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(54) **SELF-LUMINOUS DISPLAY PANEL, AND DISPLAY APPARATUS HAVING THE SAME**

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USPC **348/803**; 257/40

(57) **ABSTRACT**

A display apparatus includes: a signal receiver configured to receive an image signal; a signal processor configured to process the image signal received by the signal receiver; and a display panel configured to display the image signal processed by the signal processor as a processed image, wherein the display panel includes: a glass substrate; a first electrode layer; a second electrode layer disposed between the first electrode layer and the glass substrate; a light emitting layer disposed between the first electrode layer and the second electrode layer, configured to generate a plurality of colors of light, and configured to emit the light to the glass substrate; a linear pattern layer formed on a surface of the glass substrate and including linear bars extending in one direction to transmit a preset polarizing direction of light; and a phase retardation layer disposed between the second electrode layer and the linear pattern layer.

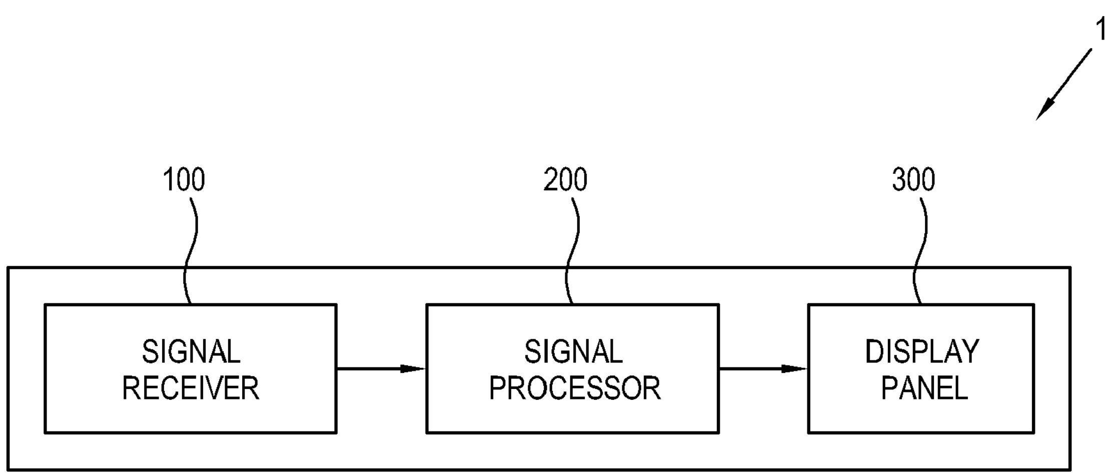


FIG. 1

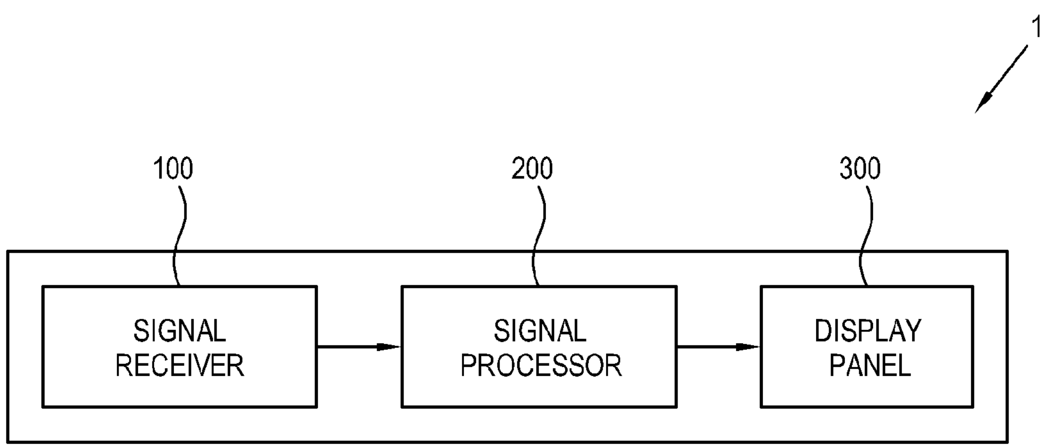

1
100
200
300
SIGNAL
RECEIVER
SIGNAL
PROCESSOR
DISPLAY
PANEL

FIG. 2

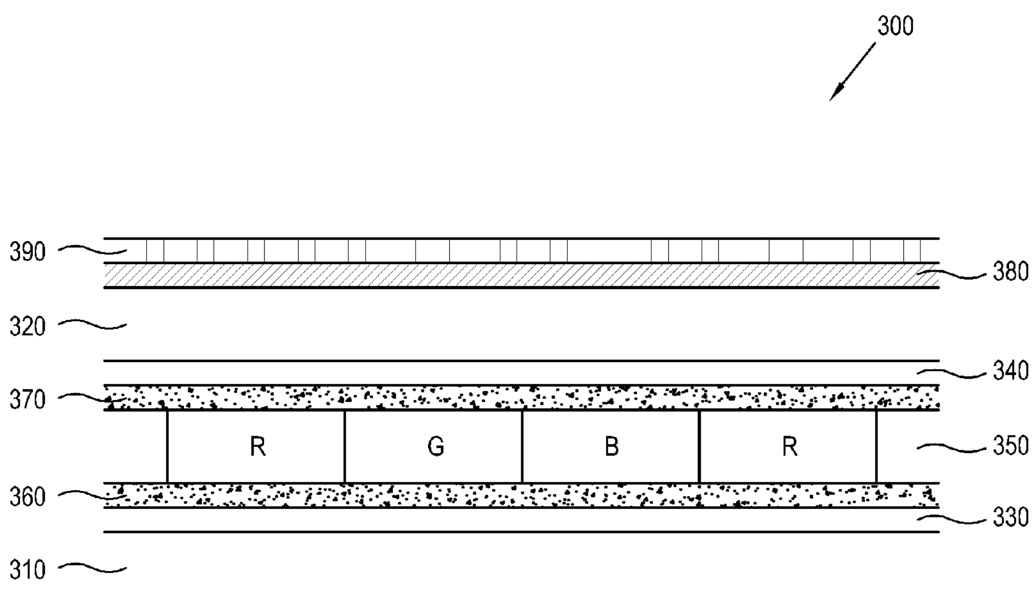


FIG. 3

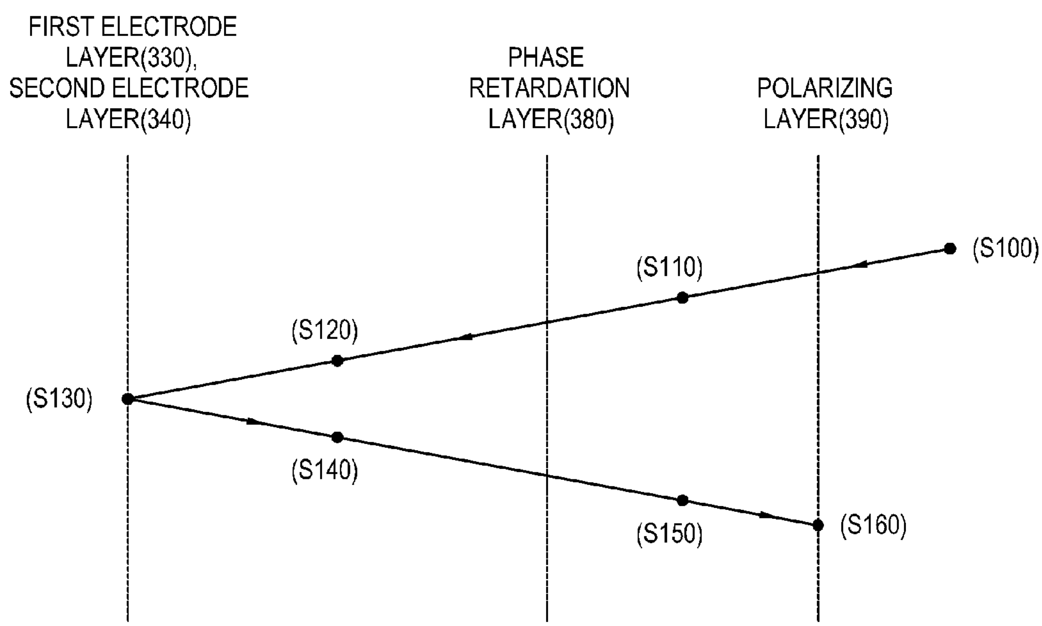

FIRST ELECTRODE LAYER(330), SECOND ELECTRODE LAYER(340)
PHASE RETARDATION LAYER(380)
POLARIZING LAYER(390)
(S100)
(S110)
(S120)
(S130)
(S140)
(S150)
(S160)

FIG. 4

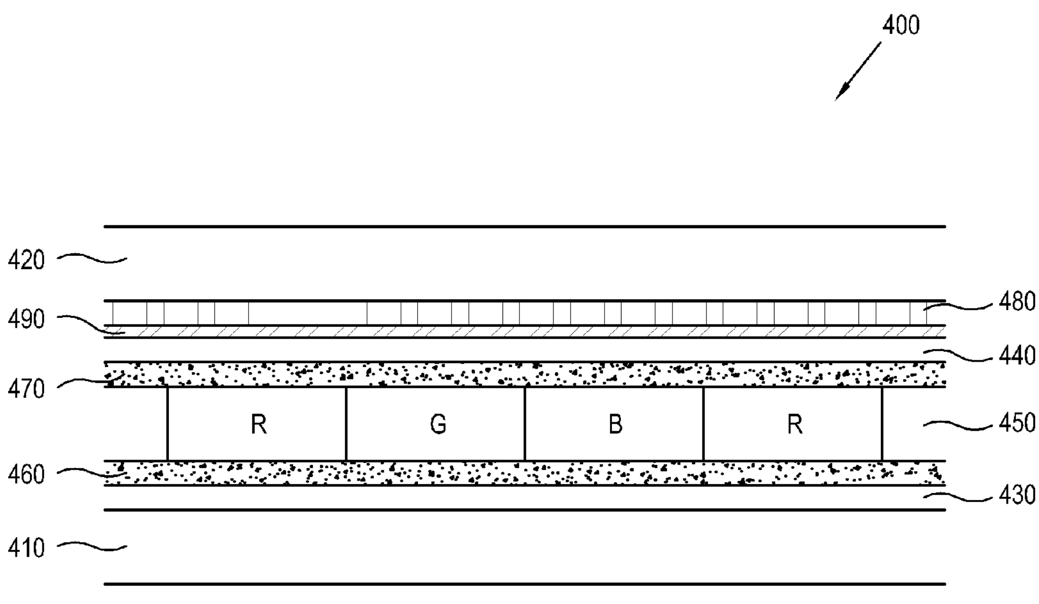


FIG. 5

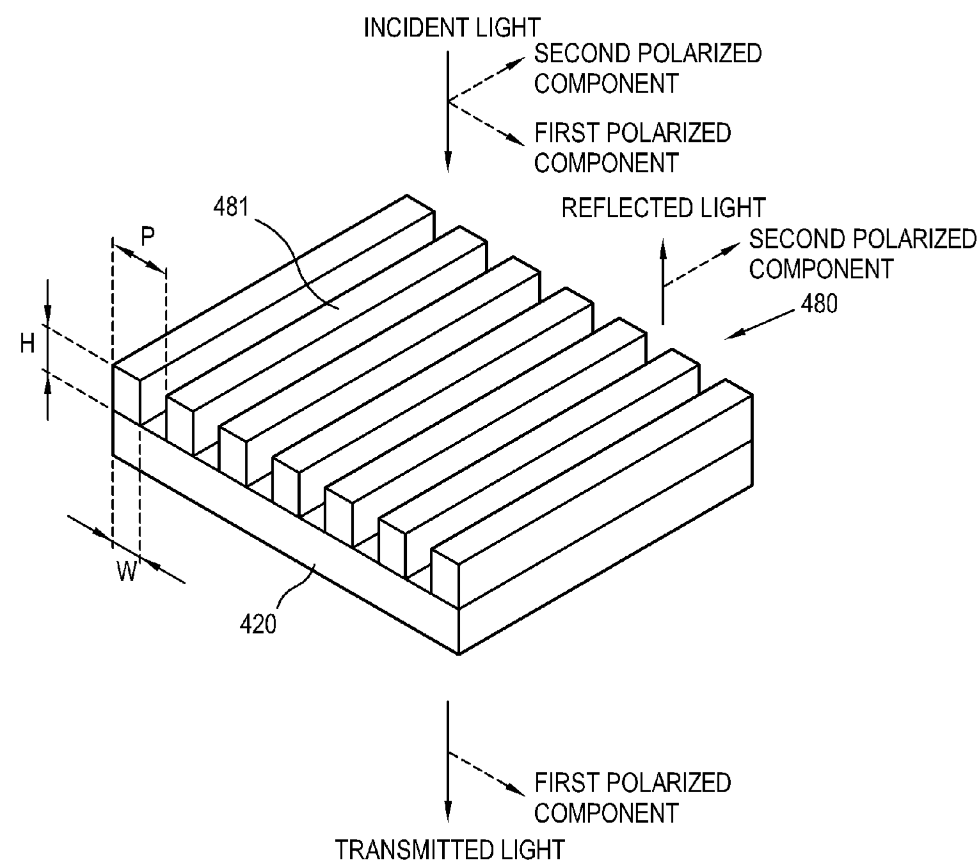

INCIDENT LIGHT
SECOND POLARIZED COMPONENT
FIRST POLARIZED COMPONENT
481
P
H
REFLECTED LIGHT
SECOND POLARIZED COMPONENT
480
W
420
FIRST POLARIZED COMPONENT
TRANSMITTED LIGHT

FIG. 6

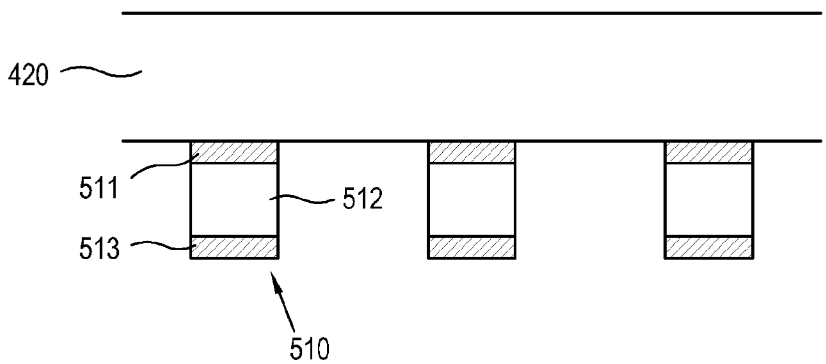


FIG. 7

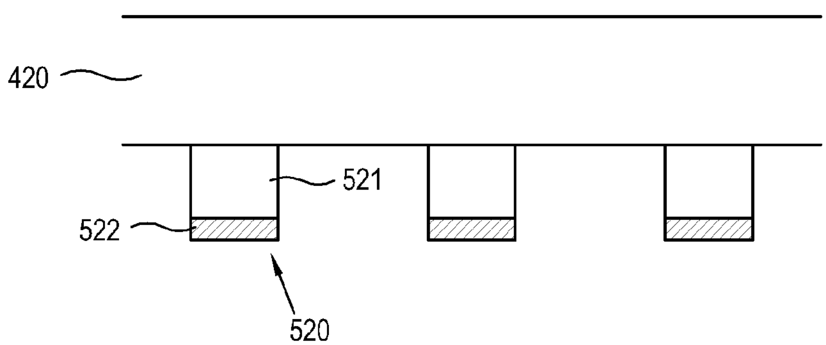


FIG. 8

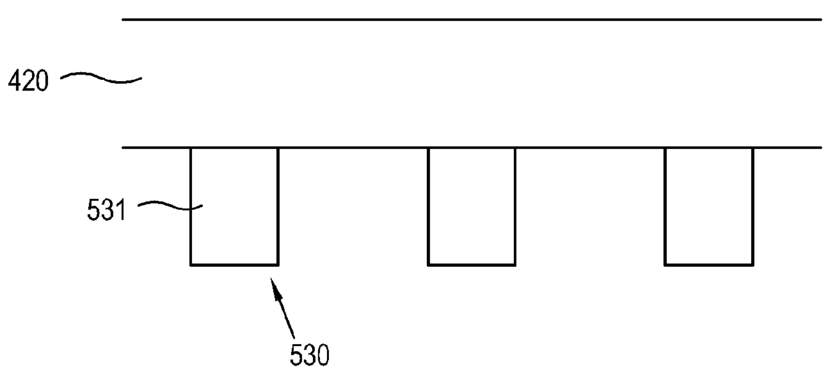
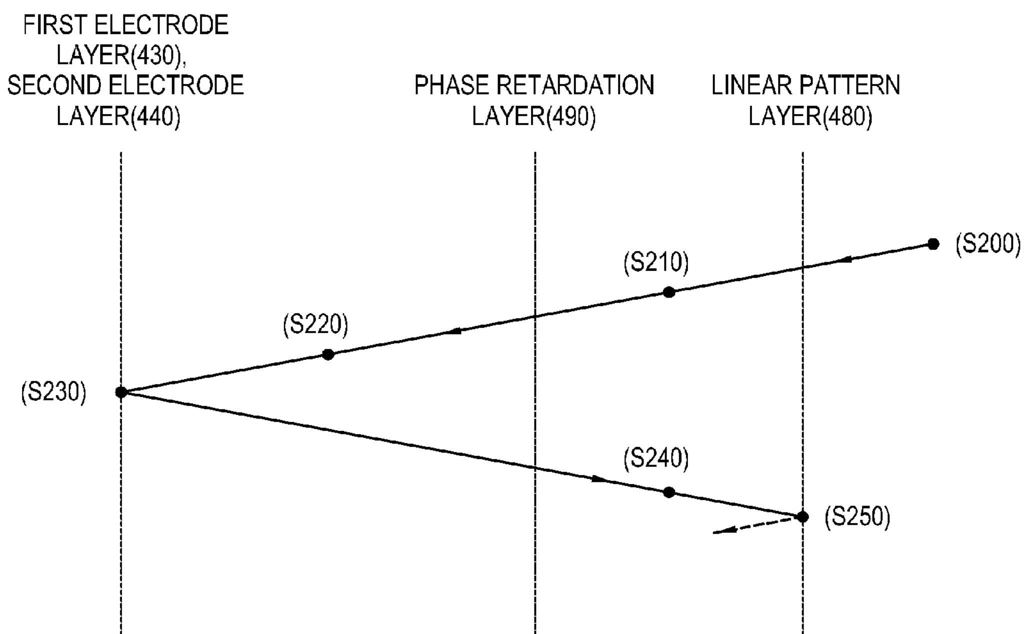


FIG. 9


FIRST ELECTRODE LAYER(430), SECOND ELECTRODE LAYER(440)
PHASE RETARDATION LAYER(490)
LINEAR PATTERN LAYER(480)
(S200)
(S210)
(S220)
(S230)
(S240)
(S250)

SELF-LUMINOUS DISPLAY PANEL, AND DISPLAY APPARATUS HAVING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority from Korean Patent Application No. 10-2013-0013986, filed on Feb. 7, 2013 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference, in its entirety.

BACKGROUND

[0002] 1. Field

[0003] Apparatuses consistent with the exemplary embodiments relate to a display panel which displays an image on a surface thereof and a display apparatus having the same. More particularly, the exemplary embodiments relate to a self-luminous display panel which displays an image by autonomously generating light without a separate backlight, and has a structure for preventing external light entering the panel from the outside from being reflected in the panel and exited to the outside, and a display apparatus having the same.

[0004] 2. Description of the Related Art

[0005] A display apparatus is a device which includes a display panel which displays images to present broadcast signals or various formats of image signals or image data, and is configured as a TV, a monitor, or the like. The display panel is configured as various types of display panels based on characteristics thereof, such as a liquid crystal display (LCD) panel, a plasma display panel (PDP), or the like, and is employed for a variety of display apparatuses.

[0006] Display panels used for a display apparatus may be classified into a light receiving panel and a self-luminous panel, depending on a method of light generation. The light receiving panel does not emit light by itself and thus includes a separate backlight to generate and provide light to the panel, and an example thereof includes an LCD panel. The self-luminous panel emits light by itself and thus does not need a backlight, and an example thereof includes an organic light emitting diode (OLED) panel.

[0007] The self-luminous display panel includes a light emitting layer on the inside to generate light. The light emitting layer is divided into a type that emits white light overall and a type in which sub-pixels respectively emit red, green and blue (RGB) colors of light. Unlike the former type of display panel, the latter type does not need a color filter layer since the light emitting layer emits RGB colors of light by sub-pixels, whereas incident external light may be reflected in the panel to cause a decrease in contrast.

SUMMARY

[0008] A display apparatus may include: a signal receiver configured to receive an image signal; a signal processor configured to process the image signal received by the signal receiver according to a preset image processing process; and a display panel configured to display the image signal processed by the signal processor as an image, wherein the display panel includes: a glass substrate; a first electrode layer; a second electrode layer disposed between the first electrode layer and the glass substrate; a light emitting layer disposed between the first electrode layer and the second electrode layer, configured to generate a plurality of colors of light based on holes and electrons transported by a voltage applied to the first electrode layer and the second electrode layer, and configured to emit the light to the glass substrate; a linear pattern layer formed on the glass substrate, the linear pattern layer includes linear bars extending in one direction to transmit a preset polarizing direction of light; and a phase retardation layer disposed between the second electrode layer and the linear pattern layer, and configured to emit entering light by retarding a phase of the light.

[0009] The linear bars may each include a metal layer configured to reflect light to inside of the display panel, in a polarized direction that the linear pattern layer does not transmit.

[0010] The linear bar may further include an insulating layer formed on a portion of the metal layer and toward the phase retardation layer.

[0011] The linear bar may further include a light absorbing layer disposed between the metal layer and the glass substrate and including a light absorbing material.

[0012] The phase retardation layer may retard a phase of light by $\lambda/4$.

[0013] An extending direction of the linear bar may be determined based on the preset polarizing direction so that the linear pattern layer transmits the preset polarizing direction of light.

[0014] The light emitting layer may generate red, green and blue colors of light by sub-pixels.

[0015] A self-luminous display panel may include: a glass substrate; a first electrode layer; a second electrode layer disposed between the first electrode layer and the glass substrate; a light emitting layer disposed between the first electrode layer and the second electrode layer, the light emitting layer being configured to generate a plurality of colors of light based on holes and electrons transported by voltage applied to the first electrode layer and the second electrode layer, and configured to emit the light to the glass substrate; a linear pattern layer formed on the glass substrate and including linear bars extending in one direction to transmit a preset polarizing direction of light; and a phase retardation layer disposed between the second electrode layer and the linear pattern layer, and configured to emit entering light by retarding a phase of the light.

[0016] The linear bar may include a metal layer to reflect light in a polarized direction that the linear pattern layer does not transmit to the inside of the display panel.

[0017] The linear bar may further include an insulating layer formed on a portion of the metal layer and extending toward the phase retardation layer.

[0018] The linear bar may further include a light absorbing layer disposed between the metal layer and the glass substrate and including a light absorbing material.

[0019] The phase retardation layer may retard a phase of light by $\lambda/4$.

[0020] The extending direction of the linear pattern layer may be determined based on the preset polarizing direction so that the linear pattern layer transmits the preset polarizing direction of light.

[0021] The light emitting layer may generate red, green and blue colors of light by sub-pixels.

[0022] An aspect of an exemplary embodiment may further provide a self-luminous display panel including: a glass substrate; a first electrode layer; a second electrode layer disposed between the first electrode layer and the glass substrate; a linear pattern layer formed on a surface of the glass substrate and comprising linear bars extending in one direction to transmit light in a preset polarizing direction; and a phase retarda-

tion layer disposed between the second electrode layer and the linear pattern layer, and configured to emit entering light by retarding a phase of the light, wherein the phase retarded light entering the self-luminous display panel, is then reflected by the first and second electrodes back towards the linear pattern layer through the phase retardation layer and is reflected back towards the phase retardation layer, whereby the entering light does not exit to the outside.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The above and/or other aspects will become apparent and more readily appreciated from the following description of the exemplary embodiments, taken in conjunction with the accompanying drawings, in which:

[0024] FIG. **1** is a block diagram which illustrates a configuration of a display apparatus, according to a first exemplary embodiment.

[0025] FIG. **2** is a lateral cross-sectional view which schematically illustrates a layered structure of a display panel of FIG. **1**.

[0026] FIG. **3** illustrates changes in polarizing characteristics, by stages, after external light enters the display panel of FIG. **2**.

[0027] FIG. **4** is a lateral cross-sectional view which schematically illustrates a layered structure of a display panel, according to a second exemplary embodiment.

[0028] FIG. **5** is a perspective view which illustrates a main part of a linear pattern layer in the display panel of FIG. **4**.

[0029] FIGS. **6**, **7** and **8** are lateral cross-sectional views which illustrate linear bars in the display panel of FIG. **4**.

[0030] FIG. **9** illustrates changes in polarizing characteristics, by stages, after external light enters the display panel of FIG. **4**.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0031] Below, exemplary embodiments will be described in detail with reference to the accompanying drawings. The exemplary embodiments may be embodied in various forms without being limited to the exemplary embodiments set forth herein. Descriptions of well-known parts are omitted for clarity and conciseness, and like reference numerals refer to like elements throughout.

[0032] FIG. **1** is a block diagram which illustrates a configuration of a display apparatus, **1** according to a first exemplary embodiment.

[0033] As shown in FIG. **1**, the display apparatus **1** includes a signal receiver **100** to receive an image signal, a signal processor **200** to process an image signal received by the signal receiver **100** according to a preset image processing process, and a display panel **300** to display an image based on an image signal processed by signal processor **200**.

[0034] Although the exemplary embodiment will be illustrated with a TV as the display apparatus **1**, the display apparatus **1** is not limited to a TV. For example, the idea of the exemplary embodiments may be applied to various kinds of display apparatuses **1** which are capable of displaying an image based on an image signal/image data provided from the outside or stored therein, such as a portable multimedia player and a mobile phone.

[0035] The signal receiver **100** receives an image signal or image data and transmits the image signal or image data to the signal processor **200**. The signal receiver **100** may be configured according to various types of standards of received image signals and configurations of the display apparatus **1**. For example, the signal receiver **100** may receive a radio frequency (RF) signal wirelessly transmitted from a broadcast station (not shown) or various image signals in accordance with composite video, component video, super video, SCART, high definition multimedia interface (HDMI), DisplayPort, unified display interface (UDI) or wireless HD standards via a cable. When the image signal is a broadcast signal, the signal receiver **100** includes a tuner to tune the broadcast signal by each channel. Alternatively, the signal receiver **100** may receive an image data packet from a server (not shown), through a network.

[0036] The signal processor **200** performs various image processing processes on the image signal received by the signal receiver **100**. The signal processor **200** outputs a processed image signal to the display panel **300**, thereby displaying on display panel **300** an image based on the processed image signal.

[0037] The signal processor **200** may perform any kind of image processing, without being limited to, for example, decoding which corresponds to an image format of image data, de-interlacing to convert interlaced image data into a progressive form, scaling to adjust image data to a preset resolution, noise reduction to improve image quality, detail enhancement, frame refresh rate conversion, or the like.

[0038] The signal processor **200** may be provided as an image processing board (not shown) formed by mounting an integrated multi-functional component, such as a system on chip (SOC), or separate components to independently conduct individual processes on a printed circuit board, and be embedded in the display apparatus **1**.

[0039] The display panel **300** displays an image based on an image signal output from the signal processor **200**. The display panel **300** according to an exemplary embodiment includes a self-luminous panel, instead of a non-light emitting panel, such as a liquid crystal display (LCD) panel. For example, the display panel **300** may be configured as an organic light emitting diode (OLED) panel.

[0040] Hereinafter, a structure of the display panel **300** according to an exemplary embodiment will be described with reference to FIG. **2**.

[0041] FIG. **2** is a lateral cross-sectional view which schematically illustrates a layered structure of the display panel **300**.

[0042] As shown in FIG. **2**, the display panel **300** includes a first glass substrate **310**, a second glass substrate **320** disposed to face the first glass substrate **310**, a first electrode layer **330**, a second electrode layer **340** disposed to face the first electrode layer **330**, a light emitting layer **350** disposed between the first electrode layer **330** and the second electrode layer **340**, an electron transport layer **360** disposed between the first electrode layer **330** and the light emitting layer **350**, a hole transport layer **370** disposed between the light emitting layer **350** and the second electrode layer **340**, a phase retardation layer **380** stacked on the second glass substrate **320**, and a polarizing layer **390** stacked on the phase retardation layer **380**.

[0043] In the following description, directional expressions "upper/upwards" and "lower/downwards" are used to describe the relative arrangement or stacked relationship between constituents in a traveling direction of light exiting from the display panel **300**. For instance, when light generated in the display panel **300** exits upwards from the display panel **300** in FIG. **2**, the display panel **300** has a structure in which the electron transport layer **360**, the light emitting layer **350**, the hole transport layer **370**, the second electrode layer **240**, the second glass substrate **320**, the phase retardation layer **380** and the polarizing layer **390** are sequentially stacked on the first electrode layer **330**.

[0044] Hereinafter, a structure of generating light in the display panel **300** will be described.

[0045] The first electrode layer **330** and the second electrode layer **340** serve as a cathode layer and an anode layer, respectively. As negative (−) and positive (+) voltages are respectively applied to the first electrode layer **330** and the second electrode layer **340**, electrons are generated in the first electrode layer **330** and holes are generated in the second electrode layer **340**. The electron transport layer **360** transports the electrons in the first electrode layer **330** to the light emitting layer **350**, and the hole transport layer **370** transports the holes in the second electrode layer **340** to the light emitting layer **350**.

[0046] The electrons and holes transported to the light emitting layer **350** form excitons in the light emitting layer **350**. An exciton is a neutral particle that is a bound state of an electron and a hole as a unit freely traveling in a nonmetallic crystal. An exciton emits light when changing from an excited state to a base state, and accordingly the light emitting layer **350** generates and emits light.

[0047] There are two ways a light emitting layer generates light in the OLED panel. First, the light emitting layer generates white light, in which case a color filter layer is used to change white light into red, green and blue (RGB) colors of light, is needed above the light emitting layer.

[0048] Second, the light emitting layer is divided into subpixels that each generate RGB colors of light, in which case a color filter layer is not necessary since each color of light is emitted from the light emitting layer. In an exemplary embodiment, the light emitting layer **350** generates RGB colors of light, and thus a color filter layer is not employed for the display panel **300**.

[0049] The light emitting layer **350** may improve light emitting efficiency by enhancing generation amounts or transport amounts of holes and electrons. To this end, the display panel **300** may further include an electron injection layer (not shown) disposed between the first electrode layer **330** and the electron transport layer **360** and a hole injection layer (not shown) disposed between the hole transport layer **370** and the second electrode layer **340** based on a design thereof.

[0050] In this structure of the display panel **300**, however, when external light enters an inside portion of the display panel **300** through the second glass substrate **320**, the entering external light may be reflected in the display panel **300** and exit out of the display panel **300**. As a result, a contrast ratio of an image displayed on the display panel **300** may be reduced, leading to deterioration in image quality.

[0051] Thus, in an exemplary embodiment, the polarizing layer **390** and the phase retardation layer **380** are employed for the display apparatus **300**. The polarizing layer **390** transmits a preset polarizing direction of light only, while the phase retardation layer **380** allows entering light to exit by retarding a phase of the light by $\lambda/4$. Here, λ is a wavelength of light.

[0052] FIG. **3** illustrates changes in polarizing characteristics, by stages, after external light enters the display panel **300**.

[0053] As shown in FIG. **3**, the external light enters the polarizing layer **390** from outside the display panel and passes through the polarizing layer **390** and the phase retardation layer **380**. The external light passing through the phase retardation layer **380** is reflected by the second electrode layer **340** or the first electrode layer **330**, passes through the phase retardation layer **380** again and then reaches the polarizing layer **390**.

[0054] For purposes of convenience, the stages after the external light entering the display panel **300** may be divided according to a light traveling order into an initial stage S**100** before the external light reaches the display panel **300**, a stage S**110** after the external light has passed through the polarizing layer **390**, a stage S**120** after the external light has passed through the phase retardation layer **380**, a stage S**130** in which the external light is reflected by the first electrode layer **330** or the second electrode layer **340**, a stage S**140** before the reflected external light reaches the phase retardation layer **380**, a stage S**150** after the external light has passed through the phase retardation layer **380**, and a stage S**160** in which the external light reaches and enters the polarizing layer **390**.

[0055] In the initial stage S**100**, the external light is a mixed state of circularly polarized light and linearly polarized P and S waves. Since the polarizing layer **390** transmits only a particular polarizing direction of light, for example, linearly polarized P waves of light, the linearly polarized P waves of light alone exist in the stage S**110** after the external light has passed through the polarizing layer **390**.

[0056] As the phase retardation layer **380** retards a phase of light by $\lambda/4$, the linearly polarized P waves of light, having passed through the phase retardation layer **380** (S**120**), is converted into circularly polarized light. The circularly polarized light is reflected by the first electrode layer **330** or the second electrode layer **340** (S**130**), and maintains polarizing characteristics thereof while heading back to the phase retardation layer **380** (S**140**).

[0057] When the circularly polarized light passes through the phase retardation layer **380** (S**150**), the circularly polarized light is converted into linearly polarized S waves of light by the phase retardation layer **380**. As described above, the polarizing layer **390** transmits the linearly polarized P waves of light only. Thus, when the linearly polarized S waves of light enter the polarizing layer **390** (S**160**), the linearly polarized S waves of light do not pass through the polarizing layer **390** and thus does not exit out of the display panel **300**.

[0058] That is, in the foregoing structure, external light entering the display panel **300** is not reflected out of the display panel **300**, thereby preventing a decrease in a contrast ratio.

[0059] However, in this structure that the polarizing layer **390** transmits a particular polarizing direction of light only, the polarizing layer **390** also transmits only a particular polarizing direction of light generated from the light emitting layer **350** other than external light. That is, the polarizing layer **390** may cause a decrease in light efficiency of the display panel **300** to about 50%.

[0060] Accordingly, the following configuration is proposed.

[0061] FIG. **4** is a lateral cross-sectional view schematically illustrating a layered structure of a display panel **400** according to a second exemplary embodiment.

[0062] As shown in FIG. **4**, the display panel **400** includes a first glass substrate **410**, a second glass substrate **420**, a first electrode layer **430**, a second electrode layer **440**, a light emitting layer **450**, an electron transport layer **460** and a hole transport layer **470**. These elements serve the same functions as those of the equivalent elements in the first exemplary embodiment, and thus descriptions thereof are omitted herein.

[0063] In addition, the display panel **400** includes a linear pattern layer **480** disposed between the second glass substrate **420** and the second electrode layer **440** and a phase retardation layer **490** disposed between the linear pattern layer **480** and the second electrode layer **440**.

[0064] The linear pattern layer **480** includes a plurality of parallel linear bars extending in one direction on a lower surface of the second glass substrate **420**. The lower surface of the second glass substrate **420** refers to a surface facing the second electrode layer **440**. The linear bars are arranged parallel with each other at a preset pitch toward the second electrode layer **440**.

[0065] The phase retardation layer **490** allows entering light to exit by retarding a phase of the light by λ/4 like in the first embodiment.

[0066] FIG. **5** is a perspective view illustrating a main portion of the linear pattern layer **480** in the display panel **400**. FIG. **5** shows the lower surface of the second glass substrate **420** and the linear pattern layer **480** so as to clearly present the linear pattern layer **480**.

[0067] As shown in FIG. **5**, the linear pattern layer **480** is formed by arranging a plurality of linear bars extending in a particular direction, parallel with each other, on the lower substrate of the second glass substrate **420**. The linear bars **481** have a preset height H, width W, and pitch P.

[0068] When the pitch P of the linear bars **481** is adjusted to ½ of a wavelength of light, only transmitted light and reflected light are formed without diffracted waves. Slits are formed between two adjacent linear bars **481**, and while entering light is passing through the slits, a first polarized component in a first polarizing direction perpendicular to an extending direction of the linear bars **481** passes through the linear pattern layer **480**. On the contrary, a second polarized component in a second polarizing direction which is parallel with the extending direction of the linear bars **481** is reflected again. That is, due to this structure of the linear bars **481**, light passing through the linear pattern layer **480** is polarized-filtered in the first polarizing direction.

[0069] That is, the extending direction of the linear bars **481** is determined based on a polarizing direction of light that the linear pattern layer **480** transmits.

[0070] The linear bars **481** include metal materials reflecting light. Thus, light that does not pass through the linear pattern layer **480** is reflected by the linear bars **481** back inside the display panel **400** and reflected again by the first electrode layer **430** or the second electrode layer **440**, thereby being transmitted back to the linear pattern layer **480** along with light exiting from the light emitting layer **450**. That is, unlike the polarizing layer **390** of the first exemplary embodiment absorbing light that does not pass, the linear pattern layer **480** does not absorb but rather re-reflects light not passing, thereby achieving recycling of light.

[0071] The linear pattern layer **480** is formed by depositing a metal layer on the second glass substrate **420** and patterning the linear bars **481** by nano imprint lithography (NIL). When a polarizing direction of entering light is parallel with the linear bars **481**, the light is reflected by the linear pattern layer **480**. When the polarizing direction of entering light is perpendicular to the linear bars **481**, the light is transmitted.

[0072] FIGS. **6**, **7** and **8** are lateral cross-sectional views illustrating linear bars according to exemplary embodiments.

[0073] As shown in FIG. **6**, one linear bar **510** is formed by sequentially stacking a light absorbing layer **511**, a metal layer **512** and an insulating layer **513** on the lower surface of the second glass substrate **420** in a direction toward an inside of the display panel **400**.

[0074] The light absorbing layer **511** absorbs part of external light incident through the second glass substrate **420**. The light absorbing layer **511** includes various materials, such as AlAs, GaAs, InGaAs, GaP, GaN, InN, CdTe, Ni—P, carbon nanotube, Ag_2S, Cr_2O_3 and black paint.

[0075] The metal layer **512** includes materials with good light reflectance, such as Au, Al, Cu, or Ag and reflects a non-transmitted polarized component of light to the inside of the display panel **400**.

[0076] The insulating layer **513** protects the metal layer **512** and includes SiO_2.

[0077] As shown in FIG. **7**, one linear bar **520** may be formed by sequentially stacking a metal layer **521** and an insulating layer **522** on the lower surface of the second glass substrate **420**. The metal layer **521** and the insulating layer **522** are substantially the same as the metal layer **512** and the insulating layer **513** shown in FIG. **6**.

[0078] As shown in FIG. **8**, one linear bar **530** may include a metal layer **531** only on the lower surface of the second glass substrate **420**. The metal layer **531** is substantially the same as the metal layer **512** shown in FIG. **6**.

[0079] As illustrated with reference to FIGS. **6** to **8**, the linear bars **510**, **520** and **530** respectively include the metal layers **512**, **521** and **531** to reflect light, so that a non-transmitted polarized component of light may not be absorbed but be reflected.

[0080] FIG. **9** illustrates changes in polarizing characteristics, by stages, after external light enters the display panel **400**.

[0081] As shown in FIG. **9**, the external light enters the linear pattern layer **480** from the outside and passes through the linear pattern layer **480** and the phase retardation layer **490**. The external light passing through the phase retardation layer **490** is reflected by the second electrode layer **440** or the first electrode layer **430**, passes through the phase retardation layer **490** again and then reaches the linear pattern layer **480**.

[0082] For convenience, the stages after the external light enters the display panel **400** may be divided according to a light traveling order into an initial stage S**200** before the external light does not yet reach the display panel **400**, a stage S**210** after the external light has passed through the linear pattern layer **480**, a stage S**220** after the external light has passed through the phase retardation layer **490**, a stage S**230** in which the external light is reflected by the first electrode layer **430** or the second electrode layer **440**, a stage S**240** after the reflected external light has passed through the phase retardation layer **490**, and a stage S**250** in which the external light reaches and enters the linear pattern layer **480**.

[0083] In the initial stage S**200**, the external light is a mixed state of circularly polarized light and linearly polarized P and S waves. Since the linear pattern layer **480** transmits only a particular polarizing direction of light, for example, linearly polarized P waves of light, the linearly polarized P waves of light alone exist in the stage S**210** after the external light has passed through the linear pattern layer **480**.

[0084] As the phase retardation layer **490** retards a phase of light by λ/4, the linearly polarized P waves of light having passed through the phase retardation layer **490** (S**220**) is converted into circularly polarized light. The circularly polarized light is reflected by the first electrode layer **430** or the second electrode layer **440** (S**230**). When the circularly polarized light passes through the phase retardation layer **490** (S**240**), the circularly polarized light is converted into linearly polarized S waves of light by the phase retardation layer **490**.

[0085] When the linearly polarized S waves of light enter the linear pattern layer **480** (S**250**), the linear pattern layer **480** does not transmit the linearly polarized S waves of light since the linear pattern layer **480** transmits the linearly polarized P waves of light only. Here, unlike the polarizing layer **380** that absorbs the linearly polarized S waves of light in the first embodiment, the linear pattern layer **480** reflects the linearly polarized S waves of light to the phase retardation layer **490** so that the light does not exit to the outside.

[0086] Accordingly, surface reflection by external light is reduced, a contrast ratio of an image is improved, and light transmittance of the display panel **400** is enhanced, thereby improving brightness of an image.

[0087] Although a few exemplary embodiments have been shown and described, it will be appreciated by those skilled in the art that changes may be made in these exemplary embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the appended claims and their equivalents.

What is claimed is:

1. A display apparatus comprising:

a signal receiver configured to receive an image signal;

a signal processor configured to process the image signal received by the signal receiver according to a preset image processing process; and

a display panel configured to display the image signal processed by the signal processing unit as a processed image,

wherein the display panel comprises:

a glass substrate;

a first electrode layer;

a second electrode layer disposed between the first electrode layer and the glass substrate;

a light emitting layer disposed between the first electrode layer and the second electrode layer, configured to generate a plurality of colors of light based on holes and electrons transported by voltage applied to the first electrode layer and the second electrode layer, and configured to emit the light to the glass substrate;

a linear pattern layer formed on the glass substrate and comprising linear bars extending in one direction to transmit the light in a preset polarizing direction; and

a phase retardation layer disposed between the second electrode layer and the linear pattern layer, and configured to emit entering light by retarding a phase of the light.

2. The display apparatus of claim **1**, wherein the linear bar comprises a metal layer configured to reflect light in a polarized direction to an inside of the display panel that the linear pattern layer does not transmit.

3. The display apparatus of claim **2**, wherein the linear bar further comprises an insulating layer formed on a portion of the metal layer and extending in a direction toward the phase retardation layer.

4. The display apparatus of claim **2**, wherein the linear bar further comprises a light absorbing layer disposed between the metal layer and the glass substrate and comprising a light absorbing material.

5. The display apparatus of claim **1**, wherein the phase retardation layer retards a phase of light by $\lambda/4$, where λ is a wavelength.

6. The display apparatus of claim **1**, wherein the extending direction of the linear bar is determined based on the preset polarizing direction so that the linear pattern layer transmits the light in the preset polarizing direction.

7. The display apparatus of claim **1**, wherein the light emitting layer generates red, green and blue colors of light by sub-pixels.

8. A self-luminous display panel comprising:

a glass substrate;

a first electrode layer;

a second electrode layer disposed between the first electrode layer and the glass substrate;

a light emitting layer disposed between the first electrode layer and the second electrode layer, the light emitting layer being configured to generate a plurality of colors of light based on holes and electrons transported by voltage applied to the first electrode layer and the second electrode layer, and configured to emit the light to the glass substrate;

a linear pattern layer formed on a surface of the glass substrate and comprising linear bars extending in one direction to transmit the light in a preset polarizing direction; and

a phase retardation layer disposed between the second electrode layer and the linear pattern layer, and configured to emit entering light by retarding a phase of the light.

9. The display panel of claim **8**, wherein the linear bar comprises a metal layer to reflect light in a polarized direction such that the linear pattern layer does not transmit the light to inside the display panel.

10. The display panel of claim **9**, wherein the linear bar further comprises an insulating layer formed on a portion of the metal layer and facing toward the phase retardation layer.

11. The display panel of claim **9**, wherein the linear bar further comprises a light absorbing layer disposed between the metal layer and the glass substrate and comprising a light absorbing material.

12. The display panel of claim **8**, wherein the phase retardation layer retards a phase of light by $\lambda/4$, where λ is a wavelength.

13. The display panel of claim **8**, wherein the extending direction of the linear pattern layer is determined based on the preset polarizing direction so that the linear pattern layer transmits the light in the preset polarizing direction.

14. The display panel of claim **8**, wherein the light emitting layer generates red, green and blue colors of light by sub-pixels.

15. A self-luminous display panel comprising:

a glass substrate;

a first electrode layer;

a second electrode layer disposed between the first electrode layer and the glass substrate;

a linear pattern layer formed on a surface of the glass substrate and comprising linear bars extending in one direction to transmit light in a preset polarizing direction; and a phase retardation layer disposed between the second electrode layer and the linear pattern layer, and configured to emit entering light by retarding a phase of the light, wherein the phase retarded light entering the self-luminous display panel, is then reflected by the first and second electrodes back towards the linear pattern layer through the phase retardation layer and is reflected back towards the phase retardation layer, whereby the entering light does not exit to the outside.

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