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DISPLAY PANEL AND DISPLAY APPARATUS

Abstract

A display panel includes a primary screen, an auxiliary screen and a connecting region, the primary screen and the auxiliary screen are connected via the connecting region, and the auxiliary screen at least partially surrounds the primary screen. A primary displaying region is disposed inside the primary screen, a plurality of first data lines are disposed within the primary displaying region, and the first data lines are configured to provide data signals to a plurality of pixels within the primary displaying region. An auxiliary displaying region is disposed inside the auxiliary screen, a plurality of second data lines are disposed within the auxiliary displaying region, and the second data lines are configured to provide data signals to a plurality of pixels within the auxiliary displaying region. A displaying device is further provided.

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Background/Summary

[0001] The present application claims the priority of the Chinese patent application filed on Jan. 5, 2023 before the Chinese Patent Office with the application number of 202310015770.2 and the title of “DISPLAY PANEL AND DISPLAY APPARATUS”, which is incorporated herein in its entirety by reference.

TECHNICAL FIELD

[0002] The present application relates to the technical field of displaying and, more particularly, to a display panel and a displaying device.

BACKGROUND

[0003] A wearable device (for example, a smart watch) is provided with a display screen, and exhibits information via the display screen. With the increasing of the functions of the wearable device, the information required to be exhibited increases correspondingly, and a more flexible information exhibition mode is urgently needed.

SUMMARY

[0004] A display panel and a displaying device are provided by the embodiments of the present application, thus the information exhibition is more flexible.

[0005] In order to achieve the above object, the following technical solutions are employed by the embodiments of the present application.

[0006] In an aspect, a display panel is provided, wherein the display panel includes a primary screen, an auxiliary screen and a connecting region, the primary screen and the auxiliary screen are connected via the connecting region, and the auxiliary screen at least partially surrounds the primary screen; a primary displaying region is disposed inside the primary screen, a plurality of first data lines are disposed within the primary displaying region, and the first data lines are configured to provide data signals to a plurality of pixels within the primary displaying region; and an auxiliary displaying region is disposed inside the auxiliary screen, a plurality of second data lines are disposed within the auxiliary displaying region, and the second data lines are configured to provide data signals to a plurality of pixels within the auxiliary displaying region; a plurality of first connecting lines and a plurality of second connecting lines are disposed inside the display panel, and one end of each of the first connecting lines and one end of each of the second connecting lines are electrically connected to a driving chip to obtain data signals of the driving chip; and the other ends of the first connecting lines are connected to the first data lines, and the other ends of the second connecting lines are connected to the second data lines passing through the connecting region.

[0007] In some embodiments, the auxiliary screen is a strip-shaped screen, the strip-shaped screen includes a first edge extending in a length direction, and the first edge at least partially surrounds a periphery of the primary screen.

[0008] In some embodiments, the auxiliary displaying region includes a plurality of pixel columns, and a plurality of pixels included by each of the plurality of pixel columns are arranged in an extending direction of the first edge; and the second data lines extend in a direction of the pixel

columns, and are configured for that each of the second data lines provides data signals to the pixels in one of the pixel columns.
[0009] In some embodiments, the second data lines are broken at a first position, to form first data sub-lines and second data sub-lines, some of the second connecting lines are connected to the first data sub-lines, and some of the second connecting lines are connected to the second data sub-lines.
[0010] In some embodiments, at the first position, the second data lines form first ends located at the first data sub-lines and second ends located at the second data sub-lines; and the first position is adjacent to the connecting region, some of the second connecting lines are connected to the first ends, and some of the second connecting lines are connected to the second ends.
[0011] In some embodiments, the auxiliary screen includes a substrate, a driving circuit and a light emitting device, the driving circuit and the light emitting device are arranged sequentially in layer configuration on the substrate, the driving circuit includes a first conducting layer and a second conducting layer that are arranged in different layers, the second data lines are located at the first conducting layer, a part of wiring of the second connecting lines is located at the second conducting layer, and the second connecting lines and the second data lines are connected through via holes.
[0012] In some embodiments, a first non-displaying region surrounding the primary displaying region is disposed inside the primary screen, the first non-displaying region is connected to the connecting region, and a part of wiring of the second connecting lines is located within the first non-displaying region.
[0013] In some embodiments, a part of wiring of the second connecting lines is located within the primary displaying region.
[0014] In some embodiments, the primary displaying region includes a substrate, a driving circuit and a light emitting device, the driving circuit and the light emitting device are arranged sequentially in layer configuration on the substrate, the driving circuit includes a third conducting layer, and a part of the wiring of the second connecting lines is located at the third conducting layer.
[0015] In some embodiments, a data selecting circuit is disposed within the connecting region, and the second connecting lines are connected to the second data lines via the data selecting circuit.
[0016] In some embodiments, the auxiliary displaying region includes a plurality of pixel rows, and a plurality of pixels included by each of the pixel rows are arranged in a second direction, wherein the second direction intersects with the extending direction of the first edge; and a second non-displaying region surrounding the auxiliary displaying region is disposed inside the auxiliary screen, a gate driving circuit is disposed within the second non-displaying region, and the gate driving circuit is located at a second edge of the auxiliary screen. wherein the second edge and the first edge are opposite.
[0017] In some embodiments, the second conducting layer further includes a signal line, one end of the signal line is configured to be connected to the driving chip, and the other end of the signal line is connected to the gate driving circuit passing through the connecting region and the auxiliary displaying region.
[0018] In some embodiments, the auxiliary screen is a ring-shaped screen, and the plurality of pixels in the pixel rows are arranged in radial directions of the auxiliary screen.
[0019] In another aspect, a displaying device is provided, wherein the displaying device includes the display panel.
[0020] In some embodiments, the connecting region of the display panel is bent, and there is a predetermined included angle between a light-exiting surface of the primary screen and a light-exiting surface of the auxiliary screen.
[0021] In the display panel and the displaying device according to the embodiments of the present application, the display panel includes the primary screen, the auxiliary screen and the connecting region connecting the primary screen and the auxiliary screen, and the second connecting lines configured for providing the data signals for the pixels in the auxiliary screen enter the primary

screen via the connecting region, so that the first connecting lines configured for providing the data signals for the pixels in the primary screen can be converged with the second connecting lines, and in turn be connected to the driving chip. In other words, the primary screen and the auxiliary screen can share the driving chip, as compared with the case where the primary screen and the auxiliary screen are individually provided with a driving chip, the quantity of the driving chips is reduced, and the power consumption is reduced.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] In order to more clearly illustrate the technical solutions of the embodiments of the present application or the related art, the figures that are required to describe the embodiments or the related art will be briefly described below. Apparently, the figures that are described below are merely embodiments of the present application, and a person skilled in the art can obtain other figures according to these figures without paying creative work.

[0023] FIG. **1** is a schematic diagram of a displaying device according to an embodiment of the present application;

[0024] FIG. **2** is a schematic diagram of the main body of a displaying device according to an embodiment of the present application;

[0025] FIG. **3** is a schematic diagram of the main body of another displaying device according to an embodiment of the present application;

[0026] FIG. **4** is a schematic diagram of the main body of yet another displaying device according to an embodiment of the present application;

[0027] FIG. **5** is a schematic diagram of a display panel according to an embodiment of the present application;

[0028] FIG. **6** is a schematic diagram of another display panel according to an embodiment of the present application;

[0029] FIG. **7** is a partially enlarged view of the I in FIG. **6**;

[0030] FIG. **8** is a partially enlarged view of the II in FIG. **6**; and

[0031] FIG. **9** is a driving principle diagram of a display panel according to an embodiment of the present application.

REFERENCE NUMBERS

[0032] **1**—main body; **2**—watchband; [0033] **100**—display panel; [0034] **110**—primary screen; **111**—primary displaying region; **112**—first non-displaying region; [0035] **120**—auxiliary screen; **121**—first edge; **122**—second data lines; **122**μa——first data sub-lines; **122***b*—second data sub-lines; **123**—second connecting lines; **124**—gate driving circuit; [0036] **130**—connecting region; [0037] **140**—driving region; and [0038] **150**—driving chip.

DETAILED DESCRIPTION

[0039] The technical solutions of the embodiments of the present application will be clearly and completely described below with reference to the drawings of the embodiments of the present application. Apparently, the described embodiments are merely certain embodiments of the present application, rather than all of the embodiments. All of the other embodiments that a person skilled in the art obtains on the basis of the embodiments of the present application without paying creative work fall within the protection scope of the present application.

[0040] In the embodiments of the present application, terms such as “first”, “second”, “third” and “fourth” are used to distinguish identical items or similar items that have substantially the same functions and effects, merely in order to clearly describe the technical solutions of the embodiments of the present application, and should not be construed as indicating or implying the degrees of importance or implicitly indicating the quantity of the specified technical features.

[0041] In the embodiments of the present application, the meaning of “plurality of” is “two or more”, and the meaning of “at least one” is “one or more”, unless explicitly and particularly defined otherwise.
[0042] In the embodiments of the present application, the terms that indicate orientation or position relations, such as “upper” and “lower”, are based on the orientation or position relations shown in the drawings, and are merely for conveniently describing the present application and simplifying the description, rather than indicating or implying that the device or element must have the specific orientation and be constructed and operated according to the specific orientation. Therefore, they should not be construed as a limitation on the present application.
[0043] As shown in FIG. **1** to FIG. **8**, a displaying device is provided by an embodiment of the present application. The displaying device may be a mobile phone, a notebook computer, an ultra-mobile personal computer (UMPC), a netbook, a personal digital assistant (PDA), a wearable device, a virtual-reality device, a mobile computing device or another device that has a display panel **100**, which is not limited in the embodiments of the present application. In order to facilitate the description, in the present application, it is taken as an example for the description that the displaying device is a smart watch.
[0044] FIG. **1** is a schematic diagram of a displaying device according to an embodiment of the present application. As shown in FIG. **1**, the displaying device may include a main body **1** and a watchband **2**. The main body **1**, as the major frame of the displaying device, is used to realize the major functions (for example, communicating, movement monitoring and health monitoring) of the displaying device. The watchband **2** is connected to the main body **1**, and is used to make that the main body **1** is detachably worn on the wrist of the user. For example, as shown in FIG. **1**, the displaying device includes two watchbands **2**, one of the two watchbands **2** is connected to the upper side of the main body **1**, the other of the two watchbands **2** is connected to the lower side of the main body **1**, and, in wearing, the two watchbands **2** surround the wrist of the user and are connected via a clip component (not shown in the figure). It can be understood that, in practical applications the main body may also be worn on the wrist of the user in other modes, which are not limited in the embodiments of the present application.
[0045] The main body includes a housing and a display panel **100** connected to the housing.
[0046] The housing, as the skeleton of the main body, is used to support and connect the components of the displaying device.
[0047] As an example, the housing is provided with a groove, and the interior of the groove is used to contain the components of the displaying device such as the central processing unit, the mainboard, the internal memory, the battery, the sensing devices and the communicating components. The display panel **100** covers the opening of the groove to cause the groove to be sealed, thereby the components contained inside the groove are protected.
[0048] As an example, when the housing is provided with the groove, the outer wall of the groove is connected to the watchband. The watchband and the housing may be of an integral structure, and the watchband may also be detachably connected to the outer wall of the groove, to facilitate the repairment and the replacement of the watchband.
[0049] FIG. **2** is a schematic diagram of the main body of a displaying device according to an embodiment of the present application. FIG. **3** is a schematic diagram of the main body of another displaying device according to an embodiment of the present application. FIG. **4** is a schematic diagram of the main body of yet another displaying device according to an embodiment of the present application. As shown in FIG. **2**, FIG. **3** and FIG. **4**, the shape of the housing may be overall a cuboid, a cylinder and so on. Certainly, the shape of the housing may also be overall a polygon prism, an elliptic cylinder, a frustum, a truncated pyramid and so on. The shape of the housing is not limited in the embodiments of the present application.
[0050] The material of the housing may be a metal, and may also be a plastic, which may be selected flexibly according to demands in practical applications.

[0051] The display panel **100** may be an electroluminescent display panel or a photoluminescent display panel. If the display panel **100** is an electroluminescent display panel, the electroluminescent display panel may be an organic electroluminescent diode (referred to for short as OLED) display panel, a quantum-dot electroluminescent diode (referred to for short as QLED) display panel or an active-matrix organic light emitting diode (referred to for short as AMOLED) display panel. Organic-light-emitting-diode display panels, because of the advantages such as self-illumination, a low driving voltage, a high luminous efficiency, a high response speed and flexible displaying, have already been extensively applied in the field of displaying, and therefore in the embodiments of the present application, it is taken as an example for the description that the display panel **100** is an OLED display panel.
[0052] The display panel **100** may display images, and exhibit information to the user by using the displayed images. For example, the display panel **100** exhibits the communicating state, the movement monitoring data, the health monitoring data, and so on, of the displaying device to the user by displaying images. The images displayed by the display panel **100** may be static images, and may also be dynamic images. The contents of the images may be texts, may also be pictures, and may also be both of texts and pictures.
[0053] In order to improve the flexibility of the information exhibition by the display panel **100**, the display panel **100** may include a primary screen **110** and an auxiliary screen **120**. During the working of the displaying device, the primary screen **110** and the auxiliary screen **120** may be separately controlled. For example, when the display panel **100** displays images, the primary screen **110** and the auxiliary screen **120** may display images simultaneously, or any one of the primary screen **110** and the auxiliary screen **120** displays images. When the primary screen **110** and the auxiliary screen **120** display images simultaneously, the primary screen **110** and the auxiliary screen **120** may display the same images, and may also display different images.
[0054] As an example, as shown in FIG. **2**, the main body is overall of a cuboid structure, the primary screen **110** may be disposed at the top surface of the main body, and the auxiliary screen **120** may be disposed at the side surface of the main body.
[0055] As an example, as shown in FIG. **3**, the main body is overall of a cylinder structure, the primary screen **110** may be disposed at the top surface of the main body. and the auxiliary screen **120** may be disposed at the side surface of the main body.
[0056] As an example, as shown in FIG. **4**, the main body is overall of a cylinder structure, the primary screen **110** may be disposed at the top surface of the main body, the auxiliary screen **120** may be disposed between the top surface and the side surface of the main body, and there is a certain included angle between the light-exiting surface of the auxiliary screen **120** and the light-exiting surface of the primary screen **110**.
[0057] It should be noted that, in the above three examples, the auxiliary screen **120** surrounds the primary screen **110** by one circle, and the whole of the periphery of the primary screen **110** is correspondingly provided with the auxiliary screen **120**. In practical applications, the auxiliary screen **120** may also partially surround the primary screen **110**. For example, in the example shown in FIG. **2**, the auxiliary screen **120** may cover merely one side surface among the four side surfaces of the main body, or two side surfaces among the four side surfaces of the main body, or three side surfaces among the four side surfaces of the main body.
[0058] The naming of the primary screen **110** and the auxiliary screen **120** is merely in order to distinguish the two display screens, there is not a structural or functional dependency relation between the primary screen **110** and the auxiliary screen **120**, and the names of the primary screen **110** and the auxiliary screen **120** are exchangeable. For example, in some examples, the primary screen **110** may also be referred to as the auxiliary screen **120**, and the auxiliary screen **120** may also be referred to as the primary screen **110**.
[0059] When the primary screen **110** and the auxiliary screen **120** displays different images, as an example, the primary screen **110** may be configured to display the communicating state, the

movement monitoring data, the health monitoring data and so on, and the auxiliary screen **120** may be configured to display the Bluetooth connection state, the residual capacity and so on. In this way, the flexibility of the information exhibition by the displaying device can be increased.

[0060] An area of the primary screen **110** may be greater than an area of the auxiliary screen **120** or less than the area of the auxiliary screen **120**, and the area of the primary screen **110** may also be equal to the area of the auxiliary screen **120**. The relative sizes of the primary screen **110** and the auxiliary screen **120** are not limited in the embodiments of the present application.

[0061] The primary screen **110** and the auxiliary screen **120** are not two independent display screens, but they belong to the same display panel **100**, and are connected by a connecting region **130** to be of an integral structure. In other words, the display panel **100** is divided into three regions, which are the primary screen **110**, the auxiliary screen **120** and the connecting region **130** located between the primary screen **110** and the auxiliary screen **120**.

[0062] FIG. **5** is a schematic diagram of a display panel according to an embodiment of the present application. FIG. **6** is a schematic diagram of another display panel according to an embodiment of the present application. Referring to FIG. **5** and FIG. **6**, the auxiliary screen **120** is a strip-shaped screen. The strip-shaped screen refers to that the auxiliary screen **120** is overall elongated, wherein the size of the auxiliary screen **120** in the length direction is significantly greater than the dimension size of the auxiliary screen **120** in the width direction. The strip-shaped screen includes a first edge **121** extending in the length direction, and, after the auxiliary screen **120** is bent, the first edge **121** at least partially surrounds the periphery of the primary screen **110**.

[0063] As an example, as shown in FIG. **5**, the display panel **100** includes the primary screen **110** that is overall rectangular, the auxiliary screen **120** that is overall strip-shaped, and the connecting region **130** connecting the primary screen **110** and the auxiliary screen **120**. In the fabrication of the displaying device, the display panel **100** is bent along a common edge of the primary screen **110** and the auxiliary screen **120** within the connecting region **130** to cause that there is an included angle of 270° between the light-exiting surface of the primary screen **110** and the light-exiting surface of the auxiliary screen **120**. Subsequently, the auxiliary screen **120** is bent along the periphery of the primary screen **110** to cause the first edge **121** to surround the periphery of the primary screen **110**, and the two ends of the auxiliary screen **120** are butted to form the structure of the display panel **100** in the example shown in FIG. **2**.

[0064] As an example, as shown in FIG. **6**, the display panel **100** includes the primary screen **110** that is overall circular, the auxiliary screen **120** that is overall circular-arc-strip-shaped, and the connecting region **130** connecting the primary screen **110** and the auxiliary screen **120**. In the fabrication of the displaying device, the display panel **100** is bent along the common edge of the primary screen **110** and the auxiliary screen **120** within the connecting region **130** to cause that there is an included angle of 225° between the light-exiting surface of the primary screen **110** and the light-exiting surface of the auxiliary screen **120**. Subsequently, the auxiliary screen **120** is bent along the periphery of the primary screen **110** to cause the first edge **121** to surround the periphery of the primary screen **110**, and the two ends of the auxiliary screen **120** are butted to cause the auxiliary screen **120** to surround the primary screen **110** by one circle, to form the structure of the display panel **100** in the example shown in FIG. **4**. Certainly, the included angle between the light-exiting surface of the primary screen **110** and the light-exiting surface of the auxiliary screen **120** may also be other angles. For example, when they have an included angle of 270°, the display panel **100** in the example shown in FIG. **3** is formed.

[0065] In the examples shown in FIG. **5** and FIG. **6**, the shape of the primary screen **110** and the shape of the auxiliary screen **120** are different. In practical applications, the shape of the primary screen **110** and the shape of the auxiliary screen **120** may also be the same.

[0066] The connecting region **130** connects the primary screen **110** and the auxiliary screen **120**. and the shape and the size of the connecting region **130** are not limited in the embodiments of the present application. As an example, as shown in FIG. **5**, the connecting region **130** may be the

common edge of the primary screen **110** and the auxiliary screen **120**. As an example, as shown in FIG. **6**, the connecting region **130** may be the peripheral region of the tangent point of the primary screen **110** and the auxiliary screen **120**.

[0067] Because the position between the primary screen **110** and the auxiliary screen **120** is bent via the connecting region **130**, if the connecting region **130** is smaller, that is more beneficial to the relative bending between the primary screen **110** and the auxiliary screen **120**. Especially, when the shape of the display panel **100** is the shape shown in FIG. **6** (when the primary screen **110** is a circular primary screen **110**, and the auxiliary screen **120** is a circular-are-strip-shaped auxiliary screen **120**), if the connecting region **130** is excessively large, the size of the connecting region **130** in the horizontal direction shown in FIG. **6** is greater, resulting in that after the primary screen **110** and the auxiliary screen **120** relatively bend, the primary screen **110** and the auxiliary screen **120** easily have wrinkles.

[0068] Certainly, the primary screen **110** and the auxiliary screen **120** of the display panel **100** may also be located in the same plane, at this moment, the connecting region **130** is not bent.

[0069] The display panel **100** may be connected to a driving chip **150** configured to drive the display panel **100**. The driving chip **150** may provide data signals for driving the primary screen **110** to display images, and data signals for driving the auxiliary screen **120** to display images. The driving chip **150** may be connected to the primary screen **110**, and may also be connected to the auxiliary screen **120**. In order to facilitate the description, it is taken as an example for the description below that the driving chip **150** is connected to the primary screen **110**.

[0070] As an example, referring continuously to FIG. **6**, the primary screen **110** is provided with a driving region **140**, and the driving chip **150** is connected within the driving region **140**. In the displaying device, the driving region **140**, along with the driving chip **150**, is bent along the common edge of the driving region **140** and the primary screen **110**, so that the driving region **140** and the driving chip **150** are located at the back surface of the primary screen **110**.

[0071] A primary displaying region **111** is disposed inside the primary screen **110**, a plurality of pixels arranged in an array are disposed within the primary displaying region **111**, and the plurality of pixels cooperate with each other to display images. One pixel refers to one light emitting unit and includes a light emitting device and a driving circuit for driving the light emitting device.

[0072] The plurality of pixels arranged in an array within the primary displaying region **111** form a plurality of pixel columns, and each of the pixel columns includes a plurality of pixels. A plurality of first data lines are disposed within the primary displaying region **111**, and each of the first data lines is connected to the driving circuit of one of the pixel columns to provide a data signal for this pixel column.

[0073] As an example, as shown in FIG. **6**, the primary screen **110** includes the primary displaying region **111** that is circular and an annular first non-displaying region **112** that surrounds the primary displaying region **111**, the plurality of pixels within the primary displaying region **111** form a plurality of pixel columns that extend in the illustrated vertical direction, and the first data lines also extend in the illustrated vertical direction.

[0074] First connecting lines are disposed inside the primary screen **110**, one end of each of the first connecting lines is connected to the driving chip **150**. and the other ends of the first connecting lines are connected to the first data lines, to transmit the data signals emitted by the driving chip **150** to the first data lines via the first connecting lines.

[0075] A plurality of first data lines are disposed within the primary displaying region **111**, and correspondingly a plurality of first connecting lines may be disposed with each first connection line corresponding one-to-one with a first data line.

[0076] The quantity of the first connecting lines may also be less than the quantity of the first data lines, to reduce the border frame of the primary screen **110**.

[0077] As an example, a data selecting circuit (Multiplexer, referred to for short as MUX) is disposed between the driving region **140** and the primary displaying region **111** of the primary

screen **110** (for example, the first non-displaying region **112**), and the first connecting lines are connected to the first data lines via the MUX. For example, the data selecting circuit is a 1:6MUX, and accordingly the quantity of the first connecting lines is equal to ⅙ of the quantity of the first data lines. In addition, after disposing the data selecting circuit, the power consumption of the displaying device can be reduced. Moreover, after disposing the data selecting circuit. the requirement on the quantity of the data-signal outputting channels of the driving chip **150** can be reduced, so that the selection range of the driving chip **150** is broader.

[0078] When the data selecting circuit is disposed inside the primary screen **110**, the data selecting circuit may be located within the region of the illustrated lower semicircle of the first non-displaying region **112**.

[0079] Furthermore, a gate driving circuit **124** (Gate On Array, referred to for short as GOA) and signal lines such as VDD, VSS and Vinit may further be disposed within the first non-displaying region **112**.

[0080] In some examples, a test circuit (Cell Test, referred to for short as CT) may further be disposed within the first non-displaying region **112**. The performance of the primary screen **110** is tested by using the test circuit, when the test passes, the driving chip **150** is bonded within the driving region **140**. The test circuit may be located within the region of the upper semicircle of the first non-displaying region **112**.

[0081] An auxiliary displaying region is disposed inside the auxiliary screen **120**, a plurality of pixels arranged in an array are disposed within the auxiliary displaying region, and the plurality of pixels cooperate with each other to display images. The plurality of pixels arranged in an array within the auxiliary displaying region form a plurality of pixel columns, and each of the pixel columns includes a plurality of pixels. A plurality of second data lines **122** are disposed within the auxiliary displaying region, and each of the second data lines **122** is connected to the driving circuit of one of the pixel columns to provide a data signal for this pixel column.

[0082] Second connecting lines **123** are disposed inside the display panel **100**, one end of each of the second connecting lines **123** is connected to the driving chip **150**, and the other ends of the second connecting lines **123** are connected to the second data lines **122** passing through the connecting region **130** to make the data signals emitted by the driving chip **150** to be transmitted to the second data lines **122** via the second connecting lines **123**.

[0083] In the embodiments of the present application, the second connecting lines **123** configured for providing the data signals for the pixels in the auxiliary screen **120** enter the primary screen **110** via the connecting region **130**, so that the first connecting lines configured for providing the data signals for the pixels in the primary screen **110** can be converged with the second connecting lines **123**, and in turn be connected to the driving chip **150**. In other words, the primary screen **110** and the auxiliary screen **120** can share the driving chip **150**, as compared with the case where the primary screen **110** and the auxiliary screen **120** are individually provided with a driving chip **150**, the quantity of the driving chips **150** is reduced, and the power consumption is reduced.

[0084] As an example, the displaying device is provided with one driving chip **150**, and the driving chip **150** provides the data signals for both of the primary screen **110** and the auxiliary screen **120** at the same time. For example, the outputting ports located within a middle region of the driving chip **150** are connected to the first connecting lines, and the outputting ports located within the regions at the two sides of the driving chip **150** are connected to the second connecting lines **123**.

[0085] When the auxiliary screen **120** is a strip-shaped screen. the plurality of pixels included by each of the pixel columns are arranged in the extending direction of the first edge **121**, and the second data lines **122** extend in the direction of the pixel columns, and are configured for that each of the second data lines **122** provides data signals to the pixels in one of the pixel columns. That the pixels in the pixel columns are arranged in the extending direction of the first edge **121** refers to that the arranging direction of the pixels is substantially the same as the extending direction of the first edge **121**, which includes both that the arranging direction of the pixels and the extending

direction of the first edge **121** are parallel, and that there is a certain included angle between the arranging direction of the pixels and the extending direction of the first edge **121**.

[0086] Because the auxiliary screen **120** is a strip-shaped screen, the size of the auxiliary screen **120** in the extending direction of the first edge **121** is significantly greater than the size of the auxiliary screen **120** in the direction perpendicular to the first edge **121**. In other words, the quantity of the pixels arranged in the extending direction of the first edge **121** is high, and the quantity of the pixels arranged in the direction perpendicular to the first edge **121** is low. The pixel columns extend in the direction of the first edge **121**, so that the quantity of the pixels in each of the pixel columns is high, and the quantity of the pixel columns is low. Therefore, the quantity of the second data lines **122** that correspond to the pixel columns is low.

[0087] In an aspect, a low quantity of the second data lines **122** can result in a low quantity of the second connecting lines **123** connected to the second data lines **122**, and a low quantity of the second connecting lines **123** can result in a low size of the connecting region **130**, so as to facilitate the relative bending of the primary screen **110** and the auxiliary screen **120**. When the second connecting lines **123** are wired within the first non-displaying region **112** inside the primary screen **110**, the lesser second connecting lines **123** can reduce the area of the first non-displaying region **112**, thus the border frame of the primary screen **110** is reduced to increase the screen-to-body ratio of the primary screen **110**.

[0088] In another aspect, a low quantity of the second data lines **122** can result in a low quantity of the second connecting lines **123** connected to the second data lines **122**, and a low quantity of the second connecting lines **123** can reduce the restriction on the quantity of the outputting channels of the driving chip **150**, so that the primary screen **110** and the auxiliary screen **120** can be driven simultaneously by using one driving chip **150**. and the power consumption is reduced.

[0089] FIG. **7** is a partially enlarged view of the I in FIG. **6**. As an example, as shown in FIG. **7**, each of the circles in the figure represents one pixel, and the pixels inside the dotted-line block are a part of one pixel column C. It can be known from FIG. **7** that, when the pixels in the pixel column C are arranged in the extending direction of the first edge **121**, the quantity of the pixel columns is low.

[0090] The plurality of pixels inside the auxiliary screen **120** may also form a plurality of pixel rows, and the plurality of pixels in the pixel rows are arranged in a second direction. The second direction intersects with the extending direction of the first edge **121**. As an example, the second direction is perpendicular to the extending direction of the first edge **121**. Referring continuously to FIG. **7**, in the direction perpendicular to the first edge **121** in the figure, every three pixels form one pixel row.

[0091] When the auxiliary screen **120** is bent to form the ring-shaped screen. the plurality of pixels in the pixel rows may be arranged in the radial directions of the round ring.

[0092] FIG. **7** shows the case where the auxiliary screen **120** includes three pixel columns. In practical applications, the quantity of the pixel columns may be greater than three. For example, the resolution of the auxiliary screen **120** is 72*1260; in other words, the auxiliary screen **120** includes 72 pixel columns and 1260 pixel rows.

[0093] In practical applications, when one pixel column includes a high quantity of pixels, the displaying brightnesses of the different pixels in the same pixel column are different, which results in nonuniformity of the displaying brightness of the auxiliary screen **120**. Moreover, as restricted by the driving capability of the driving chip **150**, when one pixel column includes a high quantity of pixels, a part of the driving chip **150** cannot drive normally.

[0094] FIG. **8** is a partially enlarged view of the II in FIG. **6**. As shown in FIG. **8**, the second data lines **122** may be broken at a first position to form first data sub-lines **122***a* and second data sub-lines **122***b*, some of the second connecting lines **123** are connected to the first data sub-lines **122***a*, and some of the second connecting lines **123** are connected to the second data sub-lines **122***b*.

[0095] The first data sub-lines **122***a* are connected to some of the pixels in one pixel column, and

the second data sub-lines **122***b* are connected to the remaining pixels in this pixel column, so that both of the quantity of the pixels connected to the first data sub-lines **122***a* and the quantity of the pixels connected to the second data sub-lines **122***b* are less than the quantity of the pixels included by one pixel column. The first data sub-lines **122***a* are connected to one outputting port of the driving chip **150** via one of the second connecting lines **123**, and the second data sub-lines **122***b* are connected to another outputting port of the driving chip **150** via another second connecting line **123**. The nonuniform displaying of the auxiliary screen **120** is improved, and the driving chip **150** is enabled to normally drive the pixels connected to the first data sub-lines **122***a* and the pixels connected to the second data sub-lines **122***b*.

[0096] In other words, the auxiliary displaying region of the auxiliary screen includes a first region and a second region, and the first region and the second region are driven separately. As an example, as shown in FIG. **9**, the resolution of the primary displaying region **111** is 384*384, the resolution of the auxiliary screen is 24*1260, the resolution of the first region **120***a* of the auxiliary screen is 24*630, the resolution of the second region **120***b* is 24*630, and the driving chip simultaneously drives the primary displaying region **111**, the first region **120***a* and the second region **120***b*.

[0097] Each of the second data lines **122** may be broken at a certain position, to form one first data sub-line **122***a* and one second data sub-line **122***b*. The breaking positions of the different second data lines **122** may be the same, and may also be different.

[0098] Further, the first position may be the center position of the second data line **122**. The second data line **122** is broken at the center position of the second data line **122**, so that the lengths of the first data sub-line **122***a* and the second data sub-line **122***b* are equal. Thus the quantity of the pixels connected to the first data sub-line **122***a* and the quantity of the pixels connected to the second data sub-line **122***b* are substantially equal, so that the auxiliary screen **120** has a better uniformity of displaying.

[0099] Certainly, the first position may also not be the center position of the second data line **122**, as long as the driving chip **150** can normally drive the pixels connected to the first data sub-line **122***a* and the second data sub-line **122***b*.

[0100] Referring continuously to FIG. **8**, at the breaking position, the second data lines **122** form first ends located at the first data sub-lines **122***a* and second ends located at the second data sub-lines **122***b*. The first position is adjacent to the connecting region **130**, some of the second connecting lines **123** are connected to the first ends, and some of the second connecting lines **123** are connected to the second ends.

[0101] Because the second connecting lines **123** pass through the connecting region **130**, enter the auxiliary screen **120**, and subsequently are connected to the second data lines **122** inside the auxiliary screen **120**, the breaking position is adjacent to the connecting region **130**, making it more convenient to connect the second connecting lines **123** with the first data sub-lines **122***a* and the second data sub-lines **122***b*.

[0102] In practical applications, the auxiliary screen **120** further includes a second non-displaying region surrounding the auxiliary displaying region, and the second connecting lines **123** may also enter the auxiliary screen **120** via the connecting region **130**, be wired within the second non-displaying region, and subsequently be connected to the first data sub-lines **122***a* and the second data sub-lines **122***b* at a proper position. For example, the second connecting lines **123** are connected to the first data sub-lines **122***a* and the second data sub-lines **122***b* at the two ends of the auxiliary screen **120**.

[0103] The auxiliary screen **120** includes a substrate, a driving circuit and a light emitting device, the driving circuit and the light emitting device are arranged sequentially in layer configuration on the substrate, the driving circuit includes a first conducting layer and a second conducting layer that are arranged in different layers, the second data lines **122** are located at the first conducting layer, a part of the wiring of the second connecting lines **123** is located at the second conducting layer, and

the second connecting lines **123** and the second data lines **122** are connected through via holes. In this way, the second connecting lines **123** and the second data lines **122** can be connected more conveniently.

[0104] As an example, the display panel **100** includes a substrate, a driving-circuit layer and a light-emitting-device layer, the driving-circuit layer and the light-emitting-device layer are arranged sequentially in layer configuration on the substrate. The driving circuit may be of a double-SD-layer structure, which includes a first SD layer and a second SD layer (the first conducting layer), the second data lines **122** are located at the second SD layer, a third SD layer (the second conducting layer) may be disposed inside the display panel **100**, the third SD layer is located at the side of the second SD layer away from the first SD layer, and the second connecting lines **123** are located at the third SD layer.

[0105] Because both of the primary screen **110** and the auxiliary screen **120** are a part of the display panel **100**, the film-layer structures of the primary screen **110** and the auxiliary screen **120** may be the same. In other words, the primary screen **110** also includes a substrate, a driving circuit and a light emitting device, the driving circuit and the light emitting device are arranged sequentially in layer configuration on the substrate, the substrate of the primary screen **110** and the substrate of the auxiliary screen **120** are of an integral structure, the driving-circuit layer of the primary screen **110** and the driving-circuit layer of the auxiliary screen **120** are arranged in the same layer, and the light-emitting-device layer of the primary screen **110** and the light-emitting-device layer of the auxiliary screen **120** are arranged in the same layer.

[0106] The driving circuit includes a third conducting layer, and a part of the wiring of the second connecting lines **123** is located at the third conducting layer. The third conducting layer of the primary screen **110** and the second conducting layer of the auxiliary screen **120** may be the same layer. In other words, the driving circuit inside the primary screen **110** is also of a double-SD-layer structure, which includes a first SD layer and a second SD layer, and the first data lines are located at the second SD layer. A third SD layer (the third conducting layer) may be disposed inside the display panel **100**, the third SD layer is located at the side of the second SD layer away from the first SD layer, and the second connecting lines **123** are located at the third SD layer.

[0107] In this way, the second connecting lines **123** can pass through the primary displaying region **111** of the primary screen **110** and enter the connecting region **130**, to result in a shorter wiring of the second connecting lines **123**, to reduce the consumption. Moreover, because wiring within the first non-displaying region **112** is not required, the screen-to-body ratio of the primary screen **110** is high.

[0108] Certainly, a part of the wiring of the second connecting lines **123** may also be located within the first non-displaying region **112**, in this way, the wiring within the primary displaying region **111** can be simpler.

[0109] A data selecting circuit (MUX) may be disposed within the connecting region **130**, and the second connecting lines **123** are connected to the second data lines **122** via the data selecting circuit. When the data selecting circuit is disposed, the power consumption of the displaying device can be reduced. Moreover, after disposing the data selecting circuit, the requirement on the quantity of the data-signal outputting channels of the driving chip **150** can be reduced, so that the selection range of the driving chip **150** is broader. For example, after disposing the data selecting circuit, one driving chip **150** can simultaneously drive the primary screen **110** and the auxiliary screen **120**.

[0110] When a part of the wiring of the second connecting lines **123** is located within the first non-displaying region **112**, by disposing the data selecting circuit, the quantity of the second connecting lines **123** can be reduced. thereby the area of the first non-displaying region **112** is reduced so as to increase the screen-to-body ratio of the primary screen **110**.

[0111] Referring continuously to FIG. **7**, a gate driving circuit **124** is disposed within the second non-displaying region, and the gate driving circuit **124** is located at a second edge of the auxiliary screen **120**, wherein the second edge and the first edge **121** are opposite. When the gate driving

circuit **124** is disposed at the first edge **121**, the size of the border frame located at the first edge **121** is increased, so that the distance between the primary displaying region inside the primary screen and the auxiliary displaying region inside the auxiliary screen is increased, that is, the border frame is large. However, by disposing the gate driving circuit **124** on the edge opposite to the first edge **121**, the distance between the primary displaying region and the auxiliary displaying region can be reduced, the visual effect is better.

[0112] The second conducting layer further includes a signal line, one end of the signal line is configured to be connected to the driving chip **150**, and the other end of the signal line is connected to the gate driving circuit **124** passing through the connecting region **130** and the auxiliary displaying region. As an example, the driving circuit is of a double-SD-layer structure, which includes a first SD layer and a second SD layer, the second data lines are located at the second SD layer, a third SD layer (the second conducting layer) may be disposed inside the display panel **100**, the third SD layer is located at the side of the second SD layer away from the first SD layer, and the signal lines are located at the third SD layer.

[0113] The VSS lines of the primary screen **110** may be disposed within the annular first non-displaying region **112**, and the VSS lines are required to be lap-joined to the cathodes of the light emitting devices. Because the display panel is an abnormal-shaped screen, in order to prevent imperfect of the lap-joining structure caused by deformation of the mask when the cathodes are lap-joined, the cathode lap-joining may be performed within the lower half-ring region of the annular first non-displaying region **112** shown in FIG. **6**.

[0114] The above are merely specific embodiments of the present application, and the protection scope of the present application is not limited thereto. All of the variations or substitutions that a person skilled in the art can easily envisage within the technical scope disclosed by the present application should fall within the protection scope of the present application. Therefore, the protection scope of the present application should be subject to the protection scope of the claims.

Claims

1. A display panel, wherein the display panel comprises a primary screen, an auxiliary screen and a connecting region, the primary screen and the auxiliary screen are connected via the connecting region, and the auxiliary screen at least partially surrounds the primary screen; a primary displaying region is disposed inside the primary screen, a plurality of first data lines are disposed within the primary displaying region, and the first data lines are configured to provide data signals to a plurality of pixels within the primary displaying region; and an auxiliary displaying region is disposed inside the auxiliary screen, a plurality of second data lines are disposed within the auxiliary displaying region, and the second data lines are configured to provide data signals to a plurality of pixels within the auxiliary displaying region; and a plurality of first connecting lines and a plurality of second connecting lines are disposed inside the display panel, and one end of each of the first connecting lines and one end of each of the second connecting lines are electrically connected to a driving chip to obtain data signals of the driving chip; and the other ends of the first connecting lines are connected to the first data lines, and the other ends of the second connecting lines are connected to the second data lines passing through the connecting region.

2. The display panel according to claim 1, wherein the auxiliary screen is a strip-shaped screen, the strip-shaped screen comprises a first edge extending in a length direction, and the first edge at least partially surrounds a periphery of the primary screen.

3. The display panel according to claim 2, wherein the auxiliary displaying region comprises a plurality of pixel columns, and a plurality of pixels comprised by each of the plurality of pixel columns are arranged in an extending direction of the first edge; and the second data lines extend in a direction of the pixel columns, and are configured for that each of the second data lines provides data signals to the pixels in one of the pixel columns.

4. The display panel according to claim 3, wherein the second data lines are broken at a first position, to form first data sub-lines and second data sub-lines, some of the second connecting lines are connected to the first data sub-lines, and some of the second connecting lines are connected to the second data sub-lines.

5. The display panel according to claim 4, wherein at the first position, the second data lines form first ends located at the first data sub-lines and second ends located at the second data sub-lines; and the first position is adjacent to the connecting region, some of the second connecting lines are connected to the first ends, and some of the second connecting lines are connected to the second ends.

6. The display panel according to claim 5, wherein the auxiliary screen comprises a substrate, a driving circuit and a light emitting device, the driving circuit and the light emitting device are arranged sequentially in layer configuration on the substrate, the driving circuit comprises a first conducting layer and a second conducting layer that are arranged in different layers, the second data lines are located at the first conducting layer, a part of wiring of the second connecting lines is located at the second conducting layer, and the second connecting lines and the second data lines are connected through via holes.

7. The display panel according to claim 1, wherein a first non-displaying region surrounding the primary displaying region is disposed inside the primary screen, the first non-displaying region is connected to the connecting region, and a part of wiring of the second connecting lines is located within the first non-displaying region.

8. The display panel according to claim 1, wherein a part of wiring of the second connecting lines is located within the primary displaying region.

9. The display panel according to claim 8, wherein the primary displaying region comprises a substrate, a driving circuit and a light emitting device, the driving circuit and the light emitting device are arranged sequentially in layer configuration on the substrate, the driving circuit comprises a third conducting layer, and a part of the wiring of the second connecting lines is located at the third conducting layer.

10. The display panel according to claim 1, wherein a data selecting circuit is disposed within the connecting region, and the second connecting lines are connected to the second data lines via the data selecting circuit.

11. The display panel according to claim 6, wherein the auxiliary displaying region comprises a plurality of pixel rows, and a plurality of pixels comprised by each of the pixel rows are arranged in a second direction, wherein the second direction intersects with the extending direction of the first edge; and a second non-displaying region surrounding the auxiliary displaying region is disposed inside the auxiliary screen, a gate driving circuit is disposed within the second non-displaying region, and the gate driving circuit is located at a second edge of the auxiliary screen, wherein the second edge and the first edge are opposite.

12. The display panel according to claim 11, wherein the second conducting layer further comprises a signal line, one end of the signal line is configured to be connected to the driving chip, and the other end of the signal line is connected to the gate driving circuit passing through the connecting region and the auxiliary displaying region.

13. The display panel according to claim 11, wherein the auxiliary screen is a ring-shaped screen, and the plurality of pixels in the pixel rows are arranged in radial directions of the auxiliary screen.

14. A displaying device, wherein the displaying device comprises the display panel claim 1.

15. The displaying device according to claim 14, wherein the connecting region of the display panel is bent, and there is a predetermined included angle between a light-exiting surface of the primary screen and a light-exiting surface of the auxiliary screen.

16. The displaying device according to claim 14, wherein the auxiliary screen is a strip-shaped screen, the strip-shaped screen comprises a first edge extending in a length direction, and the first edge at least partially surrounds a periphery of the primary screen.

17. The displaying device according to claim 16, wherein the auxiliary displaying region comprises a plurality of pixel columns, and a plurality of pixels comprised by each of the plurality of pixel columns are arranged in an extending direction of the first edge; and the second data lines extend in a direction of the pixel columns, and are configured for that each of the second data lines provides data signals to the pixels in one of the pixel columns.

18. The displaying device according to claim 17, wherein the second data lines are broken at a first position, to form first data sub-lines and second data sub-lines, some of the second connecting lines are connected to the first data sub-lines, and some of the second connecting lines are connected to the second data sub-lines.

19. The displaying device according to claim 18, wherein at the first position, the second data lines form first ends located at the first data sub-lines and second ends located at the second data sub-lines; and the first position is adjacent to the connecting region, some of the second connecting lines are connected to the first ends, and some of the second connecting lines are connected to the second ends.

20. The displaying device according to claim 19, wherein the auxiliary screen comprises a substrate, a driving circuit and a light emitting device, the driving circuit and the light emitting device are arranged sequentially in layer configuration on the substrate, the driving circuit comprises a first conducting layer and a second conducting layer that are arranged in different layers, the second data lines are located at the first conducting layer, a part of wiring of the second connecting lines is located at the second conducting layer, and the second connecting lines and the second data lines are connected through via holes.