US010158074B2

(12) **United States Patent**
Cho et al.

(10) **Patent No.: US 10,158,074 B2**
(45) **Date of Patent: Dec. 18, 2018**

(54) **ORGANIC LAYER DEPOSITION ASSEMBLY, ORGANIC LAYER DEPOSITION DEVICE INCLUDING THE SAME, AND METHOD OF MANUFACTURING ORGANIC LIGHT-EMITTING DISPLAY DEVICE USING THE ORGANIC LAYER DEPOSITION ASSEMBLY**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/390,908**

(22) Filed: **Dec. 27, 2016**

(65) **Prior Publication Data**

US 2017/0186954 A1 Jun. 29, 2017

(30) **Foreign Application Priority Data**

Dec. 24, 2015 (KR) 10-2015-0186769

(51) **Int. Cl.**

H01L 51/56	(2006.01)
H01L 51/00	(2006.01)

(Continued)

(52) **U.S. Cl.**
CPC ***H01L 51/0011*** (2013.01); ***B05B 12/22*** (2018.02); ***B05D 1/32*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC H01L 51/0011; H01L 51/56; H01L 51/50; B05B 15/0443; B05B 15/045; B05B 9/01;
(Continued)

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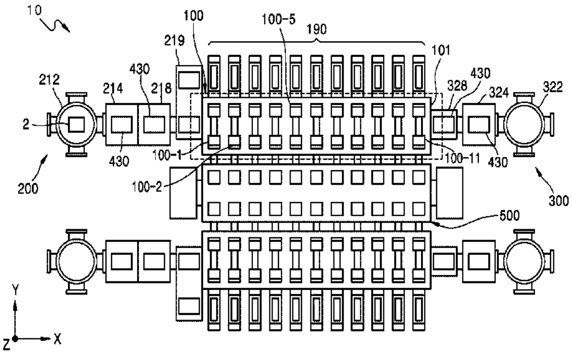
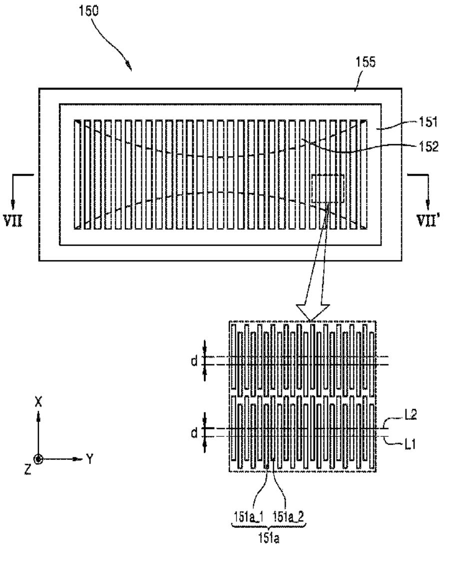
(57) ABSTRACT

An organic layer deposition assembly for depositing a deposition material on a substrate includes a deposition source configured to spray the deposition material, a deposition source nozzle arranged in one side of the deposition source and including deposition source nozzles arranged in a first direction, a patterning slit sheet arranged to face the deposition source nozzle and having patterning slits in a second direction that crosses the first direction, and a correction sheet arranged between the deposition source nozzle and the patterning slit sheet and configured to block at least a part of the deposition material sprayed from the deposition source.

5 Claims, 10 Drawing Sheets





(51) **Int. Cl.**

B05D 1/00	(2006.01)
B05D 1/32	(2006.01)
C23C 14/04	(2006.01)
B05B 12/22	(2018.01)
B05B 12/36	(2018.01)

(52) **U.S. Cl.**
CPC ***B05D 1/60*** (2013.01); ***C23C 14/042*** (2013.01); ***H01L 51/56*** (2013.01); *B05B 12/36* (2018.02)

(58) **Field of Classification Search**
CPC B05B 12/22; B05B 12/36; B05D 1/32; B05D 1/60; C23C 14/044; C23C 14/042
See application file for complete search history.

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FIG. 1

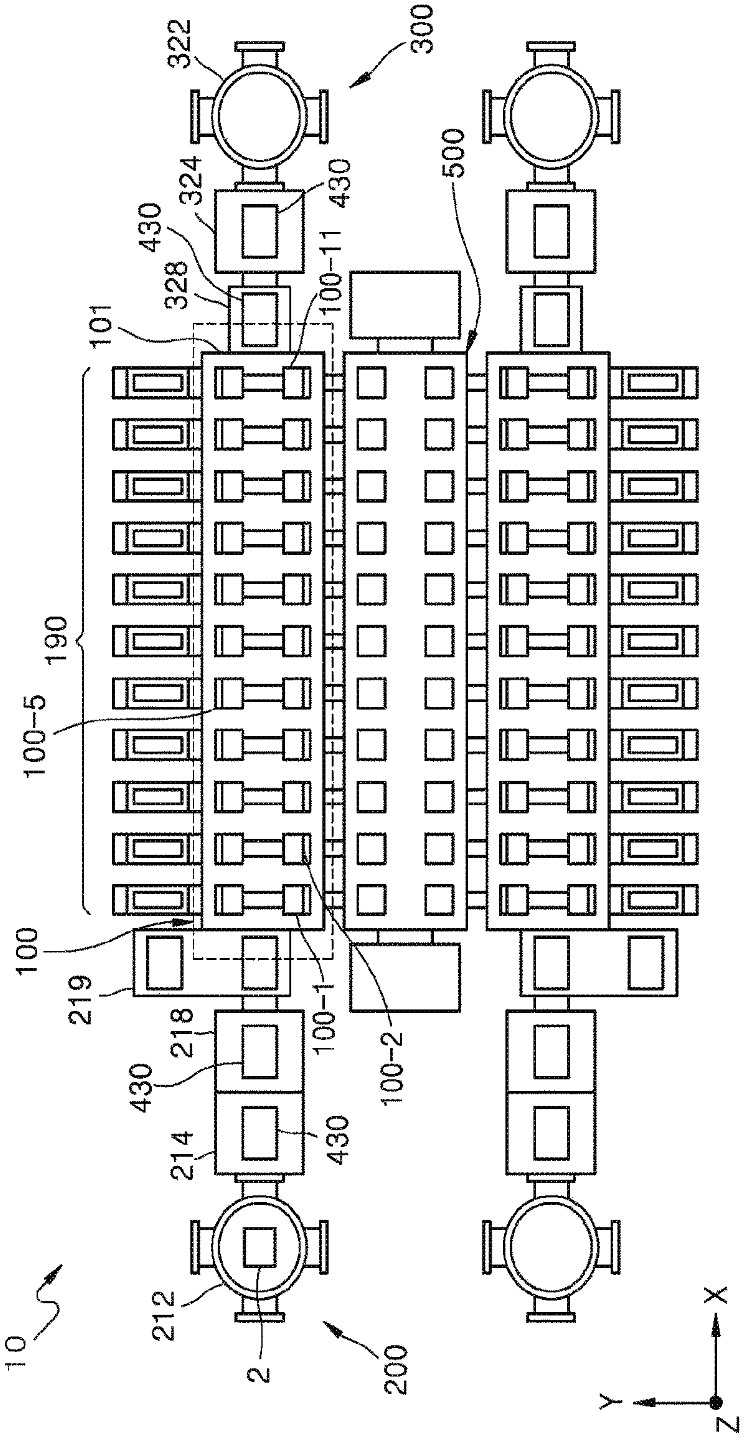

322
300
324
430
430
500
328
100-11
101
190
100-5
100
219
218
430
100-1
100-2
214
430
212
2
200
10
X
Y
Z

FIG. 2

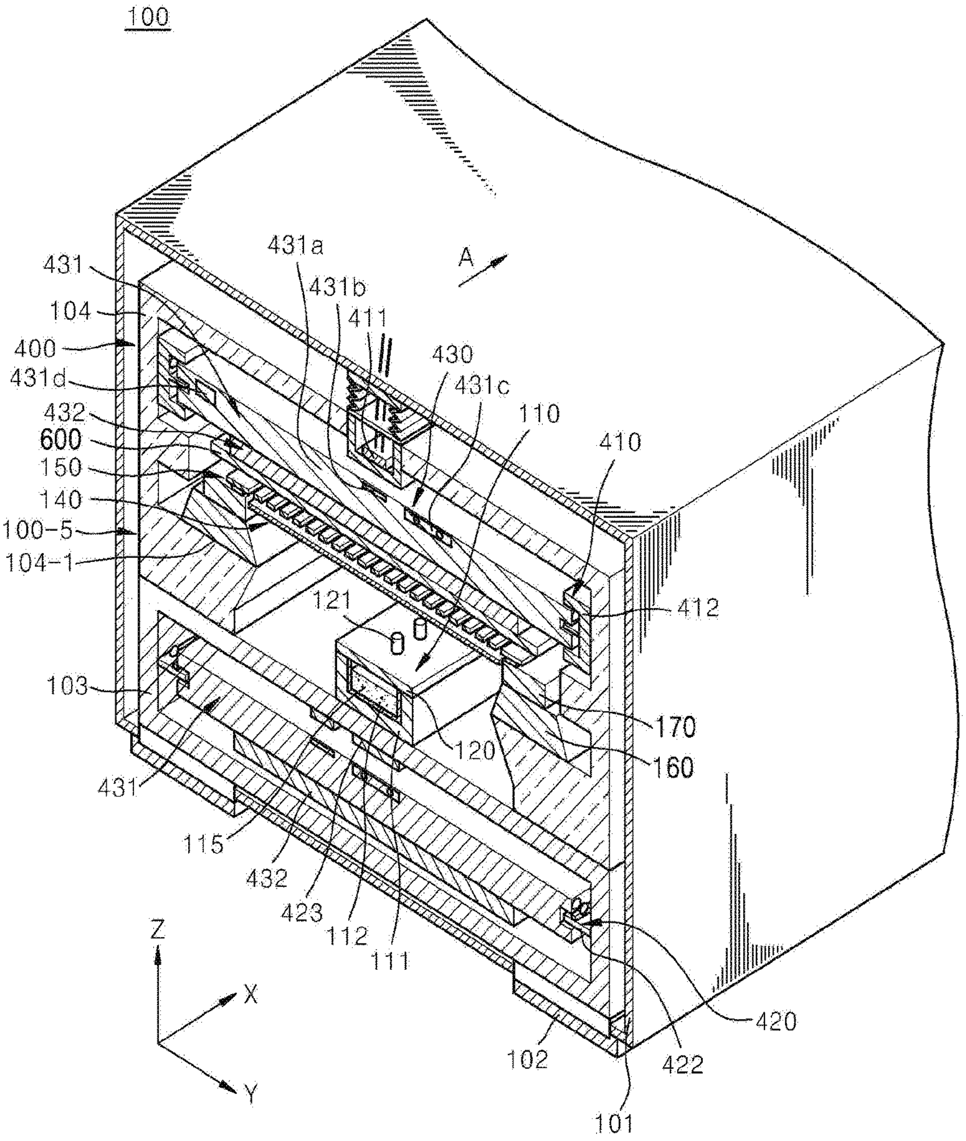

100
431
104
400
431d
432
600
150
140
100-5
104-1
103
431
115
432
423
112
111
431a
431b
411
A
430
431c
110
410
412
121
120
170
160
Z
X
Y
102
101
422
420

FIG. 3

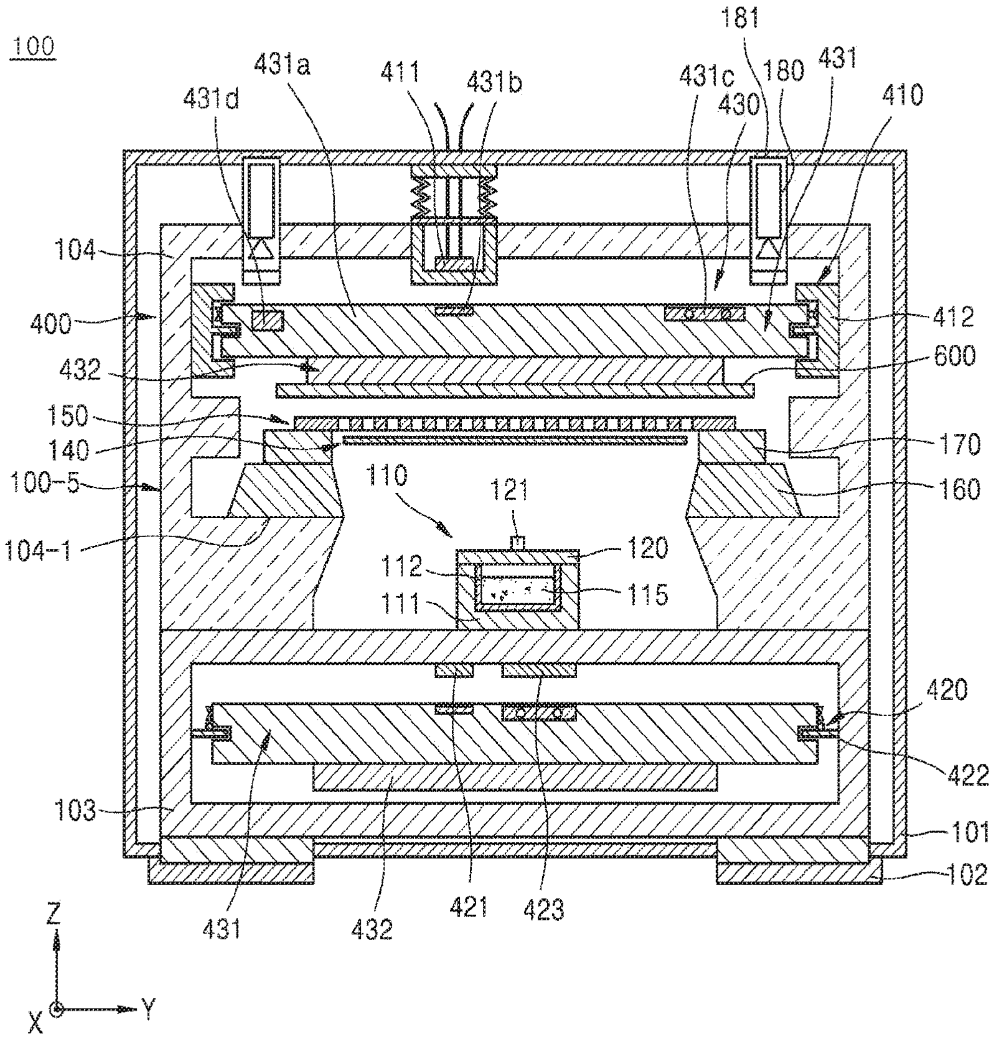

100
181
431a
411
431b
431c
180
431
410
430
431d
104
400
412
432
600
150
140
170
100-5
160
110
121
104-1
120
112
115
111
420
422
103
101
102
431
432
421
423
Z
Y
X

FIG. 4

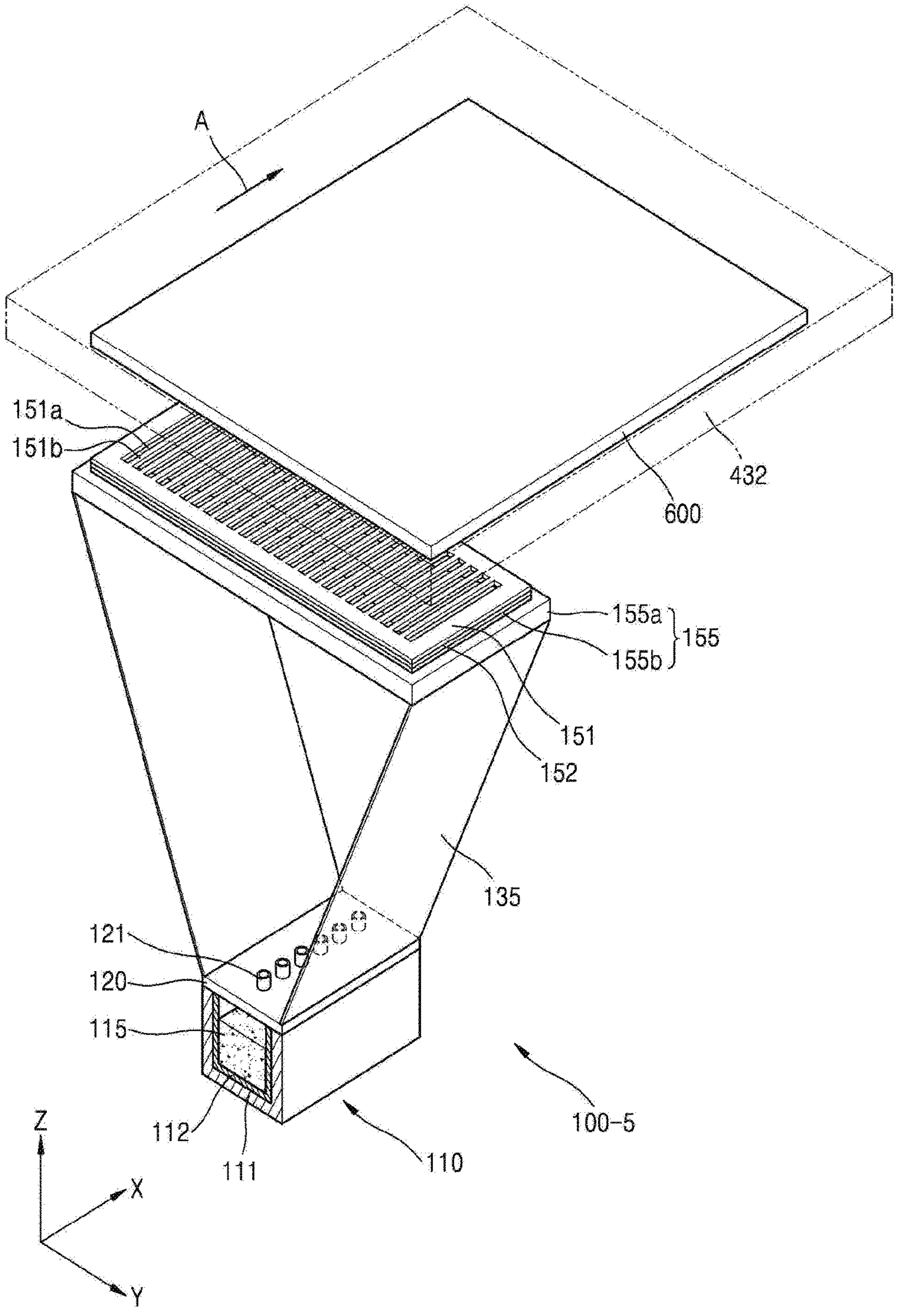

A
151a
151b
432
600
155a
155
155b
151
152
135
121
120
115
112
111
110
100-5
Z
X
Y

FIG. 5

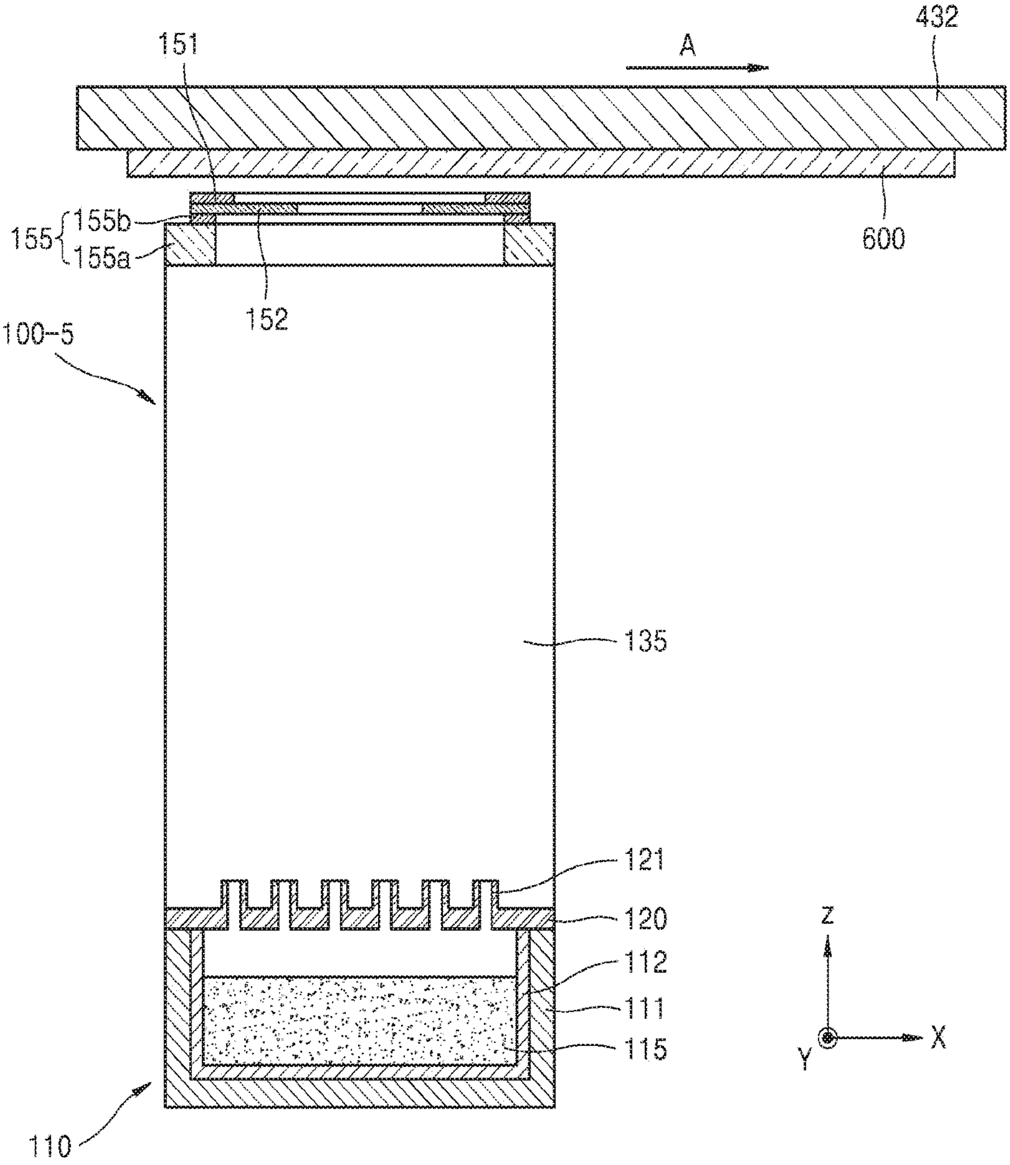

432
A
151
155b
155
155a
600
152
100-5
135
121
120
112
111
115
Z
X
Y
110

FIG. 6

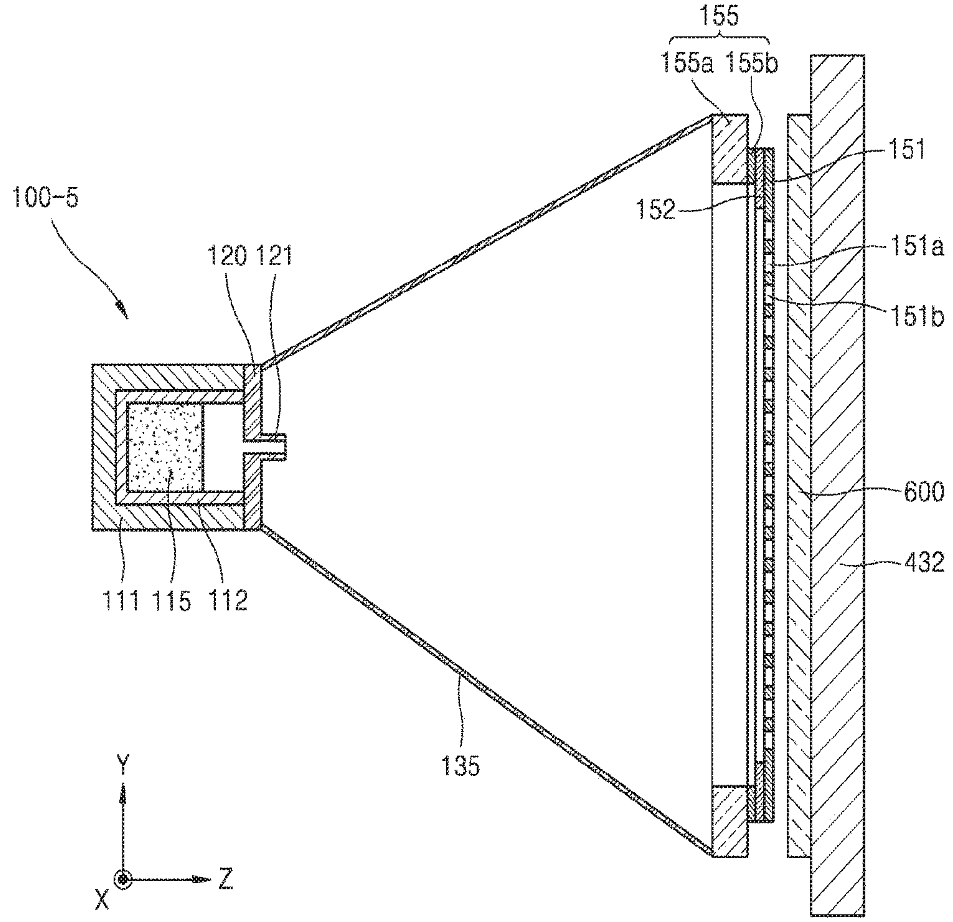

155
155a 155b
151
152
151a
151b
600
432
100-5
120 121
111 115 112
135
Y
Z
X

FIG. 7

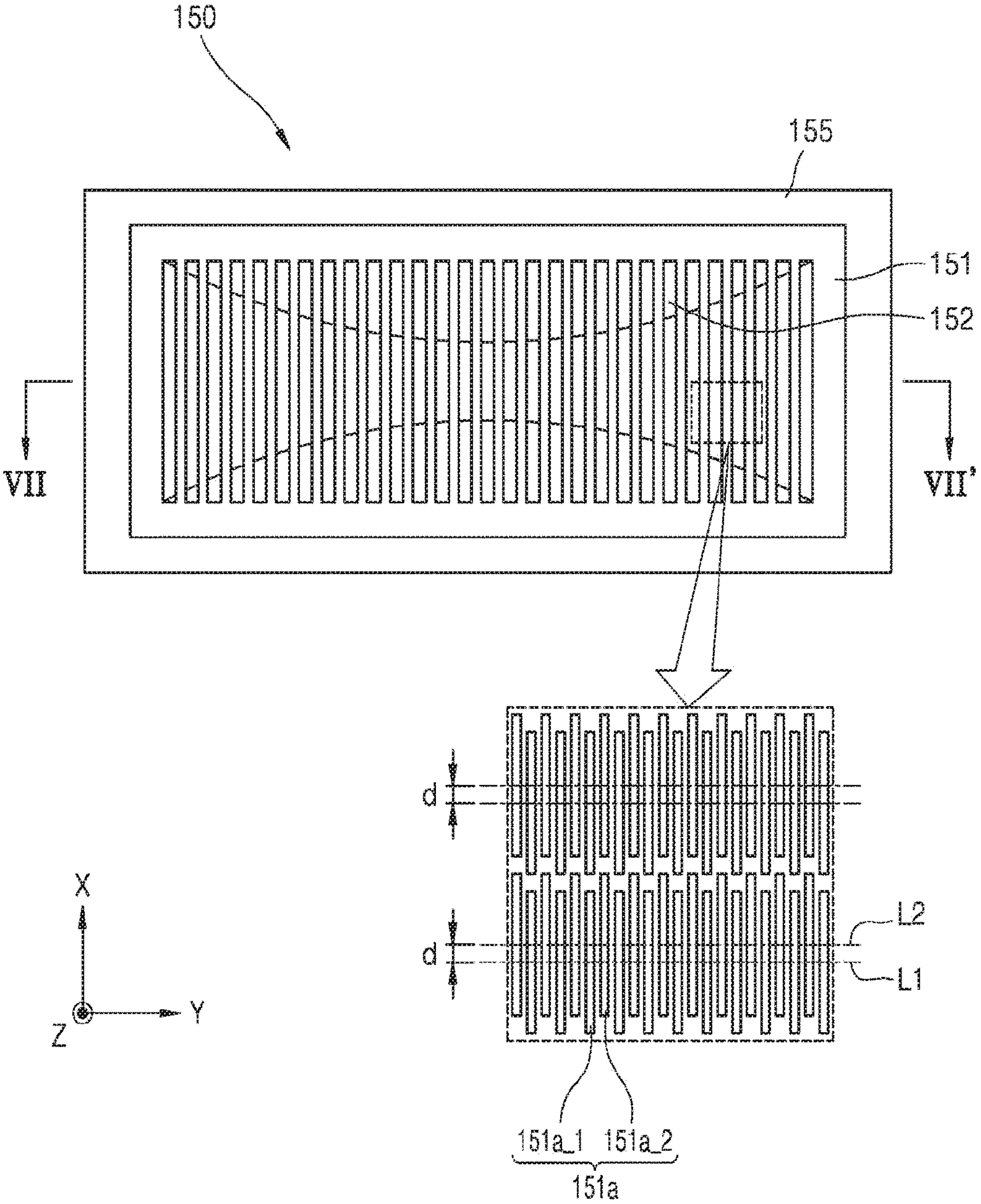


FIG. 8

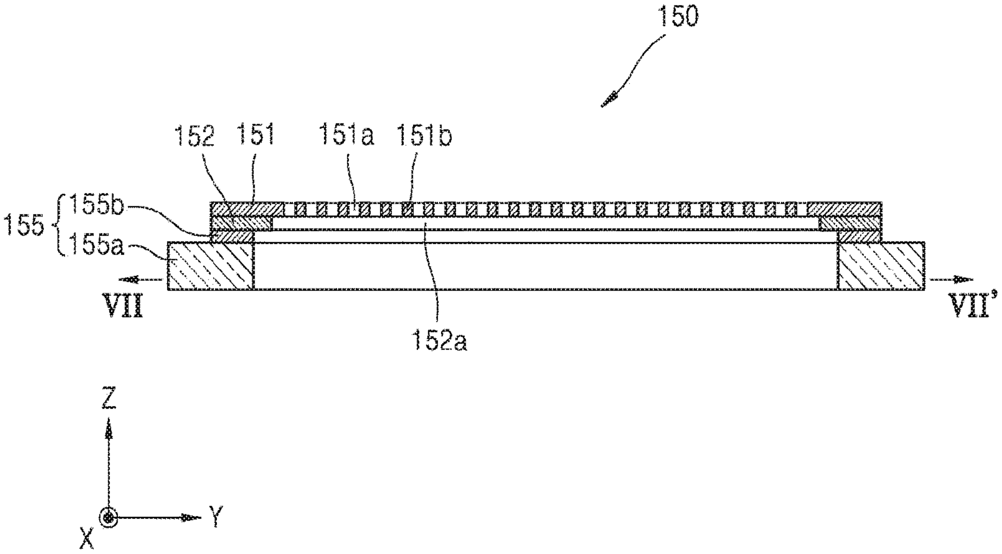


FIG. 9

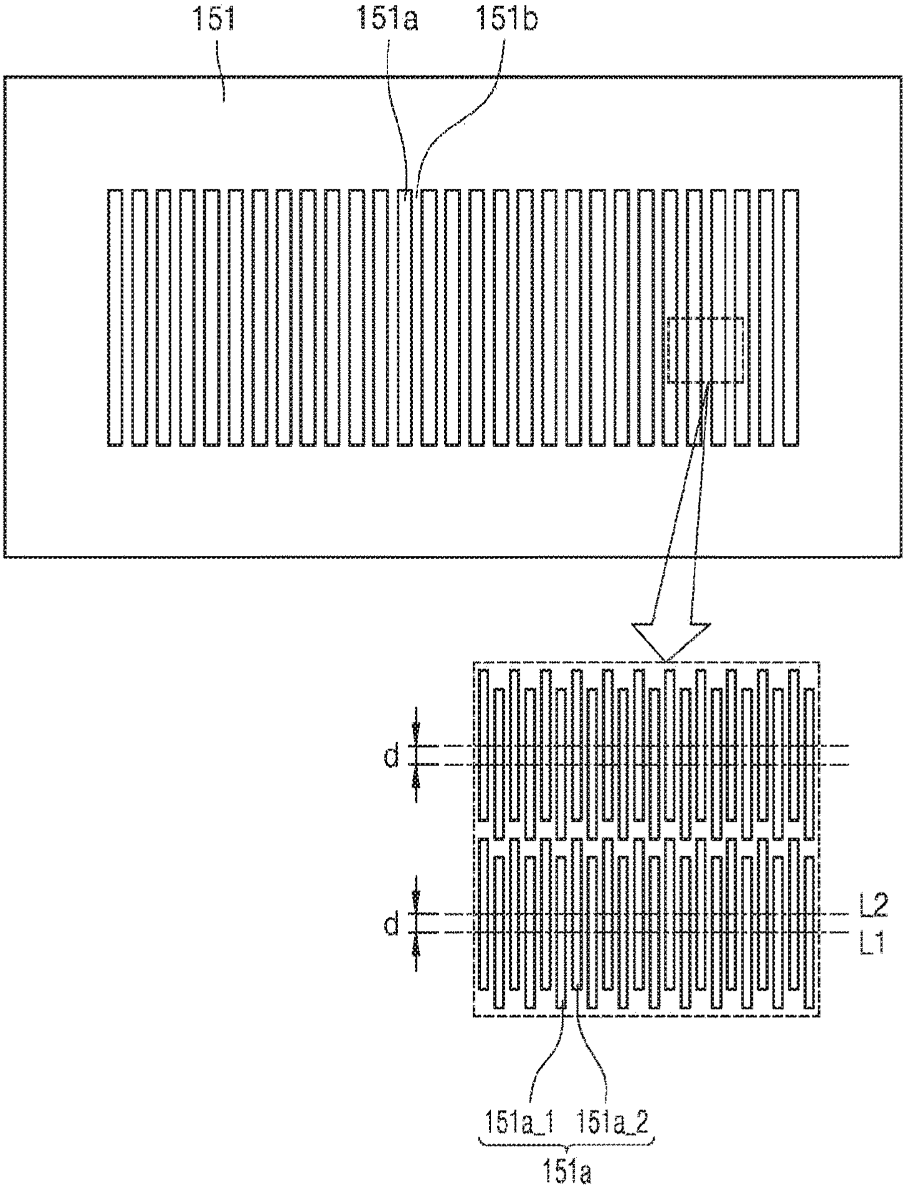


FIG. 10

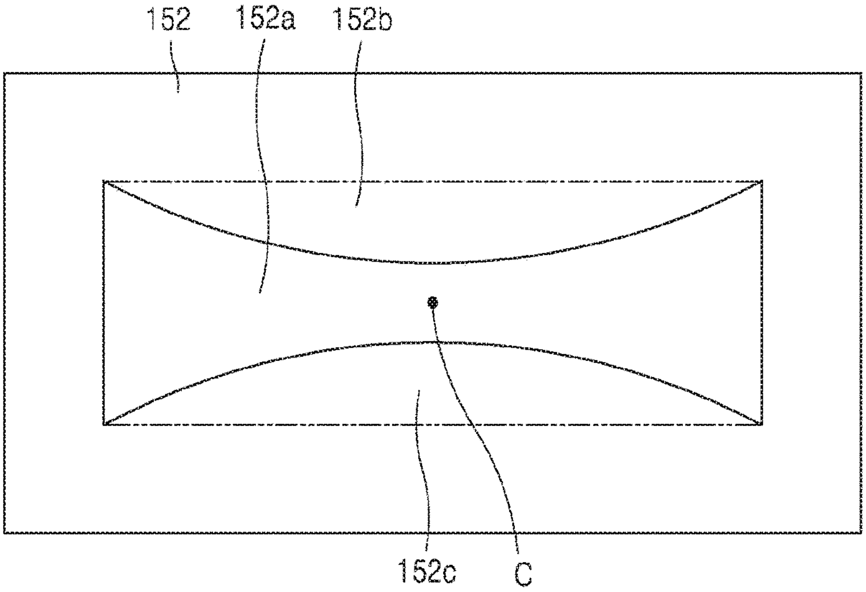
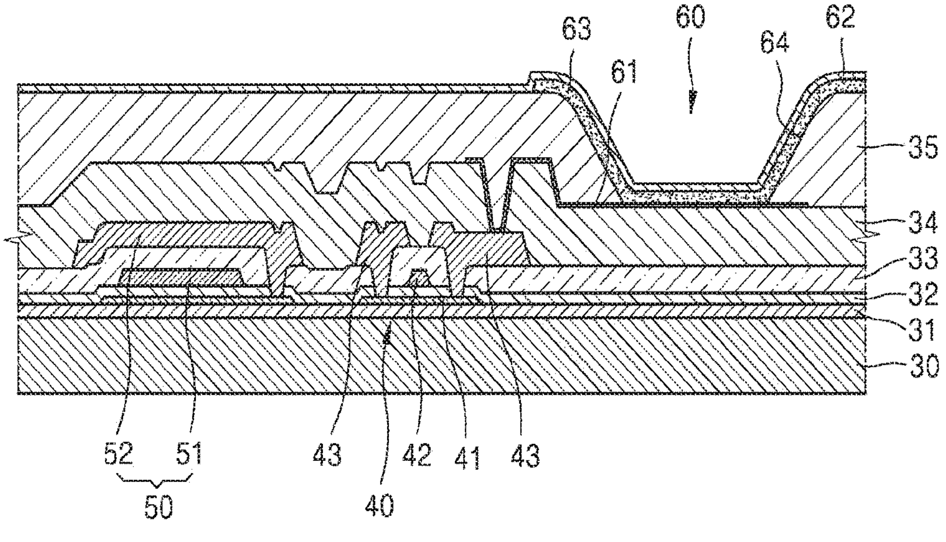

152
152a
152b
152c
C

FIG. 11


63
60
64
62
61
35
34
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ORGANIC LAYER DEPOSITION ASSEMBLY, ORGANIC LAYER DEPOSITION DEVICE INCLUDING THE SAME, AND METHOD OF MANUFACTURING ORGANIC LIGHT-EMITTING DISPLAY DEVICE USING THE ORGANIC LAYER DEPOSITION ASSEMBLY

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority from and the benefit of Korean Patent Application No. 10-2015-0186769, filed on Dec. 24, 2015, which is hereby incorporated by reference for all purposes as if fully set forth herein.

BACKGROUND

Field

Exemplary embodiments relate to an organic layer deposition assembly, an organic layer deposition device including the same, and a method of manufacturing an organic light-emitting display device using the same.

Discussion of the Background

Among display devices, an organic light-emitting display device has been in the spotlight as a next generation display device for its wide viewing angle, excellent contrast, and fast response time.

The organic light-emitting device includes a first electrode, a second electrode opposite the first electrode, and an intermediate layer disposed between the first electrode and the second electrode and including an emission layer. The first electrode, the second electrode, and the intermediate layer are formed by using various methods. One of these various methods is an independent deposition method. In order to manufacture the organic light-emitting display device by using a deposition method, an organic layer of a predetermined pattern is formed by bringing a fine metal mask (FMM) having the same pattern as the pattern of the organic layer or the like into close contact with a substrate over which the organic layer or the like is to be formed and depositing a material of the organic layer or the like.

The above information disclosed in this Background section is only for enhancement of understanding of the background of the inventive concept, and, therefore, it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

SUMMARY

Exemplary embodiments include an organic layer deposition assembly, an organic layer deposition device including the same, and a method of manufacturing an organic light-emitting display device using the same.

Additional aspects will be set forth in part in the description which follows and, in part, will be apparent from the disclosure, or may be learned by practice of the inventive concept.

According to one or more exemplary embodiments, an organic layer deposition assembly for depositing a deposition material on a substrate includes a deposition source configured to spray the deposition material, a deposition source nozzle arranged in one side of the deposition source and including deposition source nozzles arranged in a first direction, a patterning slit sheet arranged to face the deposition source nozzle and having patterning slits in a second

direction that crosses the first direction, and a correction sheet arranged between the deposition source nozzle and the patterning slit sheet and configured to block at least a part of the deposition material sprayed from the deposition source, wherein the organic layer deposition assembly is configured to perform deposition while the substrate moves in the first direction with respect to the organic layer deposition assembly, wherein the patterning slits include a first patterning slit and a second patterning slit spaced apart from each other by a predetermined distance in the first direction and in the second direction, and wherein a line crossing a center of the first patterning slit in the second direction and a line crossing a center of the second patterning slit in the second direction are spaced apart from each other by a predetermined distance.

According to one or more exemplary embodiments, an organic layer deposition device includes a transfer unit including a moving unit arranged to move along with a substrate fixed to the moving unit, a first transfer unit configured to transfer the moving unit to which the substrate is fixed in a first direction, and a second transfer unit configured to transfer the moving unit from which the substrate is separated when deposition is completed in a direction opposite the first direction, a loading unit configured to fix the substrate to the moving unit, a deposition unit including a chamber configured to maintain a vacuum therein and at least one organic layer deposition assembly configured to deposit an organic layer on the substrate fixed to the moving unit transferred from the loading unit, and an unloading unit configured to separate the substrate on which deposition is completed by passing through the deposition unit from the moving unit, wherein the moving unit is configured to move cyclically between the first transfer unit and the second transfer unit, wherein the substrate fixed to the moving unit is spaced apart from the organic layer deposition assembly by a predetermined degree while the first transfer unit is moving. The organic layer deposition assembly includes a deposition source configured to spray the deposition material, a deposition source nozzle arranged in one side of the deposition source and including deposition source nozzles arranged in a first direction, a patterning slit sheet arranged to face the deposition source nozzle and including patterning slits in a second direction crossing the first direction, and a correction sheet arranged between the deposition source nozzle and the patterning slit sheet and configured to block at least a part of the deposition material sprayed from the deposition source, wherein the organic layer deposition assembly is configured to perform deposition while the substrate moves in the first direction with respect to the organic layer deposition assembly, wherein the patterning slits include a first patterning slit and a second patterning slit spaced apart from each other by a predetermined distance in the first direction and in the second direction, and wherein a line crossing a center of the first patterning slit in the second direction and a line crossing a center of the second patterning slit in the second direction are spaced apart from each other by a predetermined distance.

According to one or more exemplary embodiments, a method of manufacturing an organic light emitting display device including an organic layer deposition device for depositing an organic layer on a substrate includes fixing the substrate to a moving unit wherein the fixing is performed by a loading unit, transferring the moving unit to which the substrate is fixed to a chamber via a first transfer unit installed to penetrate the chamber, forming the organic layer by depositing a deposition material sprayed from the organic layer deposition assembly on the substrate while the substrate relatively moves with respect to the organic layer deposition assembly wherein an organic layer deposition assembly and the substrate that are arranged in the chamber are spaced apart from each other by a predetermined degree, separating the substrate from which deposition is completed from the moving unit wherein the separating is performed by an unloading unit, and transferring the moving unit separated from the substrate to the loading unit via a second transfer unit installed to penetrate the chamber. The organic layer deposition assembly includes a deposition source configured to spray the deposition material, a deposition source nozzle arranged in one side of the deposition source and including deposition source nozzles arranged in a first direction, a patterning slit sheet arranged to face the deposition source nozzle and including patterning slits in a second direction that crosses the first direction, and a correction sheet arranged between the deposition source nozzle and the patterning slit sheet and configured to block at least a part of the deposition material sprayed from the deposition source wherein the organic layer deposition assembly is configured to perform deposition while the substrate moves in the first direction with respect to the organic layer deposition assembly, wherein the patterning slits include a first patterning slit and a second patterning slit spaced apart from each other by a predetermined distance in the first direction and in the second direction, and wherein a line crossing a center of the first patterning slit in the second direction and a line crossing a center of the second patterning slit in the second direction are spaced apart from each other by a predetermined distance.

According to one or more exemplary embodiments, an organic layer deposition assembly for depositing a deposition material on a substrate includes a deposition source, deposition source nozzles, a patterning slit, and a correction sheet. The deposition source nozzles are disposed in one side of the deposition source and are arranged in a first direction. The patterning slit sheet is arranged to face the deposition source nozzle and has patterning slits disposed in a second direction that crosses the first direction. The correction sheet is arranged between the deposition source nozzle and the patterning slit sheet, and is configured to block at least a part of the patterning slit sheet. The correction sheet is further shaped to block a larger portion of central patterning slits than peripheral patterning slits.

The foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the claimed subject matter.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the inventive concept, and are incorporated in and constitute a part of this specification, illustrate exemplary embodiments of the inventive concept, and, together with the description, serve to explain principles of the inventive concept.

FIG. **1** is a schematic plan view of an organic layer deposition device according to an exemplary embodiment.

FIG. **2** is a schematic perspective cross-sectional view of a part of a deposition unit of the organic layer deposition device shown in FIG. **1**.

FIG. **3** is a schematic cross-sectional view of a part of the deposition unit of the organic layer deposition device shown in FIG. **1**.

FIG. **4** is a schematic perspective view of an organic layer deposition assembly according to an exemplary embodiment.

FIG. **5** is a lateral cross-sectional view of the organic layer deposition assembly of FIG. **4**.

FIG. **6** is a plan cross-sectional view of the organic layer deposition assembly of FIG. **4**.

FIG. **7** is a schematic plan view of a frame sheet assembly of FIG. **4**.

FIG. **8** is a lateral cross-sectional view of the frame sheet assembly of FIG. **7** taken along a cut line VII-VII'.

FIG. **9** is a schematic plan view of a patterning slit sheet of FIG. **7**.

FIG. **10** is a schematic plan view of a correction sheet of FIG. **7**.

FIG. **11** is a cross-sectional view of an organic light-emitting display device manufactured as an organic layer deposition device according to the present disclosure.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

the following description, for the purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of various exemplary embodiments. It is apparent, however, that various exemplary embodiments may be practiced without these specific details or with one or more equivalent arrangements. In other instances, well-known structures and devices are shown in block diagram form in order to avoid unnecessarily obscuring various exemplary embodiments.

In the accompanying figures, the size and relative sizes of layers, films, panels, regions, etc., may be exaggerated for clarity and descriptive purposes. Also, like reference numerals denote like elements.

When an element or layer is referred to as being “on,” “connected to,” or “coupled to” another element or layer, it may be directly on, connected to, or coupled to the other element or layer or intervening elements or layers may be present. When, however, an element or layer is referred to as being “directly on,” “directly connected to,” or “directly coupled to” another element or layer, there are no intervening elements or layers present. For the purposes of this disclosure, “at least one of X, Y, and Z” and “at least one selected from the group consisting of X, Y, and Z” may be construed as X only, Y only, Z only, or any combination of two or more of X, Y, and Z, such as, for instance, XYZ, XYY, YZ, and ZZ. Like numbers refer to like elements throughout. As used herein, the term “and/or” includes any and all combinations of one or more of the associated listed items.

Although the terms first, second, etc. may be used herein to describe various elements, components, regions, layers, and/or sections, these elements, components, regions, layers, and/or sections should not be limited by these terms. These terms are used to distinguish one element, component, region, layer, and/or section from another element, component, region, layer, and/or section. Thus, a first element, component, region, layer, and/or section discussed below could be termed a second element, component, region, layer, and/or section without departing from the teachings of the present disclosure.

Spatially relative terms, such as “beneath,” “below,” “lower,” “above,” “upper,” and the like, may be used herein for descriptive purposes, and, thereby, to describe one element or feature’s relationship to another element(s) or feature(s) as illustrated in the drawings. Spatially relative terms are intended to encompass different orientations of an apparatus in use, operation, and/or manufacture in addition to the orientation depicted in the drawings. For example, if the apparatus in the drawings is turned over, elements described as "below" or "beneath" other elements or features would then be oriented "above" the other elements or features. Thus, the exemplary term "below" can encompass both an orientation of above and below. Furthermore, the apparatus may be otherwise oriented (e.g., rotated 90 degrees or at other orientations), and, as such, the spatially relative descriptors used herein interpreted accordingly.

The terminology used herein is for the purpose of describing particular embodiments and is not intended to be limiting. As used herein, the singular forms, "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. Moreover, the terms "comprises," "comprising," "includes," and/or "including," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, components, and/or groups thereof, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

Various exemplary embodiments are described herein with reference to sectional illustrations that are schematic illustrations of idealized exemplary embodiments and/or intermediate structures. As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, exemplary embodiments disclosed herein should not be construed as limited to the particular illustrated shapes of regions, but are to include deviations in shapes that result from, for instance, manufacturing. For example, an implanted region illustrated as a rectangle will, typically, have rounded or curved features and/or a gradient of implant concentration at its edges rather than a binary change from implanted to non-implanted region. Likewise, a buried region formed by implantation may result in some implantation in the region between the buried region and the surface through which the implantation takes place. Thus, the regions illustrated in the drawings are schematic in nature and their shapes are not intended to illustrate the actual shape of a region of a device and are not intended to be limiting.

Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure is a part. Terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense, unless expressly so defined herein.

FIG. **1** is a schematic plan view of an organic layer deposition device **10** according to an exemplary embodiment. FIG. **2** is a schematic perspective cross-sectional view of a part of a deposition unit **100** of the organic layer deposition device **10** shown in FIG. **1**. FIG. **3** is a schematic cross-sectional view of a part of the deposition unit **100** of the organic layer deposition device **10** shown in FIG. **1**.

Referring to FIGS. **1**, **2**, and **3**, the organic layer deposition device **10** may include the deposition unit **100**, a loading unit **200**, an unloading unit **300**, and a transfer unit **400**.

The loading unit **200** may include a first rack **212**, an introduction chamber **214**, a first inversion chamber **218**, and a buffer chamber **219**.

One or more substrates **600**, over which deposition is to be performed, may be loaded over the first rack **212**. An introduction robot provided in the introduction chamber **214** may hold the substrate **600** over the first rack **212**, may place the substrate **600** over a moving unit **430** moved from a second transfer unit **420**, and may move, to the first inversion chamber **218**, the moving unit **430** over which the substrate **600** is placed.

The first inversion chamber **218** may be provided adjacent to the introduction chamber **214**. A first inversion robot located in the first inversion chamber **218** may invert the moving unit **430** and may mount the moving unit **430** over a first transfer unit **410** of the deposition unit **100**.

Referring to FIG. **1**, the introduction robot of the introduction chamber **214** may place the substrate **600** over an upper surface of the moving unit **430**. In this state, the moving unit **430** may be transferred to the inversion chamber **218**. As the first inversion robot of the inversion chamber **218** may invert the inversion chamber **218**, the substrate **600** may be turned upside down in the deposition unit **100**.

A configuration of the unloading unit **300** may be opposite to that of the loading unit **200** described above. That is, a second inversion robot may invert the substrate **600** and the moving unit **430** which pass through the deposition unit **100** and may transfer the substrate **600** and the moving unit **430** to an ejection chamber **324**. An ejection robot may eject the substrate **600** and the moving unit **430** from the ejection chamber **324**, may separate the substrate **600** from the moving unit **430**, and may load the separated substrate **600** over a second rack **322**. The moving unit **430**, separated from the substrate **600**, may be retransferred to the loading unit **200** through the second transfer unit **420**.

However, exemplary embodiments of the disclosure are not necessarily limited thereto. Thus, the substrate **600** may be directly transferred to the deposition unit **100** by being fixed to a lower surface of the moving unit **430**. In this case, for example, the first inversion robot of the first inversion chamber **218** and the second inversion robot of the second inversion chamber **328** may be unnecessary.

The deposition unit **100** may include at least one chamber **101** for deposition. According to the exemplary embodiment shown in FIGS. **1** and **2**, the deposition unit **100** may include the chamber **101** in which a plurality of deposition assemblies **100-1**, **100-2**, . . . **100-*n*** may be arranged. According to the exemplary embodiment shown in FIG. **1**, although the first through eleventh deposition assemblies **100-1** through **100-11** are installed in the chamber **101**, the number of the deposition assemblies may vary according to a deposition material and a deposition condition. The chamber **101** may maintain a vacuum during deposition.

According to the exemplary embodiment shown in FIG. **1**, the moving unit **430**, to which the substrate **600** is fixed, may be moved to at least the deposition unit **100** by the transfer unit **410** or may be sequentially moved to the loading unit **200**, the deposition unit **100**, and the unloading unit **300** by the first transfer unit **410**. The moving unit **430**, separated from the substrate **600** in the unloading unit **300**, may be retransferred to the loading unit **200** by the second transfer unit **420**.

The first transfer unit **410** may penetrate the chamber **101** when passing through the deposition unit **100**. The second transfer unit **420** may transfer the moving unit **430** from which the substrate **600** is separated.

In the organic layer deposition device **10** according to the present exemplary embodiment, the first and second transfer units **410** and **420** may be respectively arranged in a vertical direction so that the moving unit **430**, that completes deposition while passing through the first transfer unit **410**, is separated from the substrate **600** in the unloading unit **300** and retransferred to the loading unit **200** through the second transfer unit **420** arranged below the moving unit **430**. Thus, space utilization efficiency in the organic layer deposition device **10** may be improved.

The deposition unit **100** of FIG. **1** may further include a deposition source replacement unit **190** at one side of each of the deposition assemblies **100-1** through **100-*n*** (where n is a natural number from 1 through n, with n being 11 in the present exemplary embodiment). Although not shown in detail in FIG. **1**, the deposition source replacement unit **190** may be formed in a cassette type so as to be ejected to the outside from each of the deposition assemblies **100-1** through **100-*n*** (where n is a natural number from 1 through 11). Thus, a deposition source (see **110** of FIG. **3**) of the organic layer deposition assembly **100-5** may be easily replaced.

As shown in FIG. **1**, two sets are provided in parallel for constituting the organic layer deposition device **10**, each including the loading unit **200**, the deposition unit **100**, the unloading unit **300**, and the transfer unit **400** (shown in FIG. **4**). That is, two organic layer deposition devices **10** may be respectively provided at an upper side and a lower side in FIG. **1**.

In this case, a patterning slit sheet replacement unit **500** may be further disposed between the two organic layer deposition devices **10**. That is, the patterning slit sheet replacement unit **500** may be disposed between the two organic layer deposition devices **10** such that the two organic layer deposition devices **10** share the patterning slit sheet replacement unit **500**, thereby improving space utilization efficiency, compared to a case where each of the two organic layer deposition devices **10** includes the patterning slit sheet replacement unit **500**.

Referring to FIGS. **2** and **3**, the deposition unit **100** of the organic layer deposition device **10** may include at least one organic layer deposition assembly **100-5** and the transfer unit **400**.

An overall configuration of the deposition unit **100** will be described below.

The chamber **101** may be formed as a hollow box shape. The at least one organic layer deposition assembly **100-5** and the transfer unit **400** may be accommodated in the chamber **101**. In more detail, a base **102** may be formed and fixed to a support surface (such as a floor), a lower housing **103** may be formed over the base **102**, and an upper housing **104** may be formed over the lower housing **103**. The chamber **101** may accommodate both of the lower and upper housings **103** and **104** therein. In this regard, a connector between the lower housing **103** and the upper housing **104** may be sealed to allow an inside of the chamber **101** to be entirely blocked from the outside.

As described above, the lower and upper housings **103** and **104** may be arranged over the base **102** fixed to the support surface, and thus the lower and upper housings **103** and **104** may maintain their fixed positions even though the chamber **101** repeatedly contracts or expands. Accordingly, the lower and upper housings **103** and **104** may function as a kind of a reference frame in the deposition unit **100**.

The organic layer deposition assembly **100-5** and the first transfer unit **410** of the transfer unit **400** may be arranged in the upper housing **104**, and the second transfer unit **420** of the transfer unit **400** may be arranged in the lower housing **103**. Deposition may be continuously performed while the moving unit **430** cyclically moves between the first transfer unit **410** and the second transfer unit **420**.

A detailed configuration of the organic layer deposition assembly **100-5** will be described below.

The organic layer deposition assembly **100-5** may include a deposition source **110**, a deposition source nozzle **120**, source shutters **140**, a frame sheet assembly **150**, a first stage **160**, and a second stage **170**. In order to ensure that a deposition material **115** is delivered in a linear manner, all elements of FIGS. **2** and **3** may be arranged in the chamber **101** in which an appropriate degree of vacuum is maintained.

The substrate **600**, that is, a deposition target, may be arranged in the chamber **101**. The substrate **600** may be a substrate for a flat panel display device. The substrate **600** may also be a large-sized substrate for manufacturing a flat panel display device having a large screen of about 40 inches or more.

In this regard, deposition may be performed while the substrate **600** moves relatively with respect to the organic layer deposition assembly **100-5**.

In more detail, it is required that a fine metal mask (FMM) has the same size as that of a substrate in the exiting FMM deposition method. Thus, if the size of the substrate increases, an FMM with a larger size is required. Accordingly, it is not easy to manufacture an FMM and also it is not easy to manufacture an FMM having tensile properties and align the FMM in a precise pattern.

In order to address these problems, deposition may be performed while the organic layer deposition assembly **100-5** and the substrate **600** move relatively with respect to each other. In other words, deposition may be continuously performed while the substrate **600** facing the organic layer deposition assembly **100-5** moves in an X-axis direction. That is, deposition may be performed in a scanning manner while the substrate **600** moves in a direction of an arrow A of FIG. **2**.

In this regard, deposition is performed while the substrate **600** moves in a Y-axis direction in the chamber **101** in FIG. **2**. However, the present disclosure is not limited thereto. Deposition may be performed while the substrate **600** is fixed, and the organic layer deposition assembly **100-5** moves in the Y-axis direction.

Thus, the mask sheet assembly **150** having a much smaller size than an existing FMM may be manufactured by using the organic layer deposition assembly **100-5**. That is, the organic layer deposition assembly **100-5** may continuously perform deposition, i.e., by moving in a scanning manner, while the substrate **600** moves in the Y-axis direction, and thus a length of the mask sheet assembly **150** in at least one of the X-axis direction and the Y-axis direction may be much less than a length of the substrate **600**.

As described above, the mask sheet assembly **150** may be much smaller than the existing FMM, and thus it is easy to manufacture the mask sheet assembly **150**. That is, in all processes of the mask sheet assembly **150** such as an etching process, a subsequent fine tensile and welding process, a transfer and washing process, etc. the mask sheet assembly **150** having a small size may be advantageous compared to a FMM deposition method. The mask sheet assembly **150** having a small size may be further advantageous as the organic light-emitting display device becomes larger.

As described above, in order to perform deposition while the organic layer deposition assembly **100-5** and the substrate **600** move relatively with respect to each other, the organic layer deposition assembly **100-5** and the substrate **600** may be spaced apart from each other. This will be described in detail later.

The deposition source **110** receiving and heating the deposition material **115** may be arranged at a side opposite to the substrate **600** in the chamber **101**. As the deposition material **115** received in the deposition source **110** is evaporated, deposition may be performed over the substrate **600**.

More specifically, the deposition source **110** may include a crucible **111** filled with the deposition material **115** therein and a heater **112** for heating the crucible **111** and evaporating the deposition material **115** filling the crucible **111** toward one side of the crucible **111**, specifically, toward the deposition source nozzle **120**.

The deposition source nozzle **120** may be arranged at one side of the deposition source **110**, specifically, at a side that faces the substrate **600** in the deposition source **110**. In this regard, in the organic layer deposition assembly **100-5**, deposition source nozzles **121** may be formed differently from each other when a common layer and a pattern layer are deposited.

The mask sheet assembly **150** may be further provided between the deposition source **110** and the substrate **600**. The above-described mask sheet assembly **150** will be described in detail below.

The deposition material **115** evaporated in the deposition source **110** may pass through the deposition source nozzle **120** and the mask sheet assembly **150** and face toward the substrate **600** that is a deposition target. In this regard, the mask sheet assembly **150** may be manufactured through etching that is the same method as an existing method of manufacturing a FMM, in particular, a stripe type mask. However, the present disclosure is not limited thereto. The mask sheet assembly **150** may be manufactured by using an electro-forming method, a laser patterning method, or the like.

In this regard, the above-described deposition source **110**, the deposition source nozzle **120** coupled to the deposition source **110**, and the mask sheet assembly **150** may be spaced apart from each other.

As described above, the deposition may be performed in the organic layer deposition assembly **100-5** while moving relatively with respect to the substrate **600**. In order for the organic layer deposition assembly **100-5** to move relatively with respect to the substrate **600**, the mask sheet assembly **150** may be spaced apart from the substrate **600** by a predetermined distance.

More specifically, an existing FMM deposition method performs a deposition process by bringing a mask into close contact with a substrate in order to prevent a shadow from being formed over the substrate. However, when the mask comes into close contact with the substrate as described above, defects occur due to the contact between the substrate and the mask. Since the mask may not move with respect to the substrate, a size of the mask needs to be the same as that of the substrate. Thus, since the organic light-emitting device becomes larger, the size of the mask needs to increase, which causes a problem in that it is not easy to form such a large-sized mask.

In order to address the problem, in the organic layer deposition assembly **100-5** according to the present exemplary embodiment, the mask sheet assembly **150** may be spaced apart from the substrate **600**, the deposition target, by a predetermined distance.

According to the present disclosure, deposition may be performed while the mask sheet assembly **150** moves with respect to the substrate **600**, thereby obtaining an effect of easily manufacturing the mask sheet assembly **150**. Since exemplary embodiments avoid mask contact with the substrate, defects caused by a contact between the substrate **600** and the mask sheet assembly **150** may be prevented. Manufacturing speed may also be increased since the time to bring the substrate **600** into close contact with the mask sheet assembly **150** during processing may be unnecessary.

A specific placement of each of configurations of the upper housing **104** will be described as follows.

The above-described deposition source **110** and deposition source nozzle **120** may be arranged over a bottom portion of the upper housing **104**. A seating unit **104-1** may protrude from both sides of the deposition source **110** and the deposition source nozzle units **120**. The mask sheet assembly **150**, the first stage **160**, and the second stage **170** may be sequentially arranged over the seating unit **104-1**.

In this regard, the first stage **160** may be configured to move in the X-axis direction and the Y-axis direction and may function to align the mask sheet assembly **150** in the X-axis direction and the Y-axis direction. That is, the first stage **160** may include a plurality of actuators and may move in the X-axis direction and the Y-axis direction with respect to the upper housing **104**.

The second stage **170** may be configured to move in a Z-axis direction and may function to align the mask sheet assembly **150** in the Z-axis direction. That is, the second stage **170** may include a plurality of actuators and may move in the Z-axis direction with respect to the first stage **160**.

The mask sheet assembly **150** may be arranged over the second stage **170**. As described above, the mask sheet assembly **150** is arranged over the first and second stages **160** and **170** such that the mask sheet assembly **150** is configured to move in the X-axis direction, the Y-axis-direction, and the Z-axis direction, and thus the substrate **600** and the mask sheet assembly **150** may be aligned.

Furthermore, the upper housing **104**, the first stage **160**, and the second stage **170** may simultaneously function to guide a movement path of the deposition material **115** such that the deposition material **115** sprayed through the deposition source nozzles **121** is not dispersed. That is, the movement path of the deposition material **115** may be closed by the upper housing **104**, the first stage **160**, and the second stage **170**, and thus the upper housing **104**, the movement of the deposition material **115** may simultaneously guide a movement of the deposition material **115** in the X-axis direction and the Y-axis direction.

The source shutters **140** may be further provided between the mask sheet assembly **150** and the deposition source **110**. The source shutters **140** may function to block the deposition material **115** sprayed from the deposition source **110**.

Although not shown in FIG. **1**, **2**, or **3**, a blocking member (not shown) for preventing an organic material from being deposited on a non-film forming region of the substrate **600** may be further provided in the deposition unit **100**. The blocking member (not shown) may be formed to move together with the substrate **600** while covering an edge portion of the substrate **600**, and thus the non-film forming region of the substrate **600** may be covered, thereby obtaining an effect of conveniently preventing the organic material from being deposited on the non-film forming region of the substrate **600** without a separate structure.

In addition, although not shown in FIGS. **1**, **2** and **3**, source shutter drivers (not shown) for moving respectively the source shutters **140** may be further provided in the deposition unit **100**. In this regard, each of the source shutter drivers may include a general motor and a gear assembly and may include a cylinder or the like that linearly moves in one direction. However, the above-described source shutter drivers are not limited thereto and may include all of devices that linearly move each of the source shutters **140**.

The transfer unit **400** for transferring the substrate **600** that is a deposition target will be described in detail below. Referring to FIGS. **2** and **3**, the transfer unit **400** may include the first transfer unit **410**, the second transfer unit **420**, and the moving unit **430**.

In order to deposit an organic layer over the substrate **600** with the organic layer deposition assembly **100-5**, the first transfer unit **410** may function to, in-line, transfer the moving unit **430** including a carrier **431** and an electrostatic chuck **432** coupled to the carrier **431** and the substrate **600** attached to the moving unit **430**.

The second transfer unit **420** may function to retransfer, to the loading unit **200**, the moving unit **430** from which the substrate **600** is separated in the unloading unit **300** after deposition is performed once while the substrate **600** passes through the deposition unit **100**. The above-described second transfer unit **420** may include a coil **421**, a roller guide **422**, and a charging track **423**.

The moving unit **430** may include the carrier **431** that is transferred along with the first and second transfer units **410** and **420** and the electrostatic chuck **432** coupled over one surface of the carrier **431** and to which the substrate **600** is attached.

Each of configurations of the transfer unit **400** will be described in more detail below.

The carrier **431** of the moving unit **430** will be described in detail.

The carrier **431** may include a body portion **431***a*, a linear motion system (LMS) magnet, a contactless power supply (CPS) module **431***c*, a power supply **431***d*, and guide grooves (not shown).

The body portion **431***a* may constitute a base portion of the carrier **431** and may include a magnetic material such as iron. The carrier **431** may be maintained to be spaced apart from a guider **412** by a predetermined distance according to a magnetic force between the body portion **431***a* of the carrier **431** and a magnetic levitation bearing (not shown).

The guide grooves (not shown) may be formed at both side surfaces of the body portion **431***a*. A guide protrusion (not shown) of the guider **412** may be accommodated in each of the guide grooves.

A magnetic rail **431***b* may be arranged along a centerline of a travel direction of the body portion **431***a*. A linear motor may be configured by combining the magnetic rail **431***b* of the body portion **431***a* and a coil **421** with each other and may transfer the carrier **431** in the direction of the arrow A.

The CPS module **431***c* and the power supply **431***d* may be disposed at one side of the magnetic rail **431***b* in the body portion **431***a*. The power supply **431***d* may be a kind of a rechargeable battery for supplying electric power such that the electrostatic chuck **432** uses the electric power to clamp the substrate **600** and maintains the state of clamping the electrostatic chuck **432** to the substrate **600**. The CPS module **431***c* may be a wireless charging module for charging the power supply **431***d*.

More specifically, the charging track **423** arranged in the second transfer unit **420** may be connected to an inverter (not shown) and may supply electric power to the CPS module **431***c* when the carrier **431** is transferred in the second transfer unit **420**, and a magnetic field is generated between the charging track **423** and the CPS module **431***c*. The electric power supplied to the CPS module **431***c* may charge the power supply **431***d*.

In the electrostatic chuck **432**, an electrode to which electric power is applied may be located in a body including ceramic, and the substrate **600** may be attached to a surface of the body by applying a high voltage to the electrode.

Driving of the moving unit **430** will be described in detail.

A driver may be configured by combining the magnetic rail **431***b* of the body portion **431***a* and the coil **421**. In this regard, the driver may be a linear motor. The linear motor may be a device having a very high positioning degree owing to a small friction coefficient and a very low occurrence of errors compared to an existing slide guide system. As described above, the linear motor may include the coil **421** and the magnetic rail **431***b*. The magnetic rail **431***b* may be arranged in a line over the carrier **431**. A plurality of coils **421** may be spaced apart from each other by a predetermined distance at one side in the chamber **101** so as to respectively face the magnetic rails **431***b*.

As described above, the magnetic rails **431***b* rather than the coils **421** may be arranged over the carrier **431** that is a moving object, and thus it may be possible to drive the carrier **431** although electric power is not applied to the carrier **431**. In this regard, the coils **421** may be installed in an atmosphere (ATM) box in an atmospheric condition. The magnetic rails **431***b* may be attached to the carrier **431** such that the carrier **431** travels in the chamber **101** that maintains vacuum.

The organic layer deposition assembly **100-5** of the organic layer deposition device **10** may further include a camera **180** for aligning. More specifically, the camera **180** may align marks formed over the frame sheet assembly **150** and marks formed over the substrate **600** in real time. In this regard, the camera **180** may be provided so as to secure a clear view in the vacuum chamber **101** in which deposition is performed. To this end, the camera **180** may be installed in a camera accommodator **181** in an atmospheric condition.

The frame sheet assembly **150** will be described in detail with reference to FIGS. **4**, **5**, **6**, **7**, **8**, **9**, and **10** below.

FIG. **4** is a schematic perspective view of the organic layer deposition assembly **100-5** according to an exemplary embodiment. FIG. **5** is a lateral cross-sectional view of the organic layer deposition assembly **100-5** of FIG. **4**. FIG. **6** is a plan cross-sectional view of the organic layer deposition assembly **100-5** of FIG. **4**.

Referring to FIGS. **4**, **5**, and **6**, the organic layer deposition assembly **100-5** according to an exemplary embodiment may include the deposition source **110**, the deposition source nozzle **120**, and the frame sheet assembly **150**.

The deposition source **110** and the deposition source nozzle **120** were described in detail above, and thus the frame sheet assembly **150** will be described in detail below.

As described above, the frame sheet assembly **150** may be disposed between the deposition source **110** and the substrate **600**. The frame sheet assembly **150** may include a patterning slit sheet **151**, a correction sheet **152**, and a frame **155**.

The frame **155** may have a polygonal shape. The correction sheet **152** and the patterning slit sheet **151** may be sequentially stacked over and combined with the frame **155**. In more detail, the frame **155** may include a body portion **155***a* and a bonding portion **155***b*. The bonding portion **155***b* may protrude from the body portion **155***a*. The bonding portion **155***b* of the frame **155** may be bonded to the correction sheet **152** via welding. The patterning slit sheet **151** may also be to the correction sheet **152** via welding. In this regard, the patterning slit sheet **151** and the correction sheet **152** will be described in more detail with reference to FIGS. **7**, **8**, **9**, and **10**.

The above-described deposition source **110** and the deposition source nozzle **120** and the frame sheet assembly **150** coupled to the deposition source **110** may be spaced apart from each other by a predetermined distance and connected to each other through a connection member **135**. That is, the deposition source **110**, the deposition source nozzle **120**, and the frame sheet assembly **150** may be connected to each other through the connection member **135** and may be integrally formed with each other.

In this regard, the connection member **135** may guide a movement path of the deposition material **115** such that the deposition material **115** sprayed through the deposition source nozzles **121** is not dispersed. Although the connection members **135** are formed only in left and right directions of the deposition source **110**, the deposition source nozzle **120**, and the frame sheet assembly **150** and guide the deposition material **115** in a Y-axis direction (as shown in FIG. **4**), this is for convenience of illustration and the present disclosure is not limited thereto. The connection member **135** may have a closed box shape and may simultaneously guide a movement of the deposition material **115** in an X-axis direction and in the Y-axis direction.

FIG. **7** is a schematic plan view of the frame sheet assembly **150** of FIG. **4**. FIG. **8** is a lateral cross-sectional view of the frame sheet assembly **150** of FIG. **7** taken along a cut line VII-VII'. FIG. **9** is a schematic plan view of the patterning slit sheet **151** of FIG. **7**.

Referring to FIGS. **7**, **8**, and **9**, the patterning slit sheet **151** may include a patterning slit **151***a* and a patterning bar **151***b*. The patterning slit **151***a* may be a region penetrating from an upper surface of the patterning slit sheet **151** to a lower surface thereof. The patterning bar **151***b* may be a blocking region disposed between patterning slits **151***a* that are adjacent to each other. That is, the deposition material **115** evaporated in the deposition source **110** may be blocked by the patterning bar **151***b* or may pass through the patterning slit **151***a* and may be deposited on the substrate **600** that is a deposition target.

In more detail, the patterning slit **151** may include a plurality of first patterning slits **151***a*_**1** and a plurality of second patterning slits **151***a*_**2**. The plurality of first patterning slits **151***a*_**1** and the plurality of second patterning slits **151***a*_**2** may be alternately arranged in a first direction (X-axis direction) or in a second direction (Y-axis direction).

In this regard, a line L1 passing through a center of the first patterning slit **151***a*_**1** in the second direction and a line L2 passing through a center of the second patterning slit **151***a*_**2** in the second direction may be spaced apart from each other by a predetermined distance d. That is, the first patterning slit **151***a*_**1** and the second patterning slit **151***a*_**2** may be arranged in a zigzag in the second direction.

In a case where patterning slits (not shown) having the same length, other than the first patterning slit **151***a*_**1** and the second patterning slit **151***a*_**2**, are continuously arranged in the first direction and in the second direction, a difference between some regions of each of the patterning slits blocked by the correction sheet **152** may occur.

That is, the deposition material **115** of a relatively small amount may pass through a patterning slit of a relatively large region blocked by the correction sheet **152**, whereas the deposition material **115** of a relatively great amount may pass through a patterning slit of a relatively small region blocked by the correction sheet **152**.

Thus, in the case where the patterning slits have the same length, an amount of the deposition material **115** passing through each of the patterning slits may be different. This means that a film thickness of the deposition material **115** deposited on the substrate **600** is not uniform. If the deposition material **115** is not uniformly deposited, the quality and reliability of a display product may deteriorate.

However, due to an arrangement of the first patterning slit **151***a*_**1** and the second patterning slit **151***a*_**2** having the configuration according to an exemplary embodiment, a thickness of the deposition material **115** deposited on the substrate **600** through the patterning slit **151***a* adjacent to the correction sheet **152** may be uniformly deposited and the occurrence of a brightness difference between regions of a display device may be further prevented.

The correction sheet **152** may be coupled with the frame **155**. The patterning slit sheet **151** may be coupled onto the correction sheet **152**. The correction sheet **152** may partially cover the patterning slit **151***a* and correct an amount of the deposition material **115** passing through the patterning slit **151***a* such that the deposition material **115** of the same amount passes through a center portion (see C in FIG. **10**) of the patterning slit **151***a* arranged at a relatively close to the deposition source nozzle **121** and an edge region of the patterning slit **151***a* arranged at a relatively far from the deposition source nozzle **121**. The correction sheet **152** will be described in detail with reference to FIG. **10** below.

FIG. **10** is a schematic plan view of the correction sheet **152** of FIGS. **7** and **8**. Referring to FIG. **10**, the correction sheet **152** may include a through hole **152***a* and blocking parts **152***b* and **152***c*. The through hole **152***a* may be a region passing through an upper surface of the correction sheet **152** and a lower surface thereof. The blocking parts **152***b* and **152***c* may bulge in a length direction of the patterning slit **151***a* toward the center portion C of the through hole **152***a*.

In more detail, the blocking parts **152***b* and **152***c* may include a first member **152***b* and a second member **152***c*. The first member **152***b* may bulge and downwardly extend toward the center portion C of the through hole **152***a*. The second member **152***c* may bulge and upwardly extend toward the center portion C of the through hole **152***a*. The through hole **152***a* formed by the blocking parts **152***b* and **152***c* may be similar to a cross-section of a concave lens. The first member **152***b* and the second member **152***c* may be symmetrical to each other with respect to the center portion C of the through hole **152***a*.

The patterning slit sheet **151** may be arranged over the correction sheet **152**, and thus upper and lower portions of the patterning slit **151***a* may be partially hidden by the blocking parts **152***b* and **152***c* of the correction sheet **152**. Thus, as shown in FIG. **7**, the farther from a center of the patterning slit sheet **151**, the longer the length of the patterning slit **151***a* exposed by the through hole **152***a*. That is, a length of the patterning slit **151***a* of a center portion of the patterning slit sheet **151** that is exposed by the through hole **152***a* may be smaller than that of the patterning slit **151***a* of both ends of the patterning slit sheet **151**.

In the organic layer deposition assembly **100-5** according to an exemplary embodiment, the deposition source nozzle **121** may be arranged in a length direction (in an X-axis direction) of the patterning slit **151***a*, and thus when the correction sheet **152** is not present, the deposition material **115** of the greatest amount may be deposited on a center portion of the substrate **600**, thereby reducing a deposition uniformity.

However, as described above, the patterning slit **151***a* in a center portion of the patterning slit sheet **151** may be hidden by the blocking parts **152***b* and **152***c* of the correction sheet **152** relatively more than the patterning bar **151***b* of both ends of the patterning slit sheet **151**, and accordingly, an amount of the deposition material **115** passing through the patterning slit **151***a* of the center portion of the patterning slit sheet **151** may be reduced. Thus, a thickness of a deposition layer deposited on the substrate **600** may be uniform.

That is, since a deposition layer deposited by an organic layer deposition device may have a bulging portion in a center thereof, a part of a deposition material moving toward the center of the deposition layer needs to be blocked in order to make the bulging portion uniform. Thus, the correction sheet **152** may be arranged below the patterning slit sheet **151** to block a part of the deposition material **115**. In this regard, since the blocking parts **152***b* and **152***c* of the correction sheet **152** bulgingly protrude toward the center portion C of the through hole **152***a*, a greater amount of the deposition material **115** may collide with the blocking parts **152***b* and **152***c* and thus may be blocked from reaching the bulging portion, and a smaller amount of the deposition material **115** may collide with the blocking parts **152***b* and **152***c* and thus may be blocked from reaching an edge portion of the deposition layer. In this case, the correction sheet **152** may be formed such that a smallest film thickness, in general, a film thickness of both ends of the patterning slit sheet **151**, is an entire film thickness.

As described above, the correction sheet **152** may be arranged in a movement path of the deposition material **115**, and thus, a thickness of the deposition film deposited by the organic layer deposition device may be corrected. That is, a part in which a great amount of the deposition material **115** is deposited may not receive a great amount of the deposition material **115** by increasing heights of the blocking parts **152***b* and **152***c* of the correction sheet **152** and a part in which a small amount of the deposition material **115** is deposited may not receive a small amount of the deposition material **115** by decreasing heights of the blocking parts **152***b* and **152***c* of the correction sheet **152**. Thus, a deposition amount may be corrected in order to achieve a uniform thickness of the deposition material **115**. An organic layer deposited on a substrate according to exemplary embodiments may be uniformly formed with a uniformity error in a range from 1% to 2%. Thus, the quality and reliability of products may increase.

The patterning slit sheet **151** may droop toward the deposition source **110** due to gravity as a size thereof increases. However, according to an exemplary embodiment, the correction sheet **152** is arranged over a lower surface of the patterning slit sheet **151**, thereby supporting the patterning slit sheet **151** and reducing drooping of the patterning slit sheet **151**.

FIG. **11** is a cross-sectional view of an organic light-emitting display device manufactured as an organic layer deposition device according to the present disclosure.

Referring to FIG. **11**, an active matrix type organic light-emitting display device may be formed over a substrate **30**. The substrate **30** may include a transparent material, for example, a glass material, a plastic material, or a metallic material. An insulating layer **31**, such as a buffer layer, may be formed over an entire surface of the substrate **30**.

A thin film transistor (TFT) **40**, a capacitor **50**, and an organic light-emitting diode (OLED) **60** may be arranged over the insulating layer **31** as shown in FIG. **11**.

A semiconductor active layer **41** may be formed on an upper surface of the insulating layer **31** in a predetermined pattern. The semiconductor active layer **41** may be covered by a gate insulating layer **32**. The semiconductor active layer **41** may include a p-type or n-type semiconductor material.

A first capacitor electrode **51** of the capacitor **50** may be formed on an upper surface of the gate insulating layer **32**. A gate electrode **42** of the TFT **40** may be formed corresponding to the semiconductor active layer **41**. An interlayer insulating layer **33** may be formed to cover the first capacitor electrode **51** and the gate electrode **42**. The semiconductor active layer **41** may be partially exposed by a contact hole formed by etching the gate insulating layer **32** and the interlayer insulating layer **33** through an etching process such as dry etching after the interlayer insulating layer **33** is formed.

Thereafter, a second capacitor electrode **52** and a source/drain electrode **43** may be formed over the interlayer insulating layer **33**. The source/drain electrode **43** may be formed to contact the semiconductor active layer **41** exposed through the contact hole. A protection layer **34** may be formed to cover the second capacitor electrode **52** and the source/drain electrode **43** and expose a part of the drain electrode **43** through the etching process. An insulating layer may be further formed over the protection layer **34** so as to planarize the protection layer **34**.

The OLED **60** may display predetermined image information by emitting red, green, or blue light according to a flow of current. A first electrode **61** may be formed over the protection layer **34**. The first electrode **61** may be electrically connected to the drain electrode **43** of the TFT **40**.

A pixel-defining layer **35** may be formed to cover the first electrode **61**. An opening **64** may be formed in the pixel-defining layer **35** and then an organic emission layer **63** may be formed in a region defined by the opening **64**. A second electrode **62** may be formed over the organic emission layer **63**.

The pixel-defining layer **35** may define individual pixels, include an organic material, and planarize a surface of the substrate in which the first electrode **61** is formed, in particular, a surface of the protection layer **34**.

The first electrode **61** and the second electrode **62** may be insulated from each other and apply voltages of opposite polarities to the organic emission layer **63** to allow the organic emission layer **63** to emit light.

The organic emission layer **63** may include a low-molecular weight organic material or a high-molecular weight organic material. When the organic emission layer **63** includes the low-molecular weight organic material, the organic emission layer **63** may have a single or multi-layer structure including a hole injection layer (HIL), a hole transport layer (HTL), the EML, an electron transport layer (ETL), and/or an electron injection layer (EIL). Examples of available organic materials may include copper phthalocyanine (CuPc), N,N'-di(naphthalene-1-yl)-N,N'-diphenyl-benzidine (NPB), and tris-8-hydroxyquinoline aluminum (Alq_3). The organic emission layer **63** including these low-molecular weight organic materials may be formed by using the organic layer deposition assembly **100** of FIGS. **1**, **2**, and **3** through a vacuum deposition method.

After the opening **64** is formed in the pixel-defining layer **35**, the substrate **30** may be transferred into a unit **100** as shown in FIG. **1**. A target organic material may be contained in a first deposition source **11** and a second deposition source **12** and then deposited. In this regard, when a host and a dopant are simultaneously deposited, a host material and a dopant material may be respectively contained in the first deposition source **11** and the second deposition source **12** and then deposited.

After the organic emission layer **63** is formed, the second electrode **62** may also be formed through the same deposition process as used in the organic emission layer **63**.

The first electrode **61** may function as an anode, and the second electrode **62** may function as a cathode. Polarities of the first electrode **61** and the second electrode **62** may be switched. The first electrode **61** may be patterned to correspond to a region of each pixel. The second electrode **62** may be formed to cover all pixels.

The first electrode **61** may be formed as a transparent electrode or a reflective electrode. When the first electrode **61** is formed as the transparent electrode, the transparent electrode may include indium tin oxide (ITO), indium zinc oxide (IZO), zinc oxide (ZnO), or indium oxide (In_2O_3). When the first electrode **61** is formed as the reflective electrode, the reflective electrode may be formed by forming a reflective layer including silver (Ag), magnesium (Mg), aluminum (Al), platinum (Pt), palladium (Pd), gold (Au), nickel (Ni), neodymium (Nd), iridium (Ir), chromium (Cr) or a compound thereof and forming a transparent layer including ITO, IZO, ZnO, or In_2O_3 on the reflective layer. The first electrode **61** may be formed by forming a layer by sputtering, etc. and then patterning the layer by photolithography, etc.

The second electrode **62** may also be formed as a transparent electrode or a reflective electrode. When the second electrode **62** is formed as the transparent electrode, since the second electrode **62** may be used as a cathode, the transparent electrode may be formed by depositing a metal having a low work function, such as lithium (Li), calcium (Ca), lithium fluoride/calcium (LiF/Ca), lithium fluoride/aluminum (LiF/Al), aluminum (Al), silver (Ag), magnesium (Mg), or a compound thereof in a direction of the organic emission layer **63** and forming an auxiliary electrode layer or a bus electrode line including ITO, IZO, ZnO, In_2O_3, or etc. thereon. When the second electrode **62** is formed as the reflective electrode, the reflective layer may be formed by entirely depositing Li, Ca, LiF/Ca, LiF/Al, Al, Ag, Mg, or a compound thereof. The second electrode **62** may be formed by using the same deposition method used in the organic emission layer **63** described above.

The organic layer deposition device according to the present invention may be applied to deposit an organic layer or an inorganic layer of an organic TFT and to form layers including various materials.

According to the exemplary embodiments of the disclosure described above, an organic layer having a uniform thickness may be deposited on a display substrate, thereby preventing the occurrence of a brightness difference.

Although certain exemplary embodiments and implementations have been described herein, other embodiments and modifications will be apparent from this description. Accordingly, the inventive concept is not limited to such embodiments, but rather to the broader scope of the presented claims and various obvious modifications and equivalent arrangements.

What is claimed is:

1. A method of manufacturing an organic light emitting display device including an organic layer deposition assembly for depositing an organic layer on a substrate, the method comprising:

fixing the substrate to a moving unit, wherein the fixing is performed by a loading unit;

transferring the moving unit to which the substrate is fixed to a chamber via a first transfer unit installed to penetrate the chamber;

forming the organic layer by depositing a deposition material sprayed from the organic layer deposition assembly on the substrate while the substrate relatively moves with respect to the organic layer deposition assembly in a state wherein an organic layer deposition assembly and the substrate that are arranged in the chamber are spaced apart from each other by a predetermined degree;

separating the substrate from which deposition is completed from the moving unit, the separating is performed by an unloading unit; and

transferring the moving unit separated from the substrate to the loading unit via a second transfer unit installed to penetrate the chamber,

wherein the organic layer deposition assembly comprises:

a deposition source configured to spray the deposition material;

a deposition source nozzle arranged in one side of the deposition source and including deposition source nozzles arranged in a first direction;

a patterning slit sheet arranged to face the deposition source nozzle and including patterning slits in a second direction that crosses the first direction; and

a correction sheet arranged between the deposition source nozzle and the patterning slit sheet and configured to block at least a part of the deposition material sprayed from the deposition source;

wherein the organic layer deposition assembly is configured to perform deposition while the substrate moves in the first direction with respect to the organic layer deposition assembly,

wherein the patterning slits comprise a first patterning slit and a second patterning slit spaced apart from each other by a predetermined distance in the first direction and in the second direction,

wherein a line crossing a center of the first patterning slit in the second direction and a line crossing a center of the second patterning slit in the second direction are spaced apart from each other by a predetermined distance, and

wherein a line connecting the center of each adjacent patterning slit in the second direction is a single zigzag pattern.

2. The method of claim **1**, wherein a plurality of organic layer deposition assemblies are provided in the chamber, each of the plurality of organic layer deposition assemblies being configured to continuously perform deposition on the substrate.

3. The method of claim **2**, wherein the moving unit is configured to move cyclically between the first transfer unit and the second transfer unit.

4. The method of claim **2**, wherein the first transfer unit and the second transfer unit are vertically arranged in parallel to each other.

5. The method of claim **2**, wherein the second transfer unit is configured to sequentially move the moving unit to the unloading unit and the loading unit.

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专利名称(译)	有机层沉积组件，包括其的有机层沉积设备，以及使用该有机层沉积组件制造有机发光显示设备的方法		
公开(公告)号	US10158074	公开(公告)日	2018-12-18
申请号	US15/390908	申请日	2016-12-27
[标]申请(专利权)人(译)	三星显示有限公司		
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IPC分类号	H01L51/56 B05B12/22 C23C14/04 B05D1/32 B05D1/00 H01L51/00 B05B12/36		
CPC分类号	H01L51/0011 B05B12/22 B05D1/32 C23C14/042 H01L51/56 B05D1/60 B05B12/36		
审查员(译)	TRINH，MICHAEL		
优先权	1020150186769 2015-12-24 KR		
其他公开文献	US20170186954A1		
外部链接	Espacenet		

摘要(译)

用于在基板上沉积沉积材料的有机层沉积组件包括：沉积源，被配置为喷射沉积材料;沉积源喷嘴，布置在沉积源的一侧并且包括沿第一方向布置的沉积源喷嘴;图案化狭缝片材，其布置成面向沉积源喷嘴并且在与第一方向交叉的第二方向上具有图案化狭缝，以及校正片，其布置在沉积源喷嘴和图案化缝隙片之间并且被配置为阻挡至少一部分喷射的沉积材料来自沉积源。