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### Display module, method for disassembling/assembling thereof, and display device

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#### Abstract

A display module includes: a display substrate, having a display side and a back side opposite the display side; and a support assembly, stacked on the back side and including a support element, a first magnetic element and a drive element, wherein the first magnetic element and the drive element are both disposed on the support element, and the first magnetic element is connected to the drive element; wherein the first magnetic element is configured to be connected to a second magnetic element in a casing, and the drive element is configured to change a position of the first magnetic element relative to the support element.

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References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
10495255	12/2018	Brashnyk	N/A	F16B 5/02
10653021	12/2019	Kim	N/A	G09F 9/3026
10653023	12/2019	Habeck	N/A	H05K 5/0217
10658099	12/2019	Habeck	N/A	H05K 5/0021
11706882	12/2022	Kim	361/730	H05K 5/0017
11984052	12/2023	Wang	N/A	G09F 9/33
2023/0240108	12/2022	Kim	N/A	G09F 9/3026

FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
203114824	12/2012	CN	N/A
108492717	12/2017	CN	N/A
211103710	12/2019	CN	H05K 6/0217
211103710	12/2019	CN	N/A
112017554	12/2019	CN	N/A
115376417	12/2021	CN	N/A
2009053703	12/2008	JP	N/A
20200144709	12/2019	KR	N/A

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Background/Summary

## CROSS-REFERENCE TO RELATED APPLICATION

(1) This application is a US national phase application based on PCT/CN2021/121972, filed on Sep. 29, 2021, the disclosure of which is incorporated herein by reference in its entirety.

## TECHNICAL FIELD

(2) The present disclosure relates to the field of display and, in particular, relates to a display module, a method for disassembling/assembling thereof and a display device.

## BACKGROUND

(3) A stitching display device is a large size display device formed by stitching a plurality of display modules together, and the display surface of the stitching display device is larger, which can improve the viewing experience of customers. The stitching display device includes a plurality of display modules and a casing, and the plurality of display modules are stitched on the casing, thereby forming a larger size stitching display device.

## SUMMARY

(4) Embodiments of the present disclosure provide display module, a method, a method for disassembling/assembling thereof and a display device. The technical solution is as follows.

(5) In a first aspect, a display module is provided. The display module includes: a display substrate, having a display side and a back side opposite the display side; and a support assembly, stacked on the back side and including a support element, a first magnetic element and a drive element, wherein the first magnetic element and the drive element are both disposed on the support element, and the first magnetic element is connected to the drive element; wherein the first magnetic element is configured to be connected to a second magnetic element in a casing, and the drive element is configured to change a position of the first magnetic element relative to the support element.

(6) In some embodiments, the support element is a rectangular plate, and the support assembly includes four first magnetic elements and two drive elements, the four first magnetic elements being disposed on four corners of the support element respectively, and the two drive elements being disposed on two opposite sides of the support element respectively; wherein one of the two drive elements is connected to two of the four first magnetic elements and the other of the two drive elements is connected to the other two of the four first magnetic elements.

(7) In some embodiments, the drive element is connected to the two first magnetic elements disposed on a side where the drive element is disposed.

(8) In some embodiments, the drive element includes: a first fixed housing, disposed on a side, distal from the display substrate, of the support element, wherein the first fixed housing is fixedly connected to the support element, and the first fixed housing includes a first mounting cavity; a magnet, movably disposed within the first mounting cavity, wherein a moving direction of the magnet is perpendicular to the back side; a connection element, having flexibility and an elongated shape, wherein at least one end of the connection element is connected to the first magnetic element, and the connection element is in contact with a side, distal from the display substrate, of the magnet; and a first elastic resetting element, disposed between the first magnetic element and the first fixed housing, wherein both ends of the first resilient resetting element are abutted against the first magnetic element and the support element respectively.

(9) In some embodiments, the drive element further includes: a guide bar, wherein one end of the guide bar is connected to an end of the connection element, the other end of the guide bar is connected to the first magnetic element, and the first elastic resetting element is sleeved on the guide bar.

(10) In some embodiments, the drive element includes: a second fixed housing, disposed on a side, distal from the display substrate, of the support element, wherein the second fixed housing is fixedly connected to the support element, and the second fixed housing includes a second mounting cavity; a magnetic block, movably disposed within the second mounting cavity, wherein a moving

direction of the magnetic block moving is perpendicular to the back side, and a surface, distal from the display side, of the magnetic block is a bevel surface; a sliding bar, wherein one end of the sliding bar is disposed on the bevel surface and the other end of the sliding bar is connected to the first magnetic element; a second elastic resetting element, disposed between the first magnetic element and the second fixed housing, wherein both ends of the second elastic resetting element are abutted against the first magnetic element and the support element respectively; and a third elastic resetting element, disposed within the second mounting cavity and between the magnetic block and the support element, wherein both ends of the third elastic resetting element are abutted against the magnetic block and the support element respectively.

(11) In some embodiments, a chute is disposed in the bevel surface, and the drive element further includes: a roller, disposed within the second mounting cavity, wherein the roller is connected to one end of the sliding bar, and the roller is disposed in the chute.

(12) In some embodiments, the drive element includes: a motor, disposed on a side, distal from the display substrate, of the support elements; a screw, wherein one end of the screw is coaxially connected to a drive shaft of the motor and the other end of the screw is in threaded to the first magnetic element; and a power supply, electrically connected to the motor.

(13) In some embodiments, the drive element further includes: a control assembly, including a first pin, a second pin, a third pin, a fourth pin, a fifth pin, a sixth pin, a first lead and a second lead, wherein the first lead is electrically connected to the second pin and the power supply, and the second lead is electrically connected to the fifth pin and the power supply; wherein a positive pole of the power supply is electrically connected to the first pin and the sixth pin sequentially, and a negative pole of the power supply is electrically connected to the fourth pin and the third pin sequentially; in the case that the first pin is electrically connected to the second pin, and the fourth pin is electrically connected to the fifth pin, the motor is rotatable in a forward direction; and in the case that the third pin is electrically connected to the second pin, and the fifth pin is electrically connected to the sixth pin, the motor is rotatable in a reverse direction.

(14) In some embodiments, the drive element further includes: a first link, wherein a middle portion of the first link is electrically connected to the second pin, and both ends of the first link are aligned with the first pin and the third pin respectively; two first springs, connected to the first link and disposed between the first pin and the third pin, wherein the second pin is disposed between the two first springs; a second link, wherein a middle portion of the second link is electrically connected to the fifth pin, and both ends of the second link are aligned with the fourth pin and the sixth pin respectively; and two second springs, connected to the second link and disposed between the fourth pin and the sixth pin, wherein the fourth pin is disposed between the two second springs; wherein a magnetic pole of the first link is the same as a magnetic pole of the second link have at an end disposed on an identical side, and the magnetic poles of opposite ends of the first link are opposite.

(15) In some embodiments, a slot hole for the first magnetic element to slide therein is disposed on the support element, and one end of the first magnetic element is disposed in the slot hole.

(16) In some embodiments, the slot hole is an oblong hole, and a length of the slot hole ranges from 10 mm to 20 mm.

(17) In some embodiments, the first magnetic element is an iron nail.

(18) In a second aspect, a method for disassembling/assembling a display module is provided. The method is applicable to disassembling/assembling the display module as described in any one of the above aspects. The method includes: controlling, by the drive element, a position of the first magnetic element relative to the support element, such that the first magnetic element moves out of an initial position, wherein the initial position is a position where the display module is disposed on the casing and magnetically connected to the second magnetic element of the casing; and placing the display module on the casing or removing the display module from the casing.

(19) In a third aspect, a display device is provided. The display device includes a casing and a

plurality of display modules, wherein at least one of the plurality of display modules is the display module as described in any one of the first aspect, and the plurality of display modules are stitched on the casing.

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## Description

### BRIEF DESCRIPTION OF THE DRAWINGS

- (1) In order to describe the technical solutions in the embodiments of the present disclosure more clearly, the following briefly describes the accompanying drawings required for describing the embodiments. Apparently, the accompanying drawings in the following description show merely some embodiments of the present disclosure, and those of ordinary skill in the art can still derive other drawings from these accompanying drawings without creative efforts.
- (2) FIG. 1 is a schematic diagram of a structure of a display module according to an embodiment of the present disclosure;
- (3) FIG. 2 is a schematic diagram of a structure of a support assembly according to an embodiment of the present disclosure;
- (4) FIG. 3 is a schematic diagram of a structure of a display module according to an embodiment of the present disclosure;
- (5) FIG. 4 is a schematic diagram of a structure of a first fixed housing according to an embodiment of the present disclosure;
- (6) FIG. 5 is a schematic diagram of a structure of a drive element according to an embodiment of the present disclosure;
- (7) FIG. 6 is a schematic diagram of a structure of a display module according to an embodiment of the present disclosure;
- (8) FIG. 7 is a schematic diagram of a structure of a display module according to an embodiment of the present disclosure;
- (9) FIG. 8 is a schematic diagram of a structure of a drive element according to an embodiment of the present disclosure;
- (10) FIG. 9 is a schematic diagram of a structure of a drive element according to an embodiment of the present disclosure;
- (11) FIG. 10 is a schematic diagram of a structure of a display module according to an embodiment of the present disclosure;
- (12) FIG. 11 is a schematic diagram of a structure of a drive element according to an embodiment of the present disclosure;
- (13) FIG. 12 is a schematic diagram of a structure of a control assembly according to an embodiment of the present disclosure;
- (14) FIG. 13 is a flowchart of a method for disassembling/assembling a display module according to an embodiment of the present disclosure; and
- (15) FIG. 14 is a schematic diagram of a structure of a display device according to an embodiment of the present disclosure.

### DETAILED DESCRIPTION

- (16) For clearer descriptions of the objectives, technical solutions, and advantages of the present disclosure, the following further describes implementations of the present disclosure in detail with reference to the accompanying drawings.
- (17) In related art, the display module includes a stacked display substrate and a support assembly. The display substrate includes a plurality of components for displaying a screen. The support assembly supports the display substrate, and a first magnetic element is arranged in the support assembly. A second magnetic element is arranged in the casing, and when the display module is mounted on the casing, the position of the first magnetic element is aligned with the position of the

second magnetic element, and the first magnetic element is magnetically connected to the second magnetic element, and the display module is fixed on the casing by magnetic attractive force between the first magnetic element and the second magnetic element.

(18) In order to ensure the stability of the display module, the magnetic attractive force between the first magnetic element and the second magnetic element is larger. In this way, during assembly of the display module, when the display module is close to the casing, the display module is to be instantly attracted to the casing by the magnetic attractive force. The display module is easy to be bumped, resulting in damage to the display module.

(19) FIG. 1 is a schematic diagram of an exploded structure of a display module according to an embodiment of the present disclosure. Referring to FIG. 1, the display module includes a display substrate **10** and a support assembly **20**. The display substrate **10** has a display side **11** and a back side **12** opposite the display side **11**.

(20) The display substrate **10** is arrayed with a plurality of components, the components are disposed on the display side **11** of the display substrate **10**, and the components are at least configured to display a screen.

(21) Exemplarily, the material of the substrate in the display substrate **10** may be any of glass, quartz, polyimide (PI) or printed circuit board, plastic, etc.

(22) Exemplarily, a component **101** is a mini light-emitting diode or a micro light-emitting diode, and the components are bound on the display substrate.

(23) The support assembly **20** is stacked on the back side **12**, and the support assembly **20** includes a support element **201**, a first magnetic element **202**, and a drive element **203**. Both the first magnetic element **202** and the drive element **203** are disposed on the support element **201**, and the first magnetic element **202** is connected to the drive element **203**. The support element **201** is attached to the back side **12**, the first magnetic element **202** is movably connected to the support element **201**, and the drive element **203** is configured to change a position of the first magnetic element **202** relative to the support element **201**.

(24) The support assembly **20** supports the display substrate **10**, and the support element **20** provides a mounting space for the first magnetic element **202** and the driver element **203**.

(25) In the embodiment, there is no magnetic attractive force between the support element **201** and the second magnetic element. In the case that the display module is mounted, the display module is not damage because the display module is not instantly attracted to the casing by the magnetic attractive force between the support element **201** and the second magnetic element.

(26) Exemplarily, the support element **201** may be a metal plate layer. For example, the support element **201** is a die-cast aluminum layer or an aluminum alloy layer.

(27) The first magnetic element **202** is configured to be magnetically connected to the second magnetic element in the casing, and the drive element **203** is configured to change the position of the first magnetic element **202** in the support element **201**.

(28) In the embodiment, the first magnetic element **202** in the display module is magnetically connected to the second magnetic element in the casing. In the case that the display module is mounted, the position of the first magnetic element **202** in the support element **201** is changed by the driving element **203**, such that the position of the first magnetic element **202** is staggered from the position of the second magnetic element in the casing, and the magnetic attractive force between the first magnetic element **202** and the second magnetic element is reduced. In the case that the display module is close to the casing, the display module is not instantly attracted to the casing because of the larger magnetic attractive force, which can reduce the possibility of damage to the display module during the mounting process.

(29) Referring again to FIG. 1, the display module also includes a protective film **30**, a cooling photoresist layer **40**, an adhesive layer **50**, and a circuit connection structure **60**. The protective film **30**, the display substrate **10**, the cooling photoresist layer **40**, the adhesive layer **50**, the support assembly **20**, and the circuit connection structure **60** are sequentially stacked.

(30) The protective film **30** prevents the display side of the display substrate **10** from being cut. The cooling photoresist layer **40** is configured to block the ambient light from the adhesive layer **50** side to avoid affecting the light output of the display module. The bonding layer **50** is configured to connect the support assembly **20** and the cooling photoresist layer **40**. The circuit connection structure **60** is configured to connect to the circuit board on the casing.

(31) Exemplarily, the protective film **30** may be black and a film layer with polyethylene terephthalate as a substrate. Both adjacent components have a protective film **30** between them, thereby avoiding adjacent components from affecting each other and improving the contrast of the display module.

(32) Exemplarily, the cooling photoresist layer **40** may be a black graphite flake doped.

(33) Exemplarily, the adhesive layer **50** may be a foam adhesive layer or an optical clear adhesive layer.

(34) Exemplarily, the circuit connection structure **60** may be an interface switch board (e.g., a multi-port repeater HUB).

(35) Referring again to FIG. 1, the display substrate **10** includes three flexible circuit boards FPC1, FPC2, and FPC3 disposed on the back side **12**, and the first terminal **601**, the second terminal **602**, and the third terminal **603** in the circuit connection structure **60** are electrically connected to FPC1, FPC2, and FPC3 respectively. The casing has an interface electrically connected to the first terminal **601**, the second terminal **602** and the third terminal **603** in the circuit connection structure **60**, and the casing transmits electrical signals to the display substrate **10** through the circuit connection structure **60**.

(36) Referring again to FIG. 1, the support element **201** has three first openings **212** for FPC1, FPC2, and FPC3 to pass through. The cooling photoresist layer **40** has three second openings **401** for FPC1, FPC2, and FPC3 to pass through.

(37) FIG. 2 is a schematic diagram of a structure of a support assembly according to an embodiment of the present disclosure. Referring to FIG. 2, a shape of the support element **201** is rectangular. In the case that the display modules are stitched on the casing, the side edges of two adjacent display modules can fit together, making the interval between two adjacent display modules smaller, and in the case that the display module displays a screen, the interval between display surfaces is smaller to avoid affecting the display effect of the display device.

(38) Referring again to FIG. 2, the support assembly **20** includes four first magnetic elements **202** and two drive elements **203**. The four first magnetic elements **202** are disposed at the four corners of the support element **201** and the two drive elements **203** are disposed on opposite sides of the support element **201**. One of the two drive elements **203** is connected to two of the four first magnetic elements **202**, and the other of the two drive elements **203** is connected to the other two first magnetic elements **202** of the four first magnetic elements **202**.

(39) In the embodiment, the four first magnetic elements **202** are disposed at the four corners of the support element **201**, and the four first magnetic elements **202** are also disposed at the four corners of the display module, such that the display module can be fixed from the four corners of the display module and tightness of the display module can be ensured. Meanwhile, by controlling two first magnetic elements **202** by one drive element **203**, the quantity of drive elements **203** can be reduced and the structure of the display module can be simplified.

(40) In other embodiments, the support assembly **20** may include other quantities of first magnetic elements **202** and drive elements **203**. For example, the support assembly **20** includes four first magnetic elements **202** and four drive elements **203**, and one drive element **203** is coupled to one first magnetic element **202**.

(41) In some embodiments, two first magnetic elements **202** connected to one drive element **203** are disposed along a first direction a, and the drive element **203** is disposed between the two first magnetic elements **202**. The four first magnetic elements **202** are slidably connected to the support element **201**, and the sliding direction of the four first magnetic elements **202** is parallel to the first

direction a. That is, the driving element **203** is connected to the two first magnetic elements **202** disposed on the side where the driving element is disposed.

(42) In some embodiments, the drive element **203** is disposed on the same side of the support element **201** as the two connected first magnetic elements **202**. A drive element **203** is connected to the two first magnetic elements **202**, and the drive element **203** controls the connected first magnetic elements **202** to slide in the first direction a, thereby changing the position of the first magnetic elements **202** in the support element **201**.

(43) In other embodiments, a drive element **203** may be connected to the two first magnetic elements **202** disposed at opposite corners.

(44) Referring again to FIG. 2, a slot hole **211** for the first magnetic element **202** to slide is disposed on the support element **201**, and one end of the first magnetic element **202** is disposed in the slot hole **211**.

(45) In the embodiment, the slot hole **211** is disposed in the support element **201** and the first magnetic element **202** can slide along the slot hole **211**, thereby controlling the sliding direction of the first magnetic element **202**.

(46) Referring again to FIG. 2, the slot hole **211** is an oblong hole, and a length of the slot hole **211** ranges from 10 millimeters (mm) to 20 mm. The oblong hole is rectangular in the middle of the projection of the back side **12**, and each of the two opposite sides of the rectangle is connected with a semicircle, the diameter of the semicircle is equal to the length of the connected side.

(47) In the embodiment, the first magnetic element **202** slides in the slot hole **211**, defining the length of the slot hole **211**, i.e., defining a path in which the first magnetic element **202** can slide. It is ensured that the position of the first magnetic element **202** in the support element **201** can be changed and a larger slot hole **211** does not need to be arranged.

(48) In some embodiments, the length of the display module ranges from 160 mm to 180 mm and the width of the display module ranges from 140 mm to 160 mm.

(49) Exemplarily, the length of the display module is 170 mm and the width of the display module is 150 mm.

(50) In some embodiments, the material of the first magnetic element **202** may be a tack including a ferromagnetic metal or ferromagnetic alloy material such as iron, nickel, cobalt, ferrous galvanized, stainless steel, etc., and the second magnetic element is a magnet. The magnet has a magnetic attractive force to an iron nail.

(51) FIG. 3 is a schematic diagram of the structure of a display module according to an embodiment of the present disclosure. Referring to FIG. 3, the drive element **203** includes a first fixed housing **231**, disposed on a side, distal from the display substrate **10**, of the support element **201**, and the first fixed housing **231** is fixedly connected to the support element **201**.

(52) FIG. 4 is a schematic diagram of the structure of a first fixed housing according to an embodiment of the present disclosure. Referring to FIG. 4, the first fixed housing **231** includes a first mounting cavity **232**. The drive element **203** further includes a magnet **233**, disposed within the first mounting cavity **232**, the magnet **233** is slidable in the first mounting cavity **232**, and the magnet **233** moves in a direction perpendicular to the display side **11**.

(53) FIG. 5 is a schematic diagram of a structure of a drive element according to an embodiment of the present disclosure. Referring to FIG. 5, the drive element **203** further includes a connection element **234** and a first elastic resetting element **235**. The connection element **234** has flexibility and an elongated shape, at least one end of the connection element **234** is connected to the first magnetic element **202**, and the connection element **234** is in contact with a side, distal from the display substrate **10**, of the magnet **233**. The connection element **234** is flexible, also referred to as flexing. The first elastic resetting element **235** is disposed between the first magnetic element **202** and the first fixed housing **231**, and both ends of the first elastic resetting element **235** are abutted against the first magnetic element **202** and the support element **201** respectively.

(54) In the embodiment, the drive element **203** can be driven by a mounting tool having



magnetism. In the case that no display module is mounted, the magnet **233** is disposed at the bottom of the first mounting cavity **232** under the action of gravity. In the case that the display module needs to be mounted, the mounting tool having magnetism is attached to the display side **11** of the display substrate **10** and makes the two magnets of the same pole are aligned with each other. Under the action of repulsive force, the magnet **233** slides in the first mounting cavity **232** and slides toward the side distal from the display side. In the case that the magnet **233** slides, the magnet **233** pulls the connection element **234** such that the end of the connection element **234** connected to the first magnetic element **202** moves toward the first fixed housing **231**, thereby pulling the first magnetic element **202** to move and changing the position of the first magnetic element **202** in the support element **201**. FIG. **6** is a schematic diagram of the structure of a display module according to an embodiment of the present disclosure. Referring to FIG. **6**, in this case, the first magnetic element **202** is disposed at the end of the slot hole **211** near the first fixed housing **231** under driven by the drive element **203**.

(55) In response to the display module being mounted, the mounting tool is removed from the display side **11**, and the first magnetic element **202** is moved toward the side distal from the first fixed housing **231** under the action of the first elastic resetting element **235**. In this case, the first magnetic element **202** is aligned with the second magnetic element in the casing, and the display module is fixed to the casing by magnetic attractive force.

(56) Referring again to FIG. **5**, the drive element **203** further includes a guide bar **236**. One end of the guide bar **236** is connected to one end of the connection element **234**, the other end of the guide bar **236** is connected to the first magnetic element **202**, and the first elastic resetting element **235** is sleeved on the guide bar **236**.

(57) In some embodiments, the guide bar **236** is arranged to limit the moving direction of the first magnetic element **234**.

(58) Exemplarily, the guide bar **236** extends along the first direction a.

(59) In FIG. **5**, a drive element **203** includes a connection element **234**. Both ends of the connection element **234** is connected to two first magnetic element **234** respectively.

(60) In other embodiments, a drive element **203** includes two connection elements **234**. One end of each connection element **234** is connected to a first magnetic element **202**, and the other end of the connection element **234** is connected to a side, distal from the display substrate **10**, of the magnet **233**.

(61) In some embodiments, the connection element **234** is a wire rope.

(62) In some embodiments, the first elastic element **235** may be a compression spring.

(63) In some embodiments, a channel for the wire rope to slide is arranged in the support element **201**.

(64) FIG. **7** is a schematic diagram of the structure of a display module according to an embodiment of the present disclosure. Referring to FIG. **7**, the drive element **203** includes a second fixed housing **237**, a sliding bar **2311**, and a second elastic resetting element **2312**.

(65) FIG. **8** is a schematic diagram of a structure of a drive element according to an embodiment of the present disclosure. Referring to FIG. **8**, the drive element **203** further includes a magnetic block **239** and a third elastic resetting element **2313**.

(66) The second fixed housing **237** is disposed on a side, distal from the display substrate **10**, of the support element **201**, the second fixed housing **237** is fixedly connected to the support element **201**, and the second fixed housing **237** includes a second mounting cavity **238**. The magnetic block **239** is disposed within the second mounting cavity **238**, and the magnetic block **239** is slidable in the second mounting cavity **238**, and the moving direction of the magnetic block **239** is perpendicular to the display side **11**, and a surface, distal from the display side **11**, of the magnetic block **239** is a bevel surface **2310**. One end of the sliding bar **2311** is disposed on the bevel surface **2310**, and the other end of the sliding bar **2311** is connected to the first magnetic element **202**. The second elastic resetting element **2312** is disposed between the first magnetic element **202** and the second fixed

housing **237**, and both ends of the second elastic resetting element **2312** are abutted against the first magnetic element **202** and the support element **201** respectively. The third elastic resetting element **2313** is disposed within the second mounting cavity **238** and between the magnetic block **239** and the support element **201**, and both ends of the third elastic resetting element **2313** are abutted against the magnetic block **239** and the inner side wall of the second fixed housing **237** respectively.

(67) In the embodiment, the drive element **203** can also be driven by a mounting tool having magnetism. In the case that the display module is not mounted, the magnetic block **239** is disposed on top of the second mounting cavity **238** under the action of the third elastic resetting element **2313**. In the case that the display module needs to be mounted, the mounting tool having magnetism is attached to the display side **11** of the display substrate **10** and makes the two magnets of different poles are aligned with each other. Under the magnetic attractive force, the magnetic block **239** slides in the second mounting cavity **238** and slides toward the side near the display side. In the case that the magnetic block **239** slides, the sliding bar **2311** slides on the bevel surface **2310** and slides in the middle of the magnetic block **239**, such that the sliding bar **2311** pulls the first magnetic element **202** toward the second fixed housing **237**, thereby changing the position of the first magnetic element **202** in the support element **201**. FIG. **8** is a schematic diagram of a structure of a drive element according to an embodiment of the present disclosure. Referring to FIG. **8**, in this case, the first magnetic element **202** is disposed at the end of the slot hole **211** near the second fixed housing **237** driven by the drive element **203**.

(68) Exemplarily, the second elastic resetting element **2312** and the third elastic resetting element **2313** may be compression springs.

(69) FIG. **9** is a schematic diagram of a structure of a drive element according to an embodiment of the present disclosure. Referring to FIG. **9**, in the case that the display module is mounted and the mounting tool is removed from the display side **11**, the first magnetic element **202** is moved toward the side distal from the second fixed housing **237** under the action of the second elastic resetting element **2312**. In this case, the first magnetic element **202** is aligned with the second magnetic element in the casing, and the display module is fixed to the casing by the magnetic attractive force.

(70) Referring again to FIGS. **8** and **9**, the bevel surface **2310** has a chute **2314**. The drive element **203** further includes a roller **2315**. The roller **2315** is disposed within the second mounting cavity **238**, and the roller **2315** is connected to one end of the sliding bar **2311**, and the roller **2315** is disposed in the chute **2314**.

(71) In the embodiment, the roller **2315** is mounted at one end of the sliding bar **2311** to facilitate sliding of the sliding bar **2311**.

(72) One end of the sliding bar **2311** in the second mounting cavity **238** has a roller **2315**, and the roller **2315** can slide on the chute **2314**. In the initial state, the third elastic resetting element **2313** pushes the magnetic block **239** upward, and the roller **2315** interposed between the magnetic block **239** and the second fixed housing **237** cannot slide, such that the end of the sliding bar **2311** is disposed at the side of the second fixed housing **237** in the initial state. In the case that the drive element is mounted, the magnetic block **239** moves downward, the distance between the magnetic block **239** and the second fixed housing **237** increases, the roller **2315** can slide, and the sliding bar **2311** moves toward the middle of the second fixed housing **237**, thus driving the first magnetic element **202** to move.

(73) FIG. **10** is a schematic diagram of the structure of a display module according to an embodiment of the present disclosure. Referring to FIG. **10**, the drive element **203** includes a motor **2316**, a screw **2317**, and a power supply **2318**. The motor **2316** is disposed on a side, distal from the display substrate **10**, of the support element **201**. One end of the screw **2317** is coaxially connected to a drive shaft of the motor **2316**, and the other end of the screw **2317** is threaded to the first magnetic element **202**. The power supply **2318** is electrically connected to the motor **2316**.

(74) In the embodiment, the motor **2316** is configured to control the rotation of the screw **2317**, causing the first magnetic element **202** on the screw **2317** to move.

(75) For example, in the case that the motor **2316** rotates in a forward direction, the screw **2317** rotates in a forward direction, causing the first magnetic element **202** to move toward the middle of the display module. In response to placing the display module on the casing, the motor **2316** is controlled to rotate in a reverse direction and the screw **2317** rotates in a reverse direction, causing the first magnetic element **202** to move toward the edge of the display module, such that the first magnetic element **202** is aligned with the second magnetic element.

(76) Exemplarily, the power supply **2318** may be powered by a printed circuit board or by a button battery.

(77) FIG. **11** is a schematic diagram of the structure of a drive element according to an embodiment of the present disclosure. Referring to FIG. **11**, the drive element **203** further includes a control assembly **2319**.

(78) FIG. **12** is a schematic diagram of the structure of a control assembly according to an embodiment of the present disclosure. Referring to FIG. **12**, the control assembly **2319** includes a first pin **2320**, a second pin **2321**, a third pin **2322**, a fourth pin **2323**, a fifth pin **2324**, and a sixth pin **2325**. Referring again to FIG. **11**, the control assembly **2319** further includes a first lead **2326** and a second lead **2327**, the first lead **2326** is electrically connected to the second pin **2321** and the motor **2316**, and the second lead **2327** is electrically connected to the fifth pin **2324** and the motor **2316**.

(79) A positive pole of the power supply **2318** is electrically connected to the first pin **2320** and the sixth pin **2325** sequentially, and a negative pole of the power supply **2318** is electrically connected to the fourth pin **2323** and the third pin **2322** sequentially. In the case that the first pin **2320** is electrically connected to the second pin **2321** and the fourth pin **2323** is electrically connected to the fifth pin **2324**, the motor **2316** is rotatable in a forward direction. In the case that the third pin **2322** is electrically connected to the second pin **2321**, the fifth pin **2324** is electrically connected to the sixth pin **2325**, the motor **2316** is rotatable in a reverse direction.

(80) In the embodiment, in the case that the power supply is positively energized, the upper part of the electromagnetic coil on the mounting tool is S-pole and the lower part is N-pole, because it is repulsive for like poles and attractive for unlike poles, and the first pin **2320** is connected to the second pin **2321**. The fourth pin **2323** is connected to the fifth pin **2324**, such that the motor is rotatable in the forward direction.

(81) In the case that the power supply is negatively energized, the upper part of the electromagnetic coil on the mounting tool is N-pole and the lower part is S-pole, because it is repulsive for like poles and attractive for unlike poles, and the third pin **2322** is connected to the second pin **2321**. The sixth pin **2325** is connected to the fifth pin **2324**, such that the motor is rotatable in the reverse direction.

(82) Referring again to FIG. **12**, the drive element **203** further includes a first link **2328**, two first springs **2329**, a second link **2330**, and two second springs **2331**.

(83) A middle portion of the first link **2328** is electrically connected to the second pin **2321**, and both ends of the first link **2328** are aligned with the first pin **2320** and the third pin **2322** respectively. The two first springs **2329** are both connected to the first link **2328**, the two first springs **2329** are disposed between the first pin **2320** and the third pin **2322**, and the second pin **2321** is disposed between the two first springs **2329**. A middle portion of the second link **2330** is electrically connected to the fifth pin **2324**, and both ends of the second link **2330** are aligned with the fourth pin **2323** and the sixth pin **2325** respectively. Both second springs **2331** are connected to the second link **2330**, and the two second springs **2331** are disposed between the fourth pin **2323** and the sixth pin **2325**, and the fourth pin **2323** is disposed between the two second springs **2331**.

(84) A magnetic pole of the first link **2328** is the same as a magnetic pole of the second link **2330** at an end disposed on an identical side, and the magnetic poles of opposite ends of the first link **2328**

are opposite. That is, the end of the first link **2328** aligning with the first pin **2320** is S or N pole, the end of the first link **2328** aligning with the third pin **2322** is S or N pole, the end of the second link **2330** aligning with the fourth pin **2323** has the same magnetic pole as the end of the first link **2338** aligning with the first pin **2320**, and the end of the second link **2330** aligning with the sixth pin **2325** has the same magnetic pole as the end of the first link **2328** aligning with the third pin **2322**.

(85) It is explained by the examples that the end of the first link **2328** aligning with the first pin **2320** is N-pole, the end of the first link **2328** aligning with the third pin **2322** is S-pole, the end of the second link **2330** aligning with the fourth pin **2323** is N-pole, and the end of the second link **2330** aligning with the sixth pin **2325** is S-pole.

(86) In the embodiment, both the first link **2328** and the second link **2330** form a lever structure, and in the initial state, the two ends of the first link **2328** are not connected to the first pin **2320** and the third pin **2322**, and the two ends of the second link **2330** are not connected to the fourth pin **2323** and the sixth pin **2325**. In the case that the display module is mounted, the upper part of the electromagnetic coil on the mounting tool is S-pole and the lower part is N-pole, because it is repulsive for like poles and attractive for unlike poles, and the first pin **2320** is connected to the second pin **2321**. The fourth pin **2323** is connected to the fifth pin **2324**, and the motor rotates in the forward direction, causing the first magnetic element **202** to move toward the middle of the display module. In response to the display module being mounted, the magnetism of the mounting tool is changed. The upper part of the electromagnetic coil on the mounting tool is N-pole and the lower part is S-pole, because it is repulsive for like poles and attractive for unlike poles, and the third pin **2322** is connected to the second pin **2321**, the sixth pin **2325** is connected to the fifth pin **2324**, and the motor rotates in the reverse direction, causing the first magnetic element **202** to move toward the edge of the display module.

(87) Embodiments of the present disclosure further provide a method for disassembling/assembling a display module, the method being applicable to stitch the above display module. FIG. **13** is a flowchart of a disassembly method of a display module according to an embodiment of the present disclosure. Referring to FIG. **13**, the method includes the followings.

(88) In step **S1301**, the drive element controls a position of the first magnetic element relative to the support element, such that the first magnetic element moves out of an initial position, wherein the initial position is a position where the display module is disposed on the casing and magnetically connected to the second magnetic element of the casing.

(89) Exemplarily, a mounting tool may be used to control the drive element. The mounting tool may be a suction cup having a magnet, such that the mounting tool can attach the display module.

(90) In step **S1302**, the display module is placed on the casing or removed from the casing.

(91) Exemplarily, the display module is placed at the corresponding position on the case by the mounting tool. In the case that the display module is placed on or removed from the case, the mounting tool can be removed from the display module.

(92) In the embodiments, the first magnetic element in the display module is magnetically connected to the second magnetic element in the casing. In the case that the display module is mounted, the position of the first magnetic element in the support element is changed by the driving element, such that the position of the first magnetic element is staggered from the position of the second magnetic element in the casing, and the magnetic attractive force between the first magnetic element and the second magnetic element is reduced. In the case that the display module is close to the casing, the display module is not instantly attracted to the casing because of the larger magnetic attractive force, which can reduce the possibility of damage to the display module during the mounting process.

(93) The method provided by the embodiment of the present disclosure can be applied to disassemble/assemble a display module having the same type or a plurality of different types, wherein the display substrate in the display module can be any one of a liquid crystal display panel,

an organic electroluminescent display substrate, a quantum dot display substrate, an electronic paper display panel, etc.

(94) Exemplarily, the casing is provided with a mounting region for mounting and fixing the display module. For example, eight display modules (**1-1**, **1-2**, **1-3**, **1-4**, **1-5**, **1-6**, **1-7**, **1-8**) are provided, and the casing has eight mounting regions arranged in two rows and four columns. Firstly, the display module **1-1** is mounted on the mounting region of the first column and second row of the casing, and the position of the display module **1-1** is adjusted, such that the display module **1-1** is firmly mounted on the casing. Secondly, the display module **1-2**, the display module **1-3**, the display module **1-4** are mounted on the corresponding mounting regions of the second row of the casing along the long side of the casing, and the positions of the display module **1-2**, the display module **1-3** and the display module **1-4** are adjusted sequentially. Next, the display module **1-5** is mounted on the mounting region of the casing of the first row and first column, and the position of display module **1-5** is adjusted, such that the display module **1-5** is firmly mounted on the casing. Finally, the display module **1-6**, the display module **1-7**, and the display module **1-8** are mounted on the corresponding mounting regions of the first row of the casing along the long side of the casing, and the positions of the display module **1-6**, the display module **1-7**, and the display module **1-8** are adjusted. Eventually, a stitching display device including 8 display modules is completed by stitching.

(95) Embodiments of the present disclosure further provide a display device. The display device includes a casing and a plurality of display modules, wherein at least one of the plurality of display modules is the display module of any one of above, and the plurality of display modules are stitched on the casing.

(96) FIG. **14** is a schematic diagram of a structure of a display device according to an embodiment of the present disclosure. Referring to FIG. **14**, the display device includes a casing **7** and a plurality of display modules **1**. Any one of the plurality of display modules **1** is a display module **1** of any of the above, and the plurality of display modules **1** are stitched on the casing **7**.

(97) The casing **7** provides a carrying surface for the plurality of display modules **1** for mounting the display modules. The casing **7** has a plurality of second magnetic elements **701**. In the case that the display module **1** is stitched on the casing **7**, the second magnetic elements **701** are positioned aligning with the first magnetic elements, and the display module **1** is fixed to the casing **7** by magnetic attractive force between the first magnetic elements and the second magnetic elements **701**.

(98) In practice, the display device provided by the embodiments of the present disclosure may be any product or assembly with display function, such as a mobile phone, a tablet computer, a television, a display screen, a laptop computer, a digital camera, a navigator, etc.

(99) The above is only an optional embodiment of the present disclosure and is not intended to limit the present disclosure. Any modification, equivalent replacement, improvement, etc. made within the spirit and principles of the present disclosure shall be included in the scope of protection of the present disclosure.

## Claims

1. A display module, comprising: a display substrate, having a display side and a back side opposite the display side; and a support assembly, stacked on the back side and comprising a support element, a first magnetic element and a drive element, wherein the first magnetic element and the drive element are both disposed on the support element, and the first magnetic element is connected to the drive element; wherein the first magnetic element is configured to be connected to a second magnetic element in a casing, and the drive element is configured to change a position of the first magnetic element relative to the support element, the support assembly is configured to support the display substrate, and the support element is configured to provide a mounting space for the first

magnetic element and the driver element.

2. The display module according to claim 1, wherein the support element is a rectangular plate, and the support assembly comprises four first magnetic elements and two drive elements, the four first magnetic elements being disposed on four corners of the support element respectively, and the two drive elements being disposed on two opposite sides of the support element respectively; wherein one of the two drive elements is connected to two of the four first magnetic elements, and the other of the two drive elements is connected to the other two of the four first magnetic elements.

3. The display module according to claim 2, wherein the drive element is connected to the two first magnetic elements disposed on a side where the drive element is disposed.

4. The display module according to claim 1, wherein the drive element comprises: a first fixed housing, disposed on a side, distal from the display substrate, of the support element, wherein the first fixed housing is fixedly connected to the support element, and the first fixed housing comprises a first mounting cavity; a magnet, movably disposed within the first mounting cavity, wherein a moving direction of the magnet is perpendicular to the back side; a connection element, having flexibility and an elongated shape, wherein at least one end of the connection element is connected to the first magnetic element, and the connection element is in contact with a side, distal from the display substrate, of the magnet; and a first elastic resetting element, disposed between the first magnetic element and the first fixed housing, wherein both ends of the first resilient resetting element are abutted against the first magnetic element and the support element respectively.

5. The display module according to claim 4, wherein the drive element further comprises: a guide bar, wherein one end of the guide bar is connected to an end of the connection element, the other end of the guide bar is connected to the first magnetic element, and the first elastic resetting element is sleeved on the guide bar.

6. The display module according to claim 1, wherein the drive element comprises: a second fixed housing, disposed on a side, distal from the display substrate, of the support element, wherein the second fixed housing is fixedly connected to the support element, and the second fixed housing comprises a second mounting cavity; a magnetic block, movably disposed within the second mounting cavity, wherein a moving direction of the magnetic block moving is perpendicular to the back side, and a surface, distal from the display side, of the magnetic block is a bevel surface; a sliding bar, wherein one end of the sliding bar is disposed on the bevel surface, and the other end of the sliding bar is connected to the first magnetic element; a second elastic resetting element, disposed between the first magnetic element and the second fixed housing, wherein both ends of the second elastic resetting element are abutted against the first magnetic element and the support element respectively; and a third elastic resetting element, disposed within the second mounting cavity and between the magnetic block and the support element, wherein both ends of the third elastic resetting element are abutted against the magnetic block and the support element respectively.

7. The display module according to claim 6, wherein a chute is disposed in the bevel surface, and the drive element further comprises: a roller, disposed within the second mounting cavity, wherein the roller is connected to one end of the sliding bar, and the roller is disposed in the chute.

8. The display module according to claim 1, wherein the drive element comprises: a motor, disposed on a side, distal from the display substrate, of the support element; a screw, wherein one end of the screw is coaxially connected to a drive shaft of the motor, and the other end of the screw is in threaded to the first magnetic element; and a power supply, electrically connected to the motor.

9. The display module according to claim 8, wherein the drive element further comprises: a control assembly, comprising a first pin, a second pin, a third pin, a fourth pin, a fifth pin, a sixth pin, a first lead, and a second lead, wherein the first lead is electrically connected to the second pin and the power supply, and the second lead is electrically connected to the fifth pin and the power supply; wherein a positive pole of the power supply is electrically connected to the first pin and the sixth pin sequentially, and a negative pole of the power supply is electrically connected to the fourth pin

and the third pin sequentially; in the case that the first pin is electrically connected to the second pin, and the fourth pin is electrically connected to the fifth pin, the motor is rotatable in a forward direction; and in the case that the third pin is electrically connected to the second pin, and the fifth pin is electrically connected to the sixth pin, the motor is rotatable in a reverse direction.

10. The display module according to claim 9, wherein the drive element further comprises: a first link, wherein a middle portion of the first link is electrically connected to the second pin, and both ends of the first link are aligned with the first pin and the third pin respectively; two first springs, connected to the first link and disposed between the first pin and the third pin, wherein the second pin is disposed between the two first springs; a second link, wherein a middle portion of the second link is electrically connected to the fifth pin, and both ends of the second link are aligned with the fourth pin and the sixth pin respectively; and two second springs, connected to the second link and disposed between the fourth pin and the sixth pin, wherein the fourth pin is disposed between the two second springs; wherein a magnetic pole of the first link is the same as a magnetic pole of the second link at an end disposed on an identical side, and the magnetic poles of opposite ends of the first link are opposite.

11. The display module according to claim 1, wherein a slot hole for the first magnetic element to slide therein is disposed on the support element, and one end of the first magnetic element is disposed in the slot hole.

12. The display module according to claim 11, wherein the slot hole is an oblong hole, and a length of the slot hole ranges from 10 mm to 20 mm.

13. The display module according to claim 1, wherein the first magnetic element is an iron nail.

14. A method for disassembling/assembling a display module, applicable to disassembling/assembling a display module, wherein the display module comprises: a display substrate, having a display side and a back side opposite the display side; and a support assembly, stacked on the back side and comprising a support element, a first magnetic element and a drive element, wherein the first magnetic element and the drive element are both disposed on the support element, and the first magnetic element is connected to the drive element; wherein the first magnetic element is configured to be connected to a second magnetic element in a casing, and the drive element is configured to change a position of the first magnetic element relative to the support element; and the method comprises: controlling, by the drive element, the position of the first magnetic element relative to the support element, such that the first magnetic element moves out of an initial position, wherein the initial position is a position where the display module is disposed on the casing and magnetically connected to the second magnetic element of the casing; and placing the display module on the casing or removing the display module from the casing, the support assembly is configured to support the display substrate, and the support element is configured to provide a mounting space for the first magnetic element and the driver element.

15. A display device, comprising a casing and a plurality of display modules, wherein at least one of the plurality of display modules comprises: a display substrate, having a display side and a back side opposite the display side; and a support assembly, stacked on the back side and comprising a support element, a first magnetic element and a drive element, wherein the first magnetic element and the drive element are both disposed on the support element, and the first magnetic element is connected to the drive element; wherein the first magnetic element is configured to be connected to a second magnetic element in the casing, and the drive element is configured to change a position of the first magnetic element relative to the support element; and the plurality of display modules are stitched on the casing, the support assembly is configured to support the display substrate, and the support element is configured to provide a mounting space for the first magnetic element and the driver element.

16. The display device according to claim 15, wherein the support element is a rectangular plate, and the support assembly comprises four first magnetic elements and two drive elements, the four first magnetic elements being disposed on four corners of the support element respectively, and the

two drive elements being disposed on two opposite sides of the support element respectively; wherein one of the two drive elements is connected to two of the four first magnetic elements, and the other of the two drive elements is connected to the other two of the four first magnetic elements.

17. The display device according to claim 16, wherein the drive element is connected to the two first magnetic elements disposed on a side where the drive element is disposed.

18. The display device according to claim 15, wherein the drive element comprises: a first fixed housing, disposed on a side, distal from the display substrate, of the support element, wherein the first fixed housing is fixedly connected to the support element, and the first fixed housing comprises a first mounting cavity; a magnet, movably disposed within the first mounting cavity, wherein a moving direction of the magnet is perpendicular to the back side; a connection element, having flexibility and an elongated shape, wherein at least one end of the connection element is connected to the first magnetic element, and the connection element is in contact with a side, distal from the display substrate, of the magnet; and a first elastic resetting element, disposed between the first magnetic element and the first fixed housing, wherein both ends of the first resilient resetting element are abutted against the first magnetic element and the support element respectively.

19. The display device according to claim 18, wherein the drive element further comprises: a guide bar, wherein one end of the guide bar is connected to an end of the connection element, the other end of the guide bar is connected to the first magnetic element, and the first elastic resetting element is sleeved on the guide bar.

20. The display device according to claim 15, wherein the drive element comprises: a second fixed housing, disposed on a side, distal from the display substrate, of the support element, wherein the second fixed housing is fixedly connected to the support element, and the second fixed housing comprises a second mounting cavity; a magnetic block, movably disposed within the second mounting cavity, wherein a moving direction of the magnetic block moving is perpendicular to the back side, and a surface, distal from the display side, of the magnetic block is a bevel surface; a sliding bar, wherein one end of the sliding bar is disposed on the bevel surface, and the other end of the sliding bar is connected to the first magnetic element; a second elastic resetting element, disposed between the first magnetic element and the second fixed housing, wherein both ends of the second elastic resetting element are abutted against the first magnetic element and the support element respectively; and a third elastic resetting element, disposed within the second mounting cavity and between the magnetic block and the support element, wherein both ends of the third elastic resetting element are abutted against the magnetic block and the support element respectively.

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