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Inventor(s)

Tseng; Li Wei et al.

SPLICING DISPLAY APPARATUS

Abstract

Disclosed is a splicing display apparatus including display panels. Each of the display panels includes a circuit substrate and pixel units. The display panels include a first display panel and a second display panel arranged in a first direction and spliced to each other. The first display panel and the second display panel have a splicing seam. A pixel unit of the first display panel closest to the splicing seam is substantially aligned in the first direction with a pixel unit of the second display panel closest to the splicing seam. A color of a light beam emitted by a light-emitting element of the pixel unit of the first display panel closest to the splicing seam is the same color as a color of a light beam emitted by a light-emitting element of the pixel unit of the second display panel closest to the splicing seam.

Inventors: Tseng; Li Wei (Hsinchu, TW), Hsieh; Chung Chuan (Hsinchu, TW), Chen; Cheng-Chuan (Hsinchu, TW), Tsai; Shau-Yu (Hsinchu, TW)

Applicant: AUO Corporation (Hsinchu, TW)

Family ID: 1000008770530

Assignee: AUO Corporation (Hsinchu, TW)

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the priority benefit of Taiwan application serial no. 113105912, filed on Feb. 20, 2024. The entirety of the above-mentioned patent application is hereby incorporated by reference herein and made a part of this specification.

BACKGROUND

Technical Field

[0002] The disclosure relates to a display apparatus, and in particular to a splicing display apparatus.

Description of Related Art

[0003] As the use of display apparatus diversifies, large display boards used to present public information or advertisements have become increasingly common in exhibition halls or department stores. To reduce the disposition and maintenance costs of large display boards, splicing display apparatus made of multiple spliced display panels have become one of the common options for setting up the large display boards. Generally, during the splicing process, display panels (such as LED panels) cannot be tightly arranged due to splicing precision issues, which easily results in splicing seams between the display panels. A part of a color light emitted by a light-emitting element close to the splicing seam is totally reflected at the seam, causing the color light emitted by the light-emitting element to predominantly travel in one direction, further leading to color casts of the splicing display apparatus at a large viewing angle.

SUMMARY

[0005] The disclosure provides a splicing display apparatus with good optical performance.

[0006] The splicing display apparatus of the disclosure includes multiple display panels. Each of the display panels includes a circuit substrate and pixel units. The pixel units are arranged in an array on the circuit substrate and electrically connected to the circuit substrate. Each of the pixel units includes multiple light-emitting elements. The display panels include a first display panel and a second display panel arranged in a first direction and spliced to each other. The first display panel and the second display panel have a splicing seam. A pixel unit of the first display panel closest to the splicing seam is substantially aligned in the first direction with a pixel unit of the second display panel closest to the splicing seam. A color of a light beam emitted by a light-emitting element of the pixel unit of the first display panel closest to the splicing seam is the same color as a color of a light beam emitted by a light-emitting element of the pixel unit of the second display panel closest to the splicing seam.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 is a schematic top view of a splicing display apparatus in an embodiment of the disclosure.

[0008] FIG. 2 is a schematic cross-sectional view of a splicing display apparatus in an embodiment of the disclosure.

[0009] FIG. 3 is a schematic cross-sectional view of a splicing display apparatus in an embodiment of the disclosure.

[0010] FIG. 4 is a schematic top view of a splicing display apparatus in a comparative example.

[0011] FIG. 5 is a schematic cross-sectional view of a splicing display apparatus in a comparative example.

[0012] FIG. 6 shows the relative light intensities and color coordinate differences of light beams in various colors of a splicing display apparatus at different viewing angles in a second direction d2 in an embodiment of the disclosure.

[0013] FIG. 7 shows the relative light intensities and color coordinate differences of light beams in various colors of a splicing display apparatus at different viewing angles in a first direction d1 in an embodiment of the disclosure.

[0014] FIG. 8 shows the relative light intensities and color coordinate differences of light beams in various colors of a splicing display apparatus at different viewing angles in a second direction d2 in a comparative example.

[0015] FIG. 9 shows the relative light intensities and color coordinate differences of light beams in various colors of a splicing display apparatus at different viewing angles in a first direction d1 in a comparative example.

[0016] FIG. 10 is a schematic top view of a splicing display apparatus in another embodiment of the disclosure.

[0017] FIG. 11 is a schematic cross-sectional view of a splicing display apparatus in still another embodiment of the disclosure.

DESCRIPTION OF THE EMBODIMENTS

[0018] Reference will now be made in detail to the exemplary embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers are used in the drawings and the description to refer to the same or like parts.

[0019] It should be understood that when an element such as a layer, film, region, or substrate is referred to as being “on” or “connected to” another element, it can be directly on or connected to the other element, or Intermediate elements may also be present. In contrast, when an element is referred to as being “directly on” or “directly connected to” another element, there are no intervening elements. As used herein, “connection” can refer to physical and/or electrical connection. Furthermore, “electrical connection” or “coupling” can mean that there are other elements between two elements.

[0020] As used herein, “about”, “approximately”, or “substantially” includes the stated value and the average value within the acceptable deviation range of the specific value determined by a person of ordinary skill in the art, taking into account the measurement in question and a certain amount of measurement-related error (i.e., the limitation of the measurement system). For example, “about” can mean within one or more standard deviations of the stated value, or within $\pm 30\%$, $\pm 20\%$, $\pm 10\%$, $\pm 5\%$. Furthermore, “about”, “approximate” or “substantially” used herein can be based on optical properties, etching properties or other properties to select a more acceptable range of deviation or standard deviation, and not one standard deviation can be applied to all properties.

[0021] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by those of ordinary skill in the art to which the disclosure belongs. It will be further understood that terms such as those defined in commonly used dictionaries should be interpreted as having meanings consistent with the relevant art and the background or context of the disclosure, and should not be interpreted in an idealized or overly formal way, unless otherwise defined in the embodiments of the disclosure.

[0022] FIG. 1 is a schematic top view of a splicing display apparatus in an embodiment of the disclosure. FIG. 2 is a schematic cross-sectional view of a splicing display apparatus in an embodiment of the disclosure. FIG. 2 corresponds to a cross-sectional line I-I' in FIG. 1. FIG. 3 is a schematic cross-sectional view of a splicing display apparatus in an embodiment of the disclosure. FIG. 3 corresponds to a cross-sectional line II-II' in FIG. 1. An optical film 140 and an optical clear adhesive 150 in FIGS. 2 and 3 are omitted in FIG. 1.

[0023] Referring to FIGS. 1, 2, and 3, a splicing display apparatus **10** includes multiple display panels **100** spliced to each other. Each of the display panels **100** includes a circuit substrate **110** and multiple pixel units **120**. In an embodiment, the circuit substrate **110** is, for example, a printed circuit board, but the disclosure is not limited thereto. The pixel units **120** are arranged in arrays on the circuit substrate **110** and electrically connected to the circuit substrate **110**. Each of the pixel units **120** includes multiple light-emitting elements **122**. For example, in an embodiment, the light-emitting elements **122** of each pixel unit **120** include a first light-emitting element **122R**, a second light-emitting element **122B**, and a third light-emitting element **122G**. The first light-emitting element **122R**, the second light-emitting element **122B**, and the third light-emitting element **122G** are used to emit a first color light LR, a second color light LB, and a third color light LG respectively. In an embodiment, the first color light LR, the second color light LB, and the third color light LG are, for example, red light, blue light, and green light respectively, but the disclosure is not limited thereto. In an embodiment, each light-emitting element **122** is, for example, a micro light-emitting diode (μ LED), but the disclosure is not limited thereto.

[0024] Referring to FIGS. 2 and 3, in an embodiment, each display panel **100** further includes an encapsulation layer **130**, disposed on the circuit substrate **110** and covering the pixel units **120**. In an embodiment, the encapsulation layer **130** directly covers the light-emitting elements **122** of the pixel units **120**. However, the disclosure is not limited thereto. In other embodiments, each display panel **100** may selectively include multiple package structures (not shown) separated from each other, wherein each package structure covers the light-emitting elements **122** of a corresponding pixel unit **120**, and each package structure forms a light-emitting element package with the light-emitting elements **122** of the pixel unit covered by the package structure. The encapsulation layer **130** may cover multiple light-emitting element package without directly contacting the light-emitting elements **122R**, **122G**, and **122B**.

[0025] In an embodiment, each display panel **100** may further selectively include an optical film **140**. The optical film **140** is disposed on the encapsulation layer **130**, and the pixel units **120** are located between the optical film **140** and the circuit substrate **110**. The optical film **140** is used to reduce reflection and enhance contrast. For example, in an embodiment, the optical film **140** may be a true black film, but the disclosure is not limited thereto. In an embodiment, each display panel **100** may further selectively include an optical clear adhesive **150**, wherein the optical film **140** is adhered to the encapsulation layer **130** through the optical clear adhesive **150**. For example, in an embodiment, the optical clear adhesive **150** is, for example, black optical clear adhesive, but the disclosure is not limited thereto.

[0026] Referring to FIGS. 1 and 2, the display panels **100** of the splicing display apparatus **10** include a first display panel **100-1** and a second display panel **100-2** arranged in a first direction d1 and spliced to each other. The first display panel **100-1** and the second display panel **100-2** have a splicing seam S. A pixel unit **120** of the first display panel **100-1** closest to the splicing seam S is substantially aligned in the first direction d1 with a pixel unit **120** of the second display panel **100-2** closest to the splicing seam S. The color of a light beam emitted by a light-emitting element **122** of the pixel unit **120** of the first display panel **100-1** closest to the splicing seam S is the same as the color of a light beam emitted by a light-emitting element **122** of the pixel unit **120** of the second display panel **100-2** closest to the splicing seam S.

[0027] Referring to FIGS. 1 and 2, for example, in an embodiment, a pixel unit **120** of the first display panel **100-1** closest to the splicing seam S is substantially aligned in the first direction d1 with a pixel unit **120** of the second display panel **100-2** closest to the splicing seam S. Both the color of a light beam (e.g., the first color light LR) emitted by a first light-emitting element **122R** of the pixel unit **120** of the first display panel **100-1** closest to the splicing seam S and the color of a light beam (e.g., the first color light LR) emitted by a first light-emitting element **122R** of the pixel unit **120** of the second display panel **100-2** closest to the splicing seam S may be red, but the disclosure is not limited thereto.

[0028] Referring to FIGS. 1 and 3, for example, in an embodiment, a pixel unit **120** of the first display panel **100-1** closest to the splicing seam **S** is substantially aligned in the first direction **d1** with a pixel unit **120** of the second display panel **100-2** closest to the splicing seam **S**. Both the color of a light beam (e.g., the second color light **LB**) emitted by a second light-emitting element **122B** of the pixel unit **120** of the first display panel **100-1** closest to the splicing seam **S** and the color of a light beam (e.g., the second color light **LB**) emitted by a second light-emitting element **122B** of the pixel unit **120** of the second display panel **100-2** closest to the splicing seam **S** may be blue, but the disclosure is not limited thereto.

[0029] Referring to FIGS. 1 and 2, in an embodiment, a pixel unit **120** of the first display panel **100-1** closest to the splicing seam **S** is substantially aligned in the first direction **d1** with a pixel unit **120** of the second display panel **100-2** closest to the splicing seam **S**. The first light-emitting element **122R**, the third light-emitting element **122G**, and the second light-emitting element **122B** of the pixel unit **120** of the first display panel **100-1** closest to the splicing seam **S** are sequentially arranged in the first direction **d1**. The second light-emitting element **122B**, the third light-emitting element **122G**, and the first light-emitting element **122R** of the pixel unit **120** of the second display panel **100-2** closest to the splicing seam **S** are sequentially arranged in the first direction **d1**.

[0030] Referring to FIGS. 1 and 3, in an embodiment, a pixel unit **120** of the first display panel **100-1** closest to the splicing seam **S** is substantially aligned in the first direction **d1** with a pixel unit **120** of the second display panel **100-2** closest to the splicing seam **S**. The second light-emitting element **122B**, the third light-emitting element **122G**, and the first light-emitting element **122R** of the pixel unit **120** of the first display panel **100-1** closest to the splicing seam **S** are sequentially arranged in the first direction **d1**. The first light-emitting element **122R**, the third light-emitting element **122G**, and the second light-emitting element **122B** of the pixel unit **120** of the second display panel **100-2** closest to the splicing seam **S** are sequentially arranged in the first direction **d1**.

[0031] Referring to FIGS. 1 and 2, it is worth mentioning that, by configuring the light-emitting elements **122** of the pixel units **120** of the first display panel **100-1** and the second display panel **100-2** closest to the splicing seam **S** through the above arrangement methods, a part of the light beams emitted by a part of the light-emitting elements **122** of the pixel unit **120** of the first display panel **100-1** closest to the splicing seam **S** may be mixed with a part of the light beams emitted by a part of the light-emitting elements **122** of the pixel unit **120** of the second display panel **100-2** closest to the splicing seam **S**, further making improvements in terms of color casts at the splicing seam **S** of the splicing display apparatus **10** at a large viewing angle.

[0032] Referring to FIGS. 1 and 2, for example, in an embodiment, the light beam **LR** emitted by the first light-emitting element **122R** of a pixel unit **120** of the first display panel **100-1** closest to the splicing seam **S** includes a first part **LR-1** and a second part **LR-2**, which are transmitted towards the right side and the left side respectively, in the encapsulation layer **130**. The first part **LR-1**, after emerging from a top surface **130a** of the encapsulation layer **130**, travels at a large viewing angle on the right side while the second part **LR-2**, only after being totally reflected at the seam **S**, emerges from the top surface **130a** of the encapsulation layer **130** and travels at the large viewing angle on the right side. The light beam **LG** emitted by the third light-emitting element **122G** of a pixel unit **120** of the first display panel **100-1** closest to the splicing seam **S** includes a first part **LG-1** and a second part **LG-2**, which are transmitted towards the right side and the left side respectively, in the encapsulation layer **130**. The first part **LG-1**, after emerging from the top surface **130a** of the encapsulation layer **130**, travels at the large viewing angle on the right side while the second part **LG-2**, after emerging from the top surface **130a** of the encapsulation layer **130**, travels at a large viewing angle on the left side. The light beam **LB** emitted by the second light-emitting element **122B** of a pixel unit **120** of the first display panel **100-1** closest to the splicing seam **S** includes a first part **LB-1** and a second part **LB-2**, which are transmitted towards the right side and the left side respectively, in the encapsulation layer **130**. The first part **LB-1**, after emerging from the top surface **130a** of the encapsulation layer **130**, travels at the large viewing

angle on the right side while the second part LB-2 after emerging from the top surface **130a** of the encapsulation layer **130**, travels at the large viewing angle on the left side. The light beam LR emitted by the first light-emitting element **122R** of a pixel unit **120** of the second display panel **100-2** closest to the splicing seam S includes a first part LR-1 and a second part LR-2, which are transmitted towards the right side and the left side respectively, in the encapsulation layer **130**. The first part LR-1, only after being totally reflected at the seam S, emerges from the top surface **130a** of the encapsulation layer **130** and travels at a large viewing angle on the left side while the second part LR-2, after emerging from the top surface **130a** of the encapsulation layer **130**, travels at the large viewing angle on the left side. The light beam LG emitted by the third light-emitting element **122G** of a pixel unit **120** of the second display panel **100-2** closest to the splicing seam S includes a first part LG-1 and a second part LG-2, which are transmitted towards the right side and the left side respectively, in the encapsulation layer **130**. The first part LG-1, after emerging from the top surface **130a** of the encapsulation layer **130**, travels at a large viewing angle on the right side while the second part LG-2, after emerging from the top surface **130a** of the encapsulation layer **130**, travels at the large viewing angle on the left side. The light beam LB emitted by the second light-emitting element **122B** of a pixel unit **120** of the second display panel **100-2** closest to the splicing seam S includes a first part LB-1 and a second part LB-2, which are transmitted towards the right side and the left side respectively, in the encapsulation layer **130**.

[0033] The first part LB-1, after emerging from the top surface **130a** of the encapsulation layer **130**, travels at the large viewing angle on the right side while the second part LB-2, after emerging from the top surface **130a** of the encapsulation layer **130**, travels at the large viewing angle on the left side.

[0034] Particularly, the second part LR-2 of the light beam LR emitted by the first light-emitting element **122R** of the pixel unit **120** of the first display panel **100-1** closest to the splicing seam S travels at the large viewing angle on the right side after emergent. The first part LG-1 of the light beam LR emitted by the third light-emitting element **122G** of the pixel unit **120** of the second display panel **100-2** closest to the splicing seam S travels at the large viewing angle on the right side after emergent. The first part LB-1 of the light beam LB emitted by the second light-emitting element **122B** of the pixel unit **120** of the second display panel **100-2** closest to the splicing seam S also travels at the large viewing angle on the right side after emergent. The three parts are mixed together at the large viewing angle on the right side and form a white light LW1, thereby making improvements in terms of color casts on the right side.

[0035] Similarly, the first part LR-1 of the light beam LR emitted by the first light-emitting element **122R** of the pixel unit **120** of the second display panel **100-2** closest to the splicing seam S travels at the large viewing angle on the left side after emergent. The second part LG-2 of the light beam LR emitted by the third light-emitting element **122G** of the pixel unit **120** of the first display panel **100-1** closest to the splicing seam S travels at the large viewing angle on the left side after emergent. The second part LB-2 of the light beam LB emitted by the second light-emitting element **122B** of the pixel unit **120** of the first display panel **100-2** closest to the splicing seam S also travels at the large viewing angle on the left side after emergent. The three parts are mixed together at the large viewing angle on the left side and form a white light LW2, thereby making improvements in terms of color casts on the left side.

[0036] It is noted that in the embodiment shown in FIG. 2, the second part LR-2 of the light beam LR provided by the first display panel **100-1** and the first part LR-1 of the light beam LR provided by the second display panel **100-2** occur as examples on a side wall **150s** of the optical clear adhesive **150** defining the splicing seam S. However, the disclosure is not limited thereto. In another embodiment, when the encapsulation layer **130** is thicker, the total reflection phenomenon may also occur on a side wall **130s** of the encapsulation layer **130** defining the splicing seam S. In other words, the total reflection phenomenon at the splicing seam S not only occurs on the display panel **100** that includes the encapsulation layer **130**, the optical clear adhesive **150**, and the optical

film **140**. The total reflection phenomenon at the splicing seam S may also occur on a display panel that includes the encapsulation layer **130** but without the optical clear adhesive **150** and the optical film **140**. The total reflection phenomenon at the splicing seam S may also occur on a display panel that includes the optical film **140** directly attached to the light-emitting element **122** but without the encapsulation layer **130**. In short, wherever an optical layer of certain thickness is shown the light-emitting element **122** of the display panel **100**, the total reflection phenomenon may occur at the splicing seam S of any of the display panels **100** regardless of the type of optical layer.

[0037] Referring to FIG. 1, the pixel units **120** of each display panel **100** are arranged into multiple pixel unit rows R and multiple pixel unit columns C. The pixel units **120** in each pixel unit row R are arranged in the first direction d1, and the pixel units **120** in each pixel unit column C are arranged in a second direction d2. The first direction d1 intersects the second direction d2.

[0038] In an embodiment, the first display panel **100-1** includes a pixel unit column C closest to the splicing seam S. The light-emitting elements **122** of the pixel units **120** in the pixel unit column C of the first display panel **100-1** closest to the splicing seam S include multiple first light-emitting elements **122R** and multiple second light-emitting elements **122B** alternately arranged in the second direction d2. The second display panel **100-2** includes a pixel unit column C closest to the splicing seam S. The pixel unit column C of the second display panel **100-2** includes multiple pixel units **120** arranged in the second direction d2. The light-emitting elements **122** of the pixel units **120** in the pixel unit column C of the second display panel **100-2** closest to the splicing seam S include multiple first light-emitting elements **122R** and multiple second light-emitting elements **122B** alternately arranged in the second direction d2. The first light-emitting elements **122R** of the first display panel **100-1** are substantially aligned in the first direction d1 with the first light-emitting elements **122R** of the second display panel **100-2** respectively, and the second light-emitting elements **122B** of the first display panel **100-1** are substantially aligned in the first direction d1 with the second light-emitting elements **122B** of the second display panel **100-2** respectively.

[0039] Referring to FIGS. 1, 2, and 3, in short, in an embodiment, a column of light-emitting elements **122** of each of the first display panel **100-1** and the second display panel **100-2** closest to the splicing seam S includes multiple first light-emitting elements **122R** and multiple second light-emitting elements **122B** that emit light beams of different colors (e.g., the first color light LR and the second color light LB) and are alternately arranged. Moreover, in the same column, the color of a light beam (e.g., the first color light LR or the second color light LB) emitted by a light-emitting element **122** of the first display panel **100-1** closest to the splicing seam S is the same as the color of a light beam (e.g., the first color light LR or the second color light LB) emitted by a light-emitting element **122** of the second display panel **100-2** closest to the splicing seam S.

[0040] Referring to FIG. 1, based on an arrangement order of the first light-emitting element **122R**, the second light-emitting element **122B**, and the third light-emitting element **122G** of a pixel unit **120**, in an embodiment, the pixel units **120** may be divided into multiple first pixel units **120-1** and multiple second pixel units **120-2**. A first light-emitting element **122R**, a third light-emitting element **122G**, and a second light-emitting element **122B** of each first pixel unit **120-1** are sequentially arranged in the first direction d1, and a second light-emitting element **122B**, a third light-emitting element **122G**, and a first light-emitting element **122R** of each second pixel unit **120-2** are sequentially arranged in the first direction d1.

[0041] In an embodiment, the first display panel **100-1** includes a pixel unit column C closest to the splicing seam S. Multiple first pixel units **120-1** and multiple second pixel units **120-2** in the pixel unit column C of the first display panel **100-1** are alternately arranged in the second direction d2. The second display panel **100-2** includes a pixel unit column C closest to the splicing seam S. Multiple first pixel units **120-1** and multiple second pixel units **120-2** in the pixel unit column C of the second display panel **100-2** are alternately arranged in the second direction d2. The first pixel units **120-1** in the pixel unit column C of the first display panel **100-1** are substantially aligned in

the first direction d1 with the second pixel units **120-2** in the pixel unit column C of the second display panel **100-2**, and the second pixel units **120-2** in the pixel unit column C of the first display panel **100-1** are substantially aligned in the first direction d1 with the first pixel units **120-1** in the pixel unit column C of the second display panel **100-2**.

[0042] FIG. 4 is a schematic top view of a splicing display apparatus in a comparative example. FIG. 5 is a schematic cross-sectional view of a splicing display apparatus in a comparative example. FIG. 5 corresponds to a cross-sectional line III-III' in FIG. 1. The optical film **140** and the optical clear adhesive **150** in FIG. 5 are omitted in FIG. 4.

[0043] Referring to FIGS. 4 and 5, a splicing display apparatus **10'** in the comparative example is similar to the splicing display apparatus **10**. The difference between the splicing display apparatus **10'** and the splicing display apparatus **10** is that the light-emitting elements **122** of each pixel unit **120** of splicing display apparatus **10'** are arranged in the same way. Specifically, in the comparative examples shown in FIGS. 4 and 5, the first light-emitting element **122R**, the third light-emitting element **122G**, and the second light-emitting element **122B** of each pixel unit **120** are sequentially arranged in the first direction d1.

[0044] FIG. 6 shows the relative light intensities and color coordinate differences of light beams in various colors of a splicing display apparatus at different viewing angles in a second direction d2 in an embodiment of the disclosure. Curve R represents the relative light intensity of red light beams of the splicing display apparatus **10** at different viewing angles in the second direction d2. Curve G represents the relative light intensity of green light beams of the splicing display apparatus **10** at different viewing angles in the second direction d2. Curve B represents the relative light intensity of blue light beams of the splicing display apparatus **10** at different viewing angles in the second direction d2. Bar Chart dx represents the differences in x color coordinates of the splicing display apparatus **10** at different viewing angles in the second direction d2, and Bar Chart dy represents the differences in y color coordinates of the splicing display apparatus **10** at different viewing angles in the second direction d2.

[0045] FIG. 7 shows the relative light intensities and color coordinate differences of light beams in various colors of a splicing display apparatus at different viewing angles in a first direction d1 in an embodiment of the disclosure. Curve R represents the relative light intensity of the red light beams of the splicing display apparatus **10** at different viewing angles in the first direction d1. Curve G represents the relative light intensity of the green light beams of the splicing display apparatus **10** at different viewing angles in the first direction d1. Curve B represents the relative light intensity of the blue light beams of the splicing display apparatus **10** at different viewing angles in the first direction d1. Bar Chart dx represents the differences in the x color coordinates of the splicing display apparatus **10** at different viewing angles in the first direction d1, and Bar Chart dy represents the differences in the y color coordinates of the splicing display apparatus **10** at different viewing angles in the first direction d1.

[0046] FIG. 8 shows the relative light intensities and color coordinate differences of light beams in various colors of the splicing display apparatus **10'** at different viewing angles in a second direction d2 in a comparative example. Curve R represents the relative light intensity of red light beams of the splicing display apparatus **10'** at different viewing angles in the second direction d2. Curve G represents the relative light intensity of green light beams of the splicing display apparatus **10'** at different viewing angles in the second direction d2. Curve B represents the relative light intensity of blue light beams of the splicing display apparatus **10'** at different viewing angles in the second direction d2. Bar Chart dx represents the differences in x color coordinates of the splicing display apparatus **10'** at different viewing angles in the second direction d2, and Bar Chart dy represents the differences in y color coordinates of the splicing display apparatus **10'** at different viewing angles in the second direction d2.

[0047] FIG. 9 shows the relative light intensities and color coordinate differences of light beams in various colors of the splicing display apparatus **10'** at different viewing angles in a first direction d1

in a comparative example. Curve R represents the relative light intensity of the red light beams of the splicing display apparatus **10'** at different viewing angles in the first direction d1. Curve G represents the relative light intensity of the green light beams of the splicing display apparatus **10'** at different viewing angles in the first direction d1. Curve B represents the relative light intensity of the blue light beams of the splicing display apparatus **10'** at different viewing angles in the first direction d1. Bar Chart dx represents the differences in the x color coordinates of the splicing display apparatus **10'** at different viewing angles in the first direction d1, and Bar Chart dy represents the differences in the y color coordinates of the splicing display apparatus **10'** at different viewing angles in the first direction d1.

[0048] By comparing FIG. 6 with FIG. 8, and FIG. 7 with FIG. 9, it is known that, compared to the splicing display apparatus **10'** in the comparative example, the splicing display apparatus **10** in an embodiment of the disclosure makes improvements in terms of asymmetrical light emission and reduces color casts at in-plane large viewing angles.

[0049] It must be noted that the same reference numbers and parts of the content from the previous embodiments are used in the following embodiments. The same numbers are adopted to refer to the same or similar elements, and descriptions of the same technical content are omitted. Reference may be made to the previous embodiments for the omitted descriptions, which will not be repeated in the following embodiments.

[0050] FIG. 10 is a schematic top view of a splicing display apparatus in another embodiment of the disclosure. A splicing display apparatus **10A** in FIG. 10 is similar to the splicing display apparatus **10** in FIG. 1. The differences between the two are as follows. In the embodiment of FIG. 1, the pixel units **120** in each pixel unit row R are multiple first pixel units **120-1** and multiple second pixel units **120-2** alternately arranged in the first direction d1. That is, in the embodiment of FIG. 1, the same pixel unit row R includes various pixel units **120** that differ in the arrangement of the first light-emitting element **122R**, the second light-emitting element **122B**, and the third light-emitting element **122G**. In the embodiment of FIG. 10, the pixel units **120** in each pixel unit row R are multiple first pixel units **120-1** or multiple second pixel units **120-2**. That is, in the embodiment of FIG. 10, the first light-emitting element **122R**, the second light-emitting element **122B**, and the third light-emitting element **122G** of all pixel units **120** in the same pixel unit row R are arranged in the same way.

[0051] FIG. 11 is a schematic cross-sectional view of a splicing display apparatus in still another embodiment of the disclosure. A splicing display apparatus **10B** in FIG. 11 is similar to the splicing display apparatus **10**. The difference between the two is as follows. In the embodiment of FIG. 11, the disposition of the optical film **140** and the optical clear adhesive **150** may be omitted for each display panel **100**.

Claims

1. A splicing display apparatus, comprising: a plurality of display panels, wherein each of the plurality of display panels comprises: a circuit substrate; and a plurality of pixel units, arranged in an array on the circuit substrate and electrically connected to the circuit substrate, wherein each of the plurality of pixel units comprises a plurality of light-emitting elements, wherein the plurality of display panels comprise a first display panel and a second display panel arranged in a first direction and spliced to each other, the first display panel and the second display panel having a splicing seam, wherein one of the pixel units of the first display panel closest to the splicing seam is substantially aligned in the first direction with one of the pixel units of the second display panel closest to the splicing seam, and a color of a light beam emitted by one of the light-emitting elements of the pixel unit of the first display panel closest to the splicing seam is a same color as a color of a light beam emitted by one of the light-emitting elements of the pixel unit of the second display panel closest to the splicing seam; wherein the plurality of light-emitting elements of each

of the plurality of pixel units comprise a first light-emitting element and a second light-emitting element for emitting a first color light and a second color light respectively; the first light-emitting element and the second light-emitting element of the pixel unit of the first display panel closest to the splicing seam are sequentially arranged in the first direction; and the second light-emitting element and the first light-emitting element of the pixel unit of the second display panel closest to the splicing seam are sequentially arranged in the first direction.

2. (canceled)

3. The splicing display apparatus according to claim 1, wherein the plurality of light-emitting elements of each of the plurality of pixel units further comprise a third light-emitting element for emitting a third color light; the first light-emitting element, the third light-emitting element, and the second light-emitting element of the pixel unit of the first display panel closest to the splicing seam are sequentially arranged in the first direction; and the second light-emitting element, the third light-emitting element, and the first light-emitting element of the pixel unit of the second display panel closest to the splicing seam are sequentially arranged in the first direction.

4. The splicing display apparatus according to claim 1, wherein the first display panel comprises a pixel unit column closest to the splicing seam, and the pixel unit column of the first display panel comprises a plurality of pixel units arranged in a second direction, the first direction intersecting the second direction, wherein the plurality of light-emitting elements of the plurality of pixel units in the pixel unit column of the first display panel closest to the splicing seam comprise a plurality of first light-emitting elements and a plurality of second light-emitting elements alternately arranged in the second direction.

5. The splicing display apparatus according to claim 4, wherein the second display panel comprises a pixel unit column closest to the splicing seam, the pixel unit column of the second display panel comprises a plurality of pixel units arranged in the second direction, and the plurality of light-emitting elements of the plurality of pixel units in the pixel unit column of the second display panel closest to the splicing seam comprise a plurality of first light-emitting elements and a plurality of second light-emitting elements alternately arranged in the second direction, the plurality of first light-emitting elements of the first display panel being substantially aligned in the first direction with the plurality of first light-emitting elements of the second display panel respectively, and the plurality of second light-emitting elements of the first display panel being substantially aligned in the first direction with the plurality of second light-emitting elements of the second display panel respectively.

6. The splicing display apparatus according to claim 1, wherein the plurality of pixel units of each of the plurality of display panels comprise a plurality of first pixel units and a plurality of second pixel units; the first light-emitting element and the second light-emitting element of each of the plurality of first pixel units are sequentially arranged in the first direction; the second light-emitting element and the first light-emitting element of each of the plurality of second pixel units are sequentially arranged in the first direction; the first display panel comprises a pixel unit column closest to the splicing seam, and the plurality of first pixel units and the plurality of second pixel units in the pixel unit column of the first display panel are alternately arranged in a second direction intersecting the first direction; the second display panel comprises a pixel unit column closest to the splicing seam, and the plurality of first pixel units and the plurality of second pixel units in the pixel unit column of the second display panel are alternately arranged in the second direction; the plurality of first pixel units in the pixel unit column of the first display panel are substantially aligned in the first direction with the plurality of second pixel units in the pixel unit column of the second display panel respectively, and the plurality of second pixel units in the pixel unit column of the first display panel are substantially aligned in the first direction with the plurality of first pixel units in the pixel unit column of the second display panel respectively.
