprising a plurality of pixel rows. Each of the pixel rows has a plurality of pixels arranged in the x direction, as shown in Figure 1. These pixel rows are arranged as lines in the y direction so that they can be sequentially driven by a plurality of scanning signals provided by the scanning lines in one or more scanning circuits. In Figure 1, the display panel **1** has a plurality of color pixels **10** arranged in a two-dimensional array.

**[0003]** In a color organic light-emitting display panel, each color pixel 10 generally comprises three color sub-pixels **R, G, B** for emitting red, green and blue colors, respectively, as shown in Figure 2. The color sub-pixels **R, G, B** comprise three different organic light-emitting devices **24, 25** and **26** in a diode form. Organic light-emitting diodes (OLEDs) are known in the art. For example, the red organic light-emitting device **24** is an organic electroluminescent device having a plurality of organic layers disposed between a cathode layer **150** and an anode layer **110** formed on a substrate 100, as shown in Figure 3. The organic layers in the organic layer section consist of a hole injection layer (HIL) **120,** a hole transport layer (HTL) **122,** an emissive layer (EML) **130,** and an electron transport layer (ETL) **140.** The green and blue organic light-emitting devices **25** and 26 are structurally similar to the layer structure as shown in Figure 3, except that each of the organic light-emitting devices **24, 25** and **26** comprises a different light emitting material in the EML layer so that each device emits a different color spectrum. In Figure 3, the thickness of the organic layer section **L**, serves as a resonant cavity in an OLED.

**[0004]** US 2006/0192220 A1 describes an organic light emitting displary comprising a plurality of sub-pixels for emittitng green, red and blue light, respectively. The thickness of the organic layer of a sub-pixel differs for two resonant wavelengths of one primary color.

**[0005]** Each of color spectra has a different spectral peak expressed by the coordinates in a CIE color space. For example, a red color spectrum can be represented by CIEx: 0.682 color coordinate. It is desirable to produce an organic light emitting display wherein the CIE coordinates can be controlled.

**[0006]** It is a further object of the present application to provide an organic light emitting display panel with improved color properties.

### Summary of the Invention

**[0007]** The above-mentioned object is solved by the organic light emitting display panel according to claim 1. Advantageous improvements of the invention are described by the dependent claims.

**[0008]** According to a preferred embodiment of the present invention, each of the first organic layer section and the second organic layer section comprise:

- an emissive layer between the anode layer and the cathode layer;
- a hole transport layer between the emissive layer and the anode layer; and
- an electron transport layer between the emissive layer and the cathode layer.

**[0009]** According to another preferred embodiment of the present invention, each of the first organic layer section and the second organic layer section further comprises a hole injection layer between the hole transport layer and the anode layer.

**[0010]** According to various preferred embodiment of the present invention, the plurality of color sub-pixels comprise a plurality of red sub-pixels having a wavelength range between 600 nm and 640 nm; a plurality of green sub-pixels having a wavelength range between 510 nm and 550 nm; and a plurality of blue sub-pixels with a wavelength range between 440 nm 480 nm.

**[0011]** The present invention will become apparent upon reading the description taken in conjunction with Figures 4-16.

### Brief Description of the Drawings

**[0012]**

- Figure 1 is a schematic presentation of an OLED panel.
- Figure 2 shows a typical pixel having three color sub-pixels.
- Figure 3 shows a typical layer structure of an OLED.
- Figure 4 shows a pixel in an OLED panel, according to one embodiment of the present invention.
- Figure 5 shows a cross sectional view of a pixel, according to various embodiments of the present invention.
- Figure 6a shows the layer structure of the pixel, according to one embodiment of the present invention.
- Figure 6b shows the layer structure of the pixel, according to another embodiment of the present invention.
- Figure 7 shows a top-emitting OLED, according to one embodiment of the present invention.
- Figure 8a shows the spectral distributions of the emitted light from a pixel, according to various embodiments of the present invention.
- Figure 8b shows the spectral distribution of the com-

bined emitted light from a pixel, according to various embodiments of the present invention.

Figure 9 shows a pixel in an OLED panel, according to another embodiment of the present invention.

Figure 10 shows a cross sectional view of a pixel, according to another embodiment of the present invention

Figure 11 shows an OLED pixel, according a different embodiment of the present invention.

Figure 12a shows the arrangement of two adjacent pixels, according to one embodiment of the present invention.

Figure 12b shows the application of a common layer to order to achieve the pixels as shown in Figure 12a.

Figure 12c shows the application of a common layer on each pixel.

Figure 13 shows the application of a common layer on four adjacent pixels.

Figure 14 shows a different way to achieve the variation of the layer thickness in a pixel.

Figure 15 shows a different arrangement of three color sub-pixels in a pixel.

Figure 16 shows a bottom-emitting OLED, according to one embodiment of the present invention.

## Detailed Description of the Invention

**[0013]** In an organic light-emitting diode (OLED) where the organic layers are placed in a resonant cavity, the coordinates of the spectrum in the color space is shifted if the length of the resonant cavity changes. The shifting of the color coordinates means a change in the color of the emitted light. The shifting of the color coordinates is dependent upon the width of the color spectrum. A spectrum having a broader spectral width, in general, will have a lesser effect in the changes of color. In an OLED, the spectral width can vary with the thickness of the cathode layer, for example. The width of a color spectrum can be increased over 100% if the thickness of the cathode layer reduces from 20 nm to 10 nm. An OLED with a thin cathode layer, however, has a shorter life and its light-emitting efficiency is inferior to an OLED with a thicker cathode layer.

**[0014]** The present invention provides a way of increasing the width of a color spectrum without appreciably affecting the useful life of an OLED. According to various embodiments of the present invention, the color spectrum of the OLED for each color sub-pixel is the sum of two or more color spectra of approximately the same color. For example, a spectrum for a red OLED can be the sum of two component spectra of CIEx: 0.657 and CIEx: 0682. If the spectral width of each of the component spectra is 23 nm, then the width of the resultant spectrum is about 35 nm. In order to produce such a resultant spectrum, each color sub-pixel has two or more pixel segments and each pixel segment emits a light beam of a different component spectrum. As shown in Figure 4, the color pixel **10** has three color sub-pixels **R, G** and **B.** The color sub-pixel **R** comprises two pixel segments **$24_1$** and **$24_2$,** the color sub-pixel **G** comprises two pixel segments **$25_1$** and **$25_2$,** and the color sub-pixel **B** comprises two pixel segments **$26_1$** and **$26_2$.**

**[0015]** An exemplary cross section of the color sub-pixel **R** is shown in Figure 5. As shown in Figure 5, while the basic structure of the organic layer section is basically the same, the length **L2** of the resonant cavity in the pixel segment **$24_2$** is greater than the length **L1** of the resonant cavity in the pixel segment **$24_1$.** As such, the color spectrum of the light beam emitted from the pixel segment **24** is shifted toward the longer wavelength region, as shown in Figure 8a.

**[0016]** The change in the resonant cavity is achieved by increasing the thickness of one or more layers in the organic layer section. For example, as shown in Figure 6a, only the thickness of the layer **120** (hole injection layer HIL) in the pixel segments **$24_2$** is different from the pixel segments **$24_1$,** whereas the thickness of each of the remaining layers is the same in both pixel segments **$24_1$** and **$24_2$.** Also, the thickness of the anode layer **110** and the cathode layer is substantially the same in both pixel segments **$24_1$** and **$24_2$.** In this example, the increase in the cavity length from **L1** and **L2** can be achieved by depositing additional HIL material on the pixel segment **$24_2$.**

**[0017]** In various embodiments of the present invention, the HIL can be made of poly(3,4-ethylenedioxythiophene) (PEDOT), 4,4',4"-tris(3-methylphenyl-phenylamino)-triphenylamine (MTDATA) or copper phthalocyanine (CuPc), for example, and its thickness can be in the range of 1 nm to 300 nm. The HTL can be made of N-propyl bromide (NPB) or 4, 4', 4"-tris(N-carbazolyl)-triphenylamine (TCTA), for example, and its thickness can be in the range of 1 nm to 300 nm. The EML can be made of a host material such as tris-(8-hydroxyquinoline) aluminum ($Alq_3$) or TCTA, for example, and its thickness can be in the range of 1 nm to 100 nm. The dopant for the red color sub-pixel can be 4-(dicyanomethylene)-2-t-butyl-6(1,1,7,7-tetramethyljulolidy 1-9-enyl)-4H-pyran (DCJTB) or dicyanomethylene (DCM), for example. The dopant for the green color sub-pixel can be coumarin 545 tetramethyl (C545T) or tris(2-phenylpyridine) iridium (Irppy3), for example. The dopant for the blue color sub-pixel can be 9,10-di(2-naphthyl) anthracene (ADN) or Bis(4,6-difluorophenylpyridinato-N,C2)picolinatoiridium (Firpic), for example. The ETL can be made of $Alq_3$, 2,2',2"-(1,3,5-benzenetryl)tris(1-phenyl)-1H-benzimidazol (TPBi), 4,7-Diphenyl-1,10-phenanthroline (Bphen), for example, and its thickness can be in the range of 1 nm to 300 nm. In some of the embodiments, an electron injection layer (EIL, not shown) can be disposed between the ETL and the cathode layer. The EIL can be made of LiF, Ca or Mg, for example, and its thickness can be in the range of 1 nm to 50 nm.

**[0018]** The cavity length L, of an OLED, is generally determined by the wavelength $\lambda$ of the emitted light, the refractive index n, and the resonance order m as follows:

$$L = m\,\lambda/2n$$

**[0019]** For a crude estimation of the cavity length, let us use $\lambda$ 620 nm (nanometer) and n=1.7 for the red color sub-pixel. We have

$$L = m^{*}\ 182.5\ \text{nm},\ m = 1, 2, 3, \ldots$$

With m=2, for example, L is about 365 nm. If we increase the cavity length by 3%, the shift of the color spectrum would be about 20 nm. Since the useful wavelength ranges in a color OLED are: R: 600-640 nm, G: 510-550 nm and B: 440-480 nm, the increase in the cavity length can be 0.5% to 30%, for example, depending on the resonance order m.

**[0020]** It should be noted that any one of the organic layers **120-142** can be changed in order to change the length of the resonant cavity. As another example, the layer **122** (hole transport layer) in the pixel segments $\mathbf{24_2}$ is different from the pixel segments $\mathbf{24_1}$ , whereas the thickness of each of the remaining layers is the same in both pixel segments $\mathbf{24_1}$ and $\mathbf{24_2}$, as shown in Figure 6b. When a voltage is applied across the cathode **150** and the anode **110,** the pixel segment $\mathbf{24_1}$ emits a light beam **221** and the pixel segment $\mathbf{24_2}$ emits a light beam **222** simultaneously, as shown in Figure 7. Because of the difference in the length of the resonant cavity, the color coordinates of the color spectrum for the light beam **221** emitted from the pixel segment $\mathbf{24_1}$ and the color spectrum for the light beam **222** emitted from the pixel segment $\mathbf{24_2}$ are different. As shown in Figure 8a, the color spectrum **242** for the light beam **222** emitted from the pixel segment $\mathbf{24_2}$ is shifted toward the longer wavelength region as compared to the color spectrum **241** for the light beam **221** emitted from the pixel segment $\mathbf{24_1}$. As a result, the light emitting from both the pixel segments $\mathbf{24_1}$ and $\mathbf{24_2}$ has a broader color spectrum **249,** as shown in Figure 8b. The resultant color spectrum **249** is the sum of the spectra **241** and **242** as shown in Figure 8a. It is desirable that color shift between the two light beams **221** and **222** (Figure 7) is not too far such that the color spectra **241** and **242** are significantly overlapped.

**[0021]** It is possible to produce a color sub-pixel having three or more pixel segments. As shown in Figure 9, each of color sub-pixels **R, G, B** has three pixel segments. The **R** color sub-pixel has three pixel segments $\mathbf{24_1}$, $\mathbf{24_2}$ and $\mathbf{24_3}$. The **G** color sub-pixel has three pixel segments $\mathbf{25_1}$, $\mathbf{25_2}$ and $\mathbf{25_3}$. The **B** color sub-pixel has three pixel segments $\mathbf{26_1}$, $\mathbf{26_2}$ and $\mathbf{26_3}$. The cross section of the **R** color sub-pixel is shown in Figure 10. As shown in Figure 10, the organic layer section has three different thicknesses or cavity lengths **L1, L2** and **L3.** When a voltage is applied across the cathode **150** and the anode **110,** three light beams of different color spectra will be simultaneously emitted from the pixel segments $\mathbf{24_1}$, $\mathbf{24_2}$ and $\mathbf{24_3}$. The width of the resultant color spectrum can be further increased.

**[0022]** According to the present invention, each of the color sub-pixels has two or more pixel segments with different cavity lengths. The proportion of the pixel segments in one color sub-pixel can be the same as that in the other two color sub-pixels, as shown in Figure 4. The proportion can be different, as shown in Figure 11. When the cavity length in two adjacent rows of color pixels is increased in the same amount, it is desirable to arrange such that the pixel segments with an increased cavity length in one row is adjacent to similar pixel segments in the other row, as shown in Figure 12a. As such, it is possible to deposit an additional layer **80** on the relevant organic layer during manufacturing so that all six pixel segments with an increased cavity length can be achieved at the same time, as shown in Figure 12b. Alternatively, each row of the color sub-pixels has a separate additional layer **80,** as shown in Figure 12c. In a different embodiment of the present invention, the arrangement of **R, G, B** color sub-pixels is different from one row of color pixel to another, as shown in Figure 13. In yet another embodiment of the present invention, the additional layer **80** can be broken up into a plurality of smaller areas, as shown in Figure 14. Furthermore, the color sub-pixels **R, G, B** can be arranged such that one color sub-pixel in the same pixel is adjacent to the other two color sub-pixels, as shown in Figure 15.

**[0023]** In the manufacturing process, the non-uniformity in the layer thickness can cause a shift in the color coordinates in the color sub-pixels. The color shift when the width of the color spectrum is narrow is more noticeable. By broadening the width of the color spectrum, the color shift would become less appreciable. Thus, broadening the width of the color spectrum would ease the strict requirements in manufacturing.

**[0024]** It should be noted that the present invention is applicable to the top-emitting OLED, as shown in Figure 7. It is also applicable to the bottom-emitting OLED, as shown in Figure 16.

**[0025]** In summary, the present invention provides a device in which the light emitted from a color sub-pixel can be the sum of two or more light beams of slightly different colors in the same wavelength range. The difference in color is the result of difference in the length of the resonant cavity within the same color sub-pixel.

**[0026]** Although the present invention has been described with respect to one or more embodiments thereof, it will be understood by those skilled in the art that the foregoing and various other changes, omissions and deviations in the form and detail thereof may be made. The scope of this invention is defined in the claims.

## Claims

1. An organic light emitting display panel, comprising:

a plurality of color sub-pixels, each of the sub-pixels comprising:

an anode layer (110);
a cathode layer (150);
a first organic layer section disposed between the anode layer (110) and the cathode layer (150) forming a resonant cavity, the first organic layer section having a first thickness arranged for emitting light in a color spectrum of a first wavelength distribution in a wavelength range, the color spectrum of the first wavelength distribution having a first spectral width; and
a second organic layer section disposed between the anode layer (110) and the cathode layer (150), the second organic layer section having a second thickness greater than the first thickness arranged for emitting light in a color spectrum of a second wavelength distribution in said wavelength range, the difference between the first thickness and the second thickness is in the range of 0.5% to 30 %, the second wavelength distribution is at the wavelength greater than the first wavelength distribution, the color spectrum of the second wavelength distribution having a second spectral width, the color spectrums of the first wavelength distribution and the second wavelength distribution being overlapped,
wherein the first wavelength distribution and the second wavelength distribution in each sub-pixel are located in the same wavelength range of a color of Red, Green or Blue, the first wavelength distribution and the second wavelength distribution forms a combined spectrum, which has a third spectral width broader than the first spectral width and broader than the second spectral width.

**2.** The light emitting display panel of claim 1, wherein each of the first organic layer section and the second organic layer section comprises:

an emissive layer (130) between the anode layer (110) and the cathode layer (150);
a hole transport layer (122) between the emissive layer (130) and the anode layer (110); and
an electron transport layer (140) between the emissive layer (130) and the cathode layer (150).

**3.** The light emitting display panel of claim 2, wherein each of the first organic layer section and the second organic layer section further comprises a hole injection layer (120) between the hole transport layer (122) and the anode layer (110).

**4.** The light emitting display panel of claim 1, wherein the plurality of color sub-pixels comprise a plurality of red sub-pixels and wherein the wavelength range is between 600 nm and 640 nm.

**5.** The light emitting display panel of claim 1, wherein the plurality of color sub-pixels comprise a plurality of green sub-pixels and wherein the wavelength range is between 510 nm and 550 nm.

**6.** The light emitting display panel of claim 1, wherein the plurality of color sub-pixels comprise a plurality of blue sub-pixels and wherein the wavelength range is between 440 nm and 480 nm.

**7.** The light emitting display panel of claim 1, wherein the at least one of the sub-pixels further comprises a third organic layer section disposed between the anode layer (110) and the cathode layer (150), the third organic layer section having a third thickness different from the first thickness and the second thickness arranged for emitting light in a color spectrum of a third wavelength distribution in said wavelength range.

## Patentansprüche

**1.** Organisches Lichtemmissionsanzeigefeld, umfassend:

eine Vielzahl von Farbteilbildpunkten, wobei jeder der Farbteilbildpunkte umfasst:

eine Anodenschicht (110);
eine Kathodenschicht (150);
einen ersten organischen Schichtbereich, der zwischen der Anodenschicht (110) und der Kathodenschicht (150) ausgebildet ist und eine Resonanzkavität bildet, wobei der erste organische Schichtbereich eine erste Dicke zum Aussenden von Licht in einem Farbspektrum einer ersten Wellenlängenverteilung in einem Wellenlängenbereich aufweist, und wobei das Farbspektrum der ersten Wellenlängenverteilung eine erste Spektralbreite aufweist; und
einen zweiten organischen Schichtbereich, der zwischen der Anodenschicht (110) und der Kathodenschicht (150) ausgebildet ist, wobei der zweite organische Schichtbereich eine zweite Dicke, die größer ist als die erste Dicke ist, zum Aussenden von Licht in einem Farbspektrum einer zweiten Wellenlängenverteilung in besagtem Wellenlängenbereich aufweist, wobei der Un-

terschied zwischen der ersten Dicke und der zweiten Dicke sich in dem Bereich von 0.5 % bis 30 % befindet, wobei die zweite Wellenlängenverteilung von der Wellenlänge her größer ist als die erste Wellenlängenverteilung, wobei das Farbspektrum der zweiten Wellenlängenverteilung eine zweite Spektralbreite aufweist, und wobei die Farbspektren der ersten Wellenlängenverteilung und der zweiten Wellenlängenverteilung überlappen,
wobei die erste Wellenlängenverteilung und die zweite Wellenlängenverteilung in jedem Teilbildpunkt im selben Wellenlängenbereich einer Farbe Rot, Grün oder Blau angeordnet sind, und wobei die erste Wellenlängenverteilung und die zweite Wellenlängenverteilung ein kombiniertes Spektrum bilden, welches eine dritte Spektralbreite aufweist, die größer ist als die erste Spektralbreite und größer ist als die zweite Spektralbreite.

**2.** Organisches Lichtemmissionsanzeigefeld gemäß Anspruch 1, wobei sowohl der erste organische Schichtbereich als auch der zweite organische Schichtbereich umfassen:

eine emittierende Schicht (130), die zwischen der Anodenschicht (110) und der Kathodenschicht (150) ausgebildet ist;
eine Lochtransportschicht (122), die zwischen der emittierenden Schicht (130) und der Anodenschicht (110) ausgebildet ist; und
eine Elektrontransportschicht (140), die zwischen der emittierenden Schicht (130) und der Kathodenschicht (150) ausgebildet ist.

**3.** Organisches Lichtemmissionsanzeigefeld gemäß Anspruch 2, wobei sowohl der erste organische Schichtbereich als auch der zweite organische Schichtbereich weiter eine Lochinjektionsschicht (120) umfassen, die zwischen der Lochtransportschicht (122) und der Anodenschicht (150) ausgebildet ist.

**4.** Organisches Lichtemmissionsanzeigefeld gemäß Anspruch 1, wobei die Vielzahl an Farbteilbildpunkten eine Vielzahl an roten Teilbildpunkten umfasst, wobei der Wellenlängenbereich zwischen 600 nm und 550 nm liegt.

**5.** Organisches Lichtemmissionsanzeigefeld gemäß Anspruch 1, wobei die Vielzahl an Farbteilbildpunkten eine Vielzahl an grünen Teilbildpunkten umfasst, wobei der Wellenlängenbereich zwischen 510 nm und 550 nm liegt.

**6.** Organisches Lichtemmissionsanzeigefeld gemäß Anspruch 1, wobei die Vielzahl an Farbteilbildpunkten eine Vielzahl an blauen Teilbildpunkten umfasst, wobei der Wellenlängenbereich zwischen 440 nm und 480 nm liegt.

**7.** Organisches Lichtemmissionsanzeigefeld gemäß Anspruch 1, wobei mindestens einer der Teilbildpunkte weiter einen dritten organischen Schichtbereich aufweist, der zwischen der Anodenschicht (110) und der Kathodenschicht (150) ausgebildet ist, und wobei der dritte organische Schichtbereich eine dritte Dicke aufweist, die sich von der ersten Dicke und der zweiten Dicke unterscheidet und zur Emission von Licht in einem Farbspektrum einer dritten Wellenlängenverteilung in besagtem Wellenlängenbereich dient.

## Revendications

**1.** Panneau d'affichage émetteur de lumière organique comprenant :

une pluralité de sous-pixels de couleur, chacun des sous-pixels comprenant :

une couche d'anode (110),
une couche de cathode (150),
une première section de couche organique disposée entre la couche d'anode (110) et la couche de cathode (150) formant une cavité résonnante, la première section de couche organique ayant une première épaisseur arrangée pour émettre de la lumière dans un spectre de couleurs d'une première répartition de longueur d'onde ayant une première largeur spectrale et
une seconde section de couche organique disposée entre la couche d'anode (110) et la couche de cathode (150), la seconde section de couche organique ayant une seconde épaisseur plus grande que la première épaisseur arrangée pour émettre de la lumière dans un spectre de couleurs d'une seconde répartition de longueur d'onde dans ladite plaque de longueurs d'onde, la différence entre la première épaisseur et la seconde épaisseur étant de l'ordre de 0,5% à 30%, la seconde répartition de longueur d'onde est de longueur d'onde plus grande que la première répartition de longueur d'onde, le spectre de couleurs de la seconde répartition de longueur d'onde ayant une seconde largeur spectrale, les spectres de couleurs de la première répartition de longueur d'onde et de la seconde répartition de longueur d'onde se chevauchant,

la première répartition de longueur d'onde et la seconde répartition de longueur d'onde dans chaque sous-pixel étant situées dans le même ordre de longueur d'onde d'une couleur rouge, vert ou bleu, la première répartition de longueur d'onde et la seconde répartition de longueur d'onde formant un spectre combiné qui a une troisième largeur spectrale plus large que la première largeur spectrale et plus large que la seconde largeur spectrale.

**2.** Panneau d'affichage émetteur de lumière selon la revendication 1, chacune des sections de couche, la première section de couche organique et la seconde section de couche organique comprenant :

une couche émissive (130) entre la couche d'anode (110) et la couche de cathode (150),
une couche de transport de trous (122) entre la couche émissive (130) et la couche d'anode (110) et
une couche de transport d'électrons (140) entre la couche émissive (130) et la couche de cathode (150).

**3.** Panneau d'affichage émetteur de lumière selon la revendication 2, chacune des sections de couche, la première section de couche organique et la seconde section de couche organique comprenant de plus une couche d'injection de trous (120) entre la couche de transport de trous (122) et la couche d'anode (110).

**4.** Panneau d'affichage émetteur de lumière selon la revendication 1, la pluralité des sous-pixels de couleur comprenant une pluralité de sous-pixels rouges, l'ordre de longueur d'onde étant entre 600 nm et 640 nm.

**5.** Panneau d'affichage émetteur de lumière selon la revendication 1, la pluralité des sous-pixels de couleur comprenant une pluralité de sous-pixels verts, l'ordre de longueur d'onde étant entre 510 nm et 550 nm.

**6.** Panneau d'affichage émetteur de lumière selon la revendication 1, la pluralité des sous-pixels de couleur comprenant une pluralité de sous-pixels bleus, l'ordre de longueur d'onde étant entre 440 nm et 480 nm.

**7.** Panneau d'affichage émetteur de lumière selon la revendication 1, le sous-pixel qui existe au moins comprenant de plus une troisième section de couche organique disposée entre la couche d'anode (110) et la couche de cathode (150), la troisième section de couche organique ayant une troisième épaisseur différente de la première épaisseur et de la seconde épaisseur arrangée pour émettre de la lumière dans un spectre de couleurs d'une troisième distribution de longueur d'onde dans ladite plage de longueur d'onde.

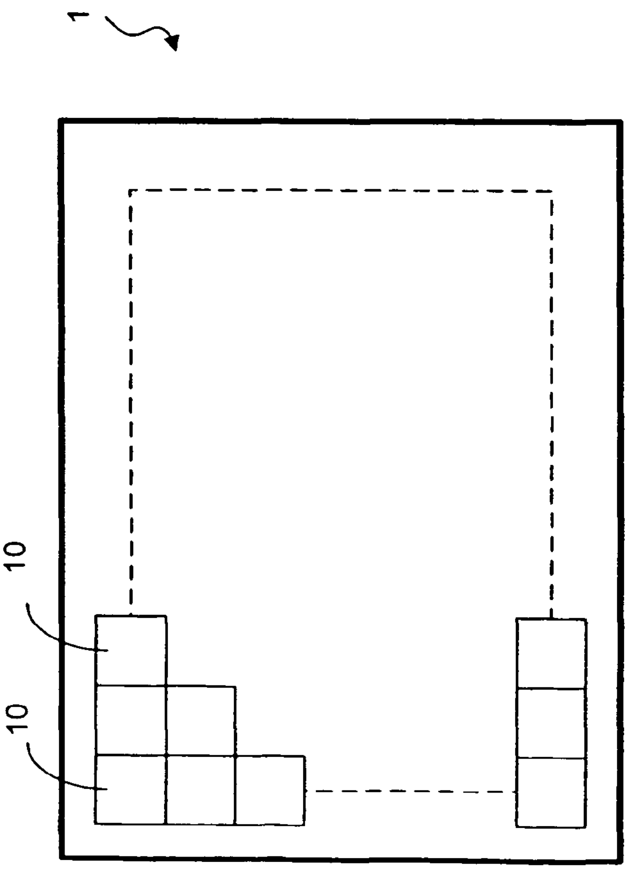



FIG. 1
(prior art)

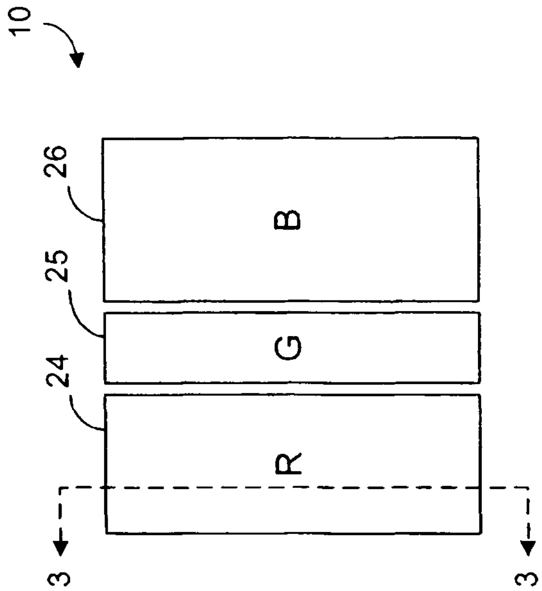



FIG. 2
(prior art)

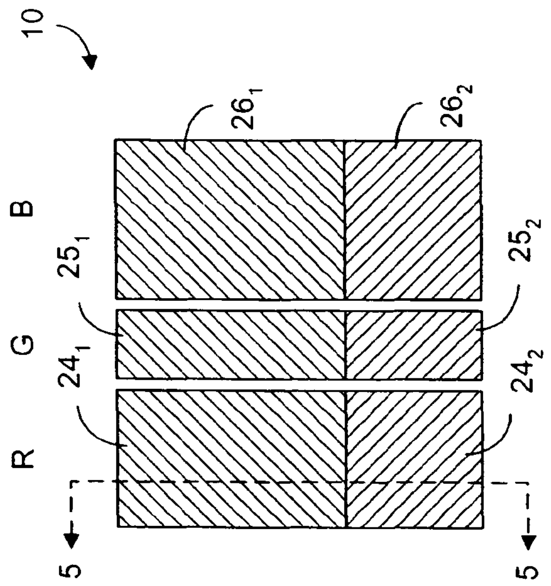



FIG. 4

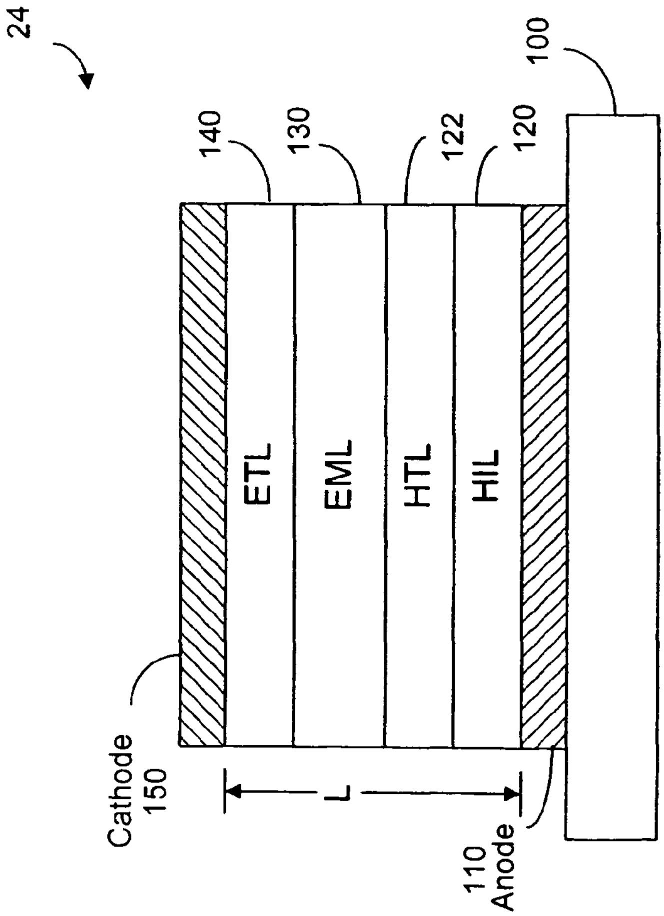
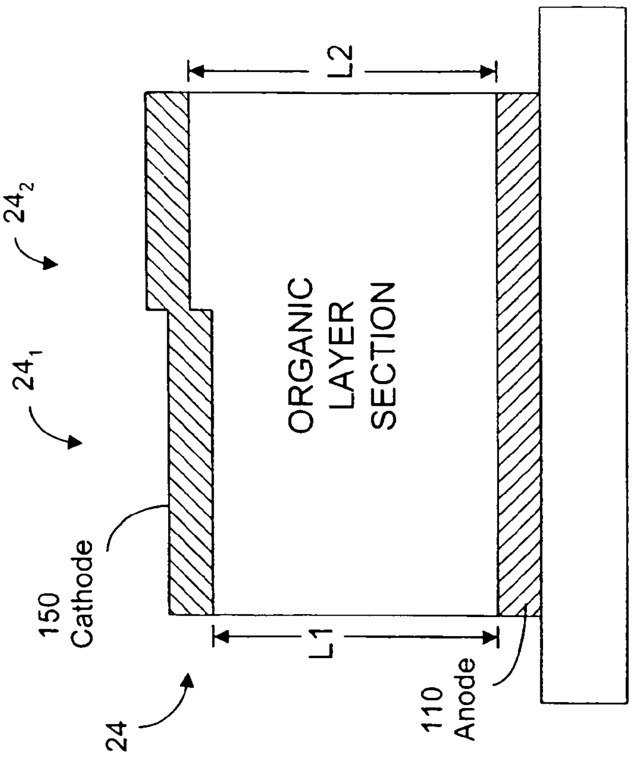
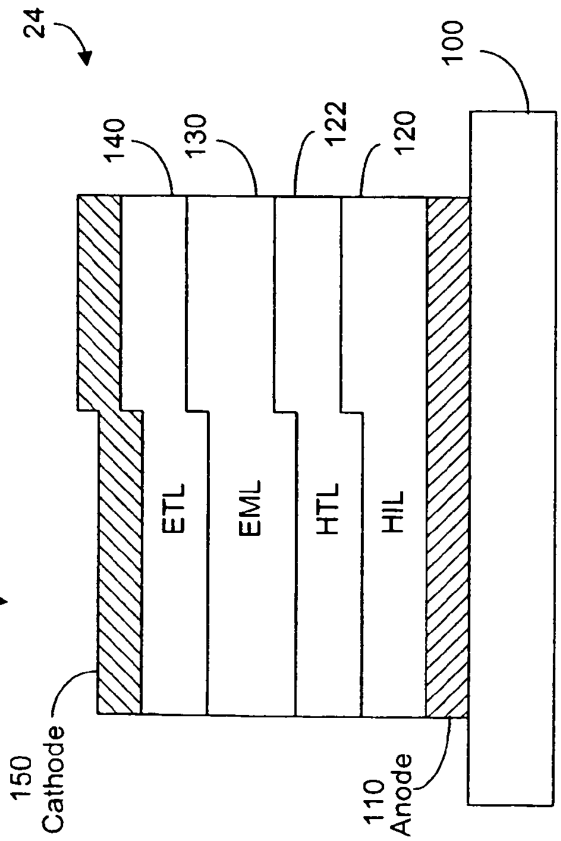



FIG. 3
(prior art)



$24_2$
$24_1$
ORGANIC
LAYER
SECTION
L2
L1
150
Cathode
24
110
Anode


FIG. 5



24
100
140
130
122
120
$24_2$
$24_1$
ETL
EML
HTL
HIL
150
Cathode
110
Anode


FIG. 6a

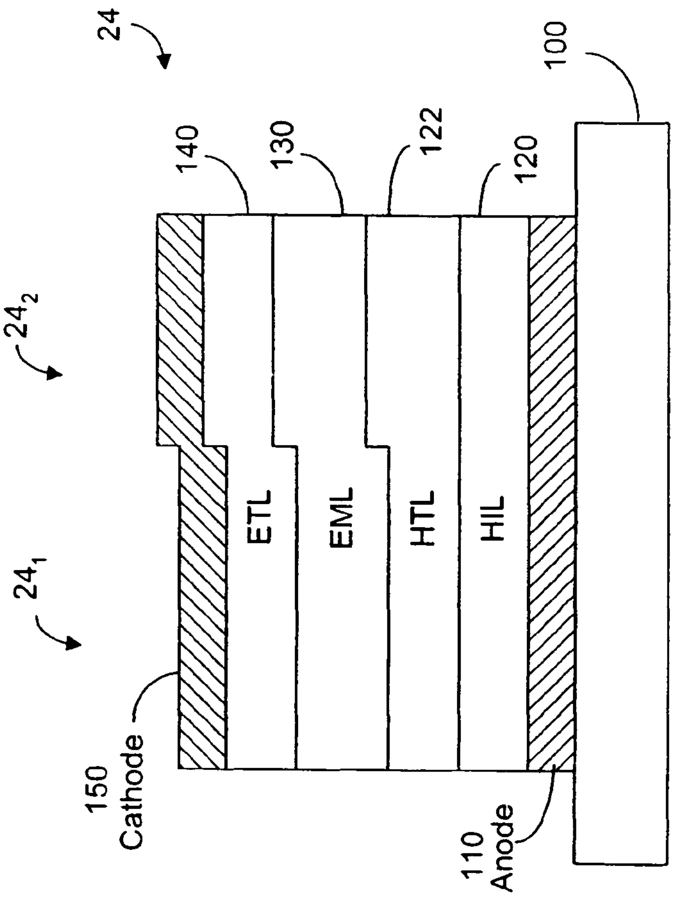

24
100
140
130
122
120
$24_2$
$24_1$
ETL
EML
HTL
HIL
150
Cathode
110
Anode

FIG. 6b

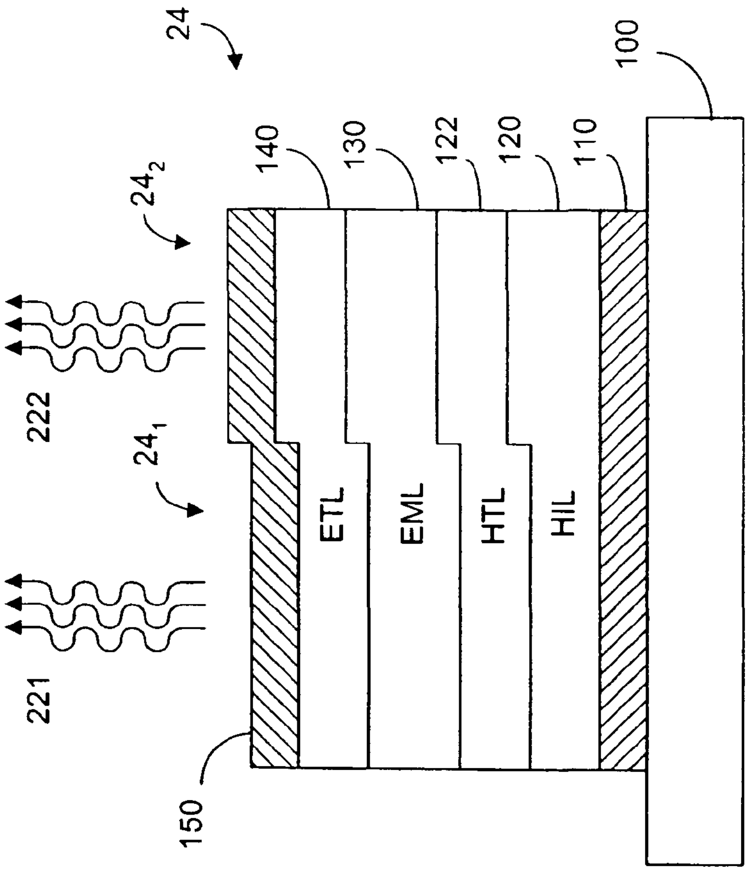



FIG.7

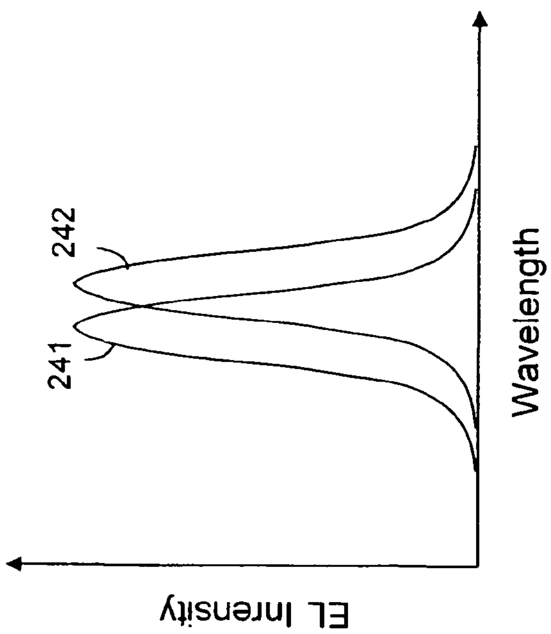

EL Inrensity
Wavelength
241
242

FIG. 8a

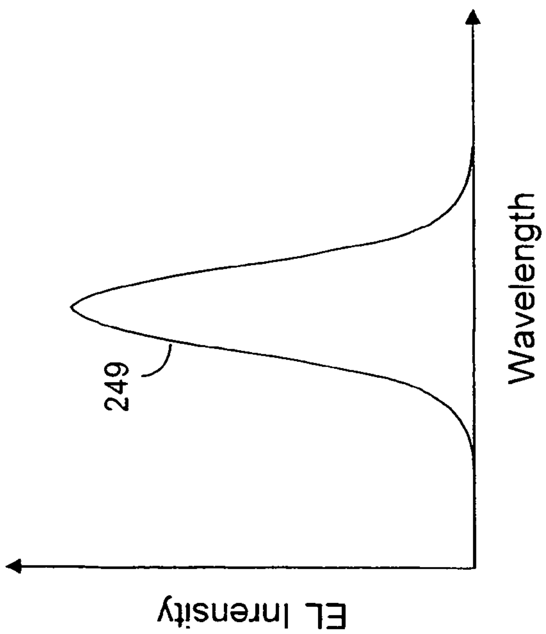

EL Inrensity
Wavelength
249

FIG. 8b

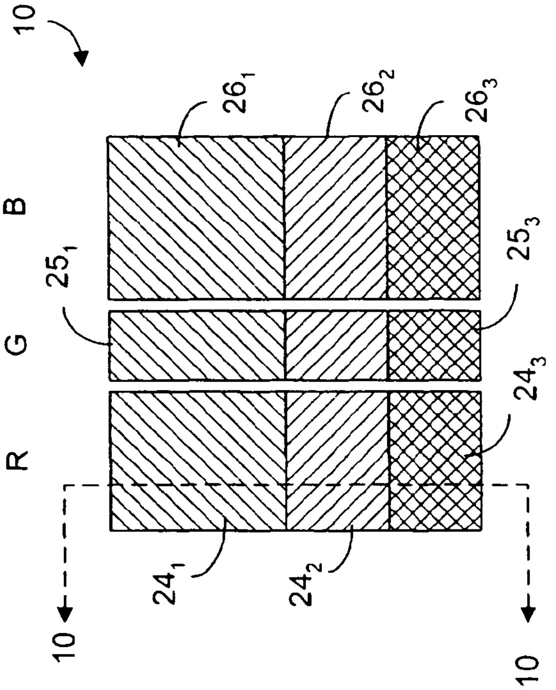

10
B
G
R
$26_1$
$26_2$
$26_3$
$25_1$
$25_3$
$24_1$
$24_2$
$24_3$
10
10

FIG. 9

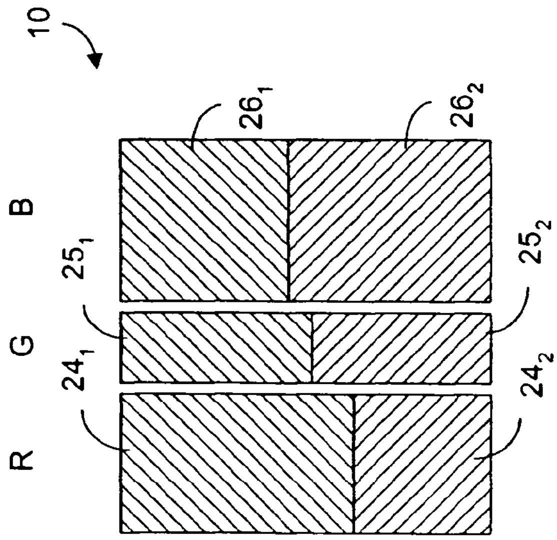
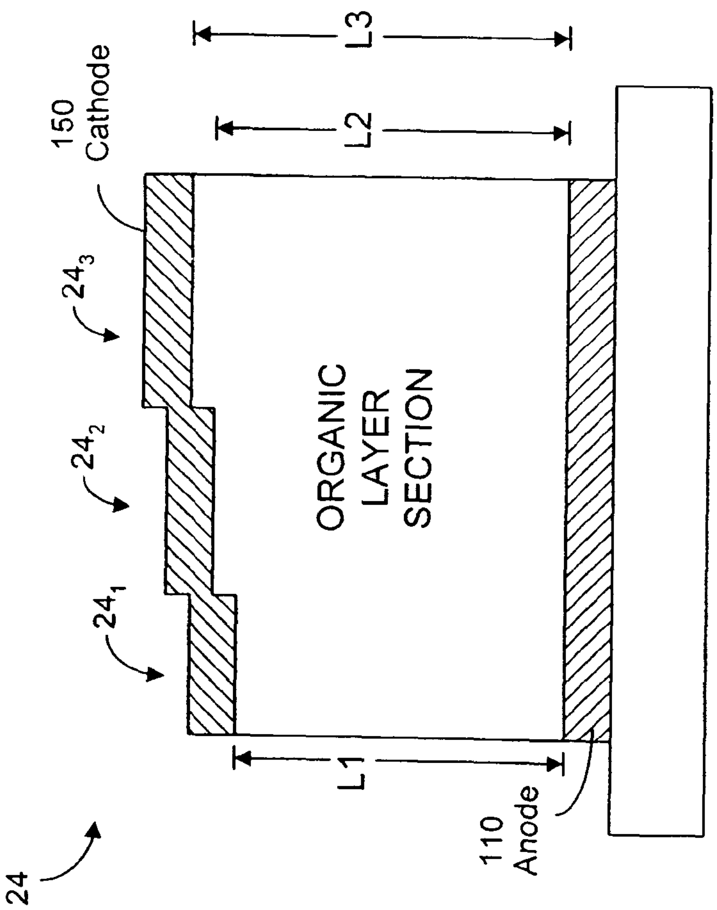

10
B
G
R
$26_1$
$26_2$
$25_1$
$25_2$
$24_1$
$24_2$

FIG. 11



24
$24_1$
$24_2$
$24_3$
150
Cathode
L1
L2
L3
ORGANIC
LAYER
SECTION
110
Anode


FIG. 10

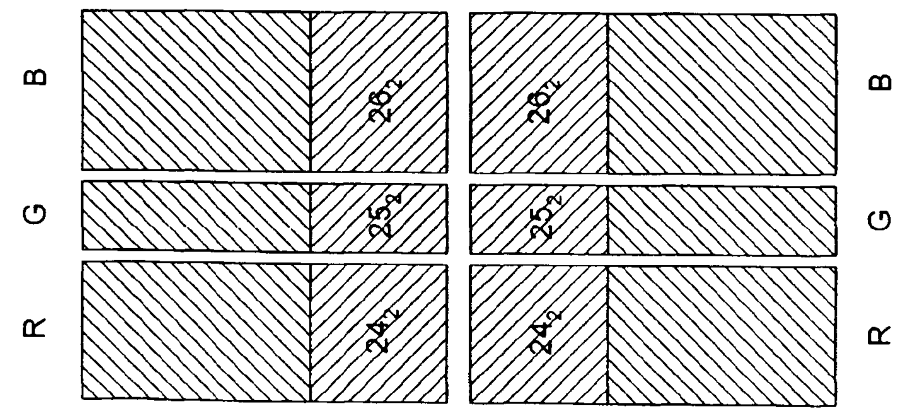



FIG. 12a

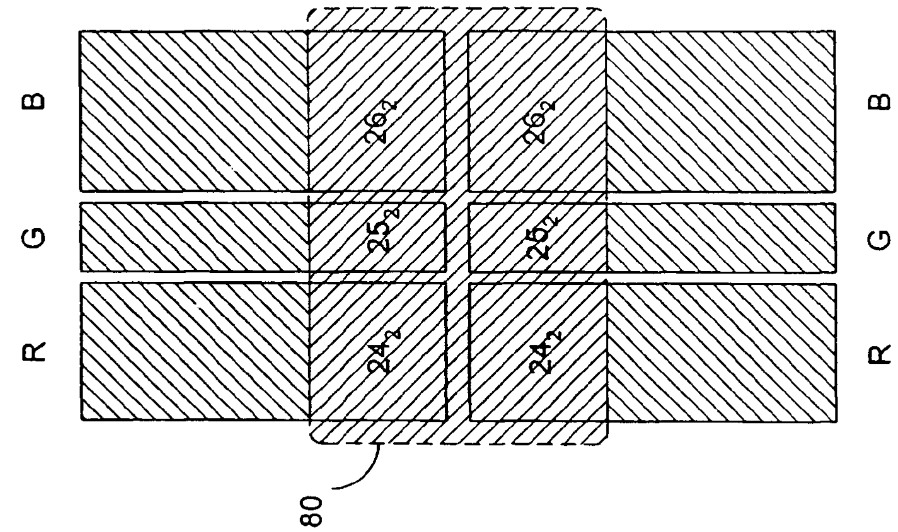



FIG. 12b

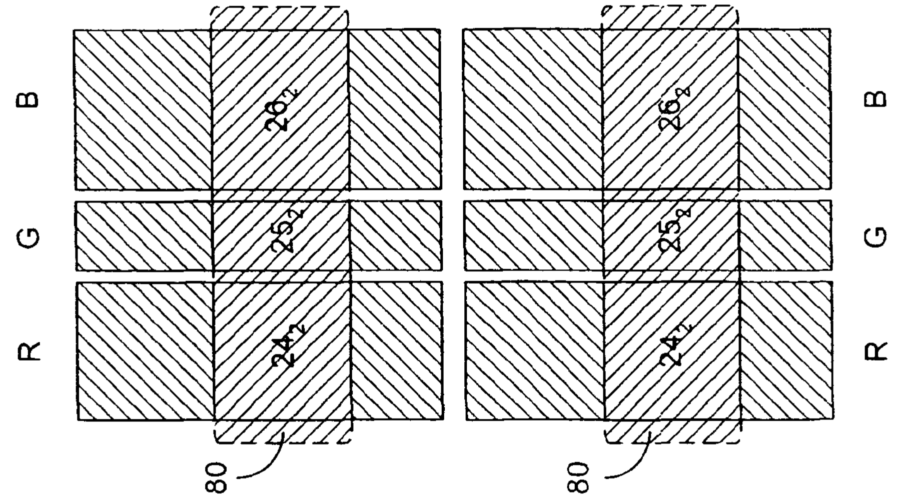



FIG. 12c

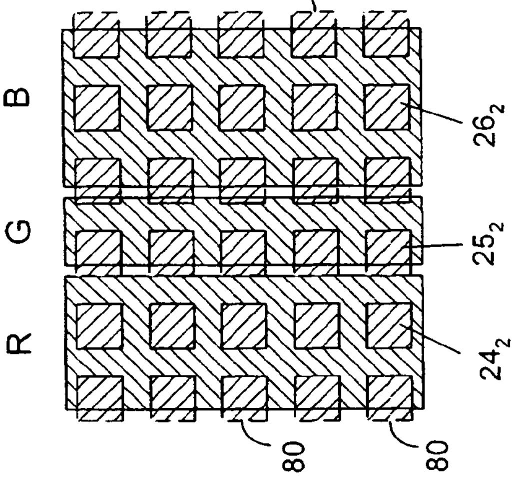



FIG. 14

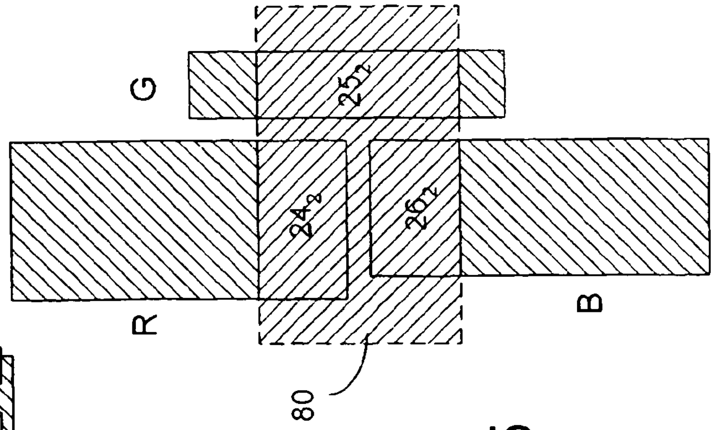



FIG. 15

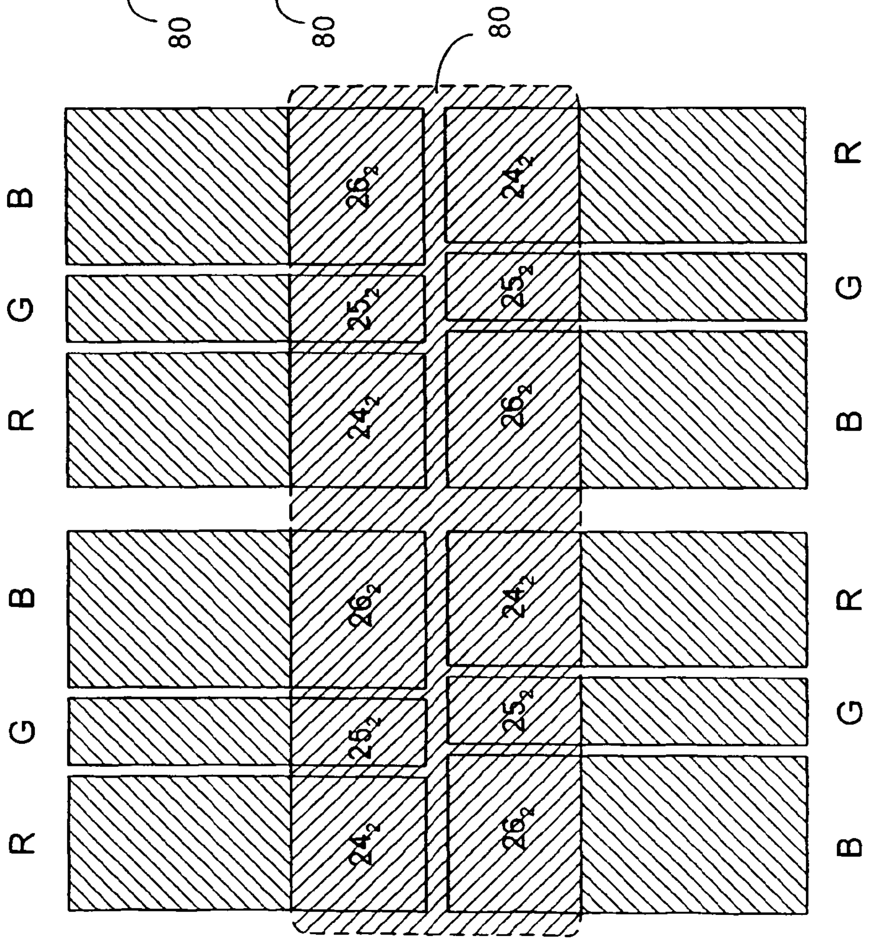



FIG. 13

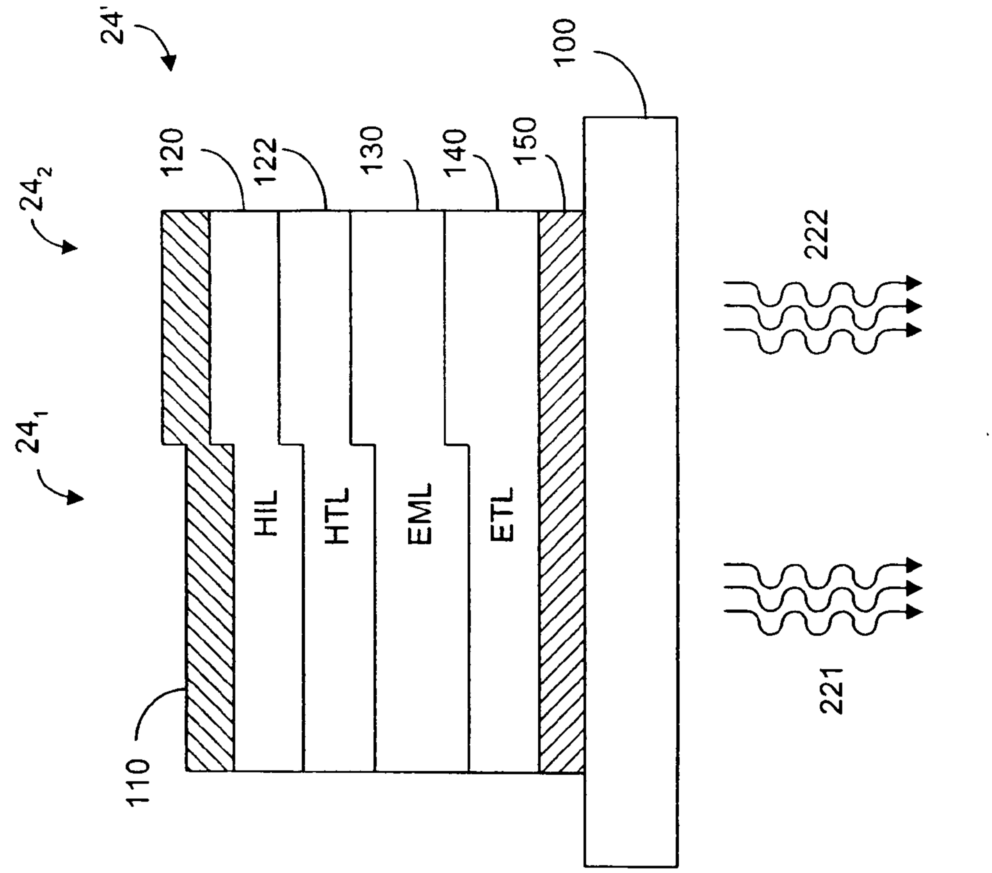



FIG. 16

## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


- US 20060192220 A1 **[0004]**

| | | | |
|---|---|---|---|
| 专利名称(译) | 带有加宽颜色光谱成分的Oled面板 | | |
| 公开(公告)号 | EP2267778B1 | 公开(公告)日 | 2014-12-10 |
| 申请号 | EP2009175586 | 申请日 | 2009-11-10 |
| [标]申请(专利权)人(译) | 友达光电股份有限公司 | | |
| 申请(专利权)人(译) | 友达光电股份有限公司 | | |
| 当前申请(专利权)人(译) | 友达光电股份有限公司 | | |
| [标]发明人 | LIN HAO WU<br>HSU SHIH FENG | | |
| 发明人 | LIN, HAO-WU<br>HSU, SHIH-FENG | | |
| IPC分类号 | H01L51/52 H01L51/50 H01L27/32 | | |
| CPC分类号 | H01L51/5012 H01L27/3216 H01L27/3218 H01L51/5265 | | |
| 代理机构(译) | LANG , CHRISTIAN | | |
| 优先权 | 12/459021 2009-06-24 US | | |
| 其他公开文献 | EP2267778A3<br>EP2267778A2 | | |
| 外部链接 | Espacenet | | |


摘要(译)

从有机发光显示面板中的彩色子像素发射的光可以是在相同波长范围内具有略微不同颜色的两个或更多个光束的总和的方法和装置。颜色的差异是相同颜色子像素内的谐振腔的长度差异的结果。在制造过程中，层厚度的不均匀性可导致彩色子像素中的色坐标的偏移。当色谱宽度窄时的色移更明显。通过加宽色谱的宽度，色移将变得不太明显。因此，加宽色谱宽度将简化制造中的严格要求。


$$L = m\lambda/2n$$