rack 54. The end effector is configured to be thick since it has to have a function of sandwiching the substrate and secure stiffness. Therefore, even if the robot tries to insert the end effector in between two substrates 51 and 52 (or two substrates 52 and 53), the robot cannot insert it. Even if the robot could insert the end effector, the end effector may hit and break the substrates 51 to 53 and the like. On this account, the storage interval between the substrates in the rack 54 needs to be increased drastically. In this case, the installation area of the rack 54 increases.

[0008] This problem occurs not only in the case of carrying the substrates 51 to 53 out but also in the case of carrying the substrates 51 to 53 in. To be specific, no problem occurs in the case of carrying the substrates 51 to 53 in the rack in order in the arrangement direction. However, in a case where two substrates 51 and 53 are carried in the rack 54 first, and then the substrate 52 is carried in the rack 54, the same problem as the above case of carrying the substrate out occurs. To solve this problem, the storage interval between the substrates in the rack 54 needs to be increased drastically, and this increases the installation area of the rack 54.

[0009] Embodiments~~Herein, an object~~ of the present invention ~~is to~~ provide a plate-shaped member transfer facility capable of carrying a plate-shaped member in between two spaced-apart plate-shaped members carrying any of a plurality of stored plate-shaped members out from the rack without inserting an end effector in a substrate storage portion of a rack even if a storage pitch between the plate-shaped members is short.

Solution to Problem

~~[0010] A plate-shaped member transfer facility of the present invention includes: a rack~~ configured to store a plurality of plate-shaped members such that the plurality of plate-~~shaped members are arranged in an arrangement direction intersecting with a~~

~~conveying direction, the plurality of plate-shaped members being supported by~~ supporting portions and standing to extend in the conveying direction, the rack further configured such that the plurality of plate-shaped members are able to be carried therein in the conveying direction and carried out therefrom in the conveying direction; and a plate-shaped member transfer mechanism configured to carry the plate-shaped members in the rack in the conveying direction and carry the plate-shaped members out from the rack in the conveying direction, wherein: the plate-shaped member transfer mechanism includes a flip rotating mechanism including a flip and configured to cause the flip to rotate to stand or lay the plate-shaped member, the flip being configured to support the plate-shaped member and be rotatable about a rotation axis line parallel to the conveying direction, a conveying mechanism including a conveyance body in which a feed portion is formed, the feed portion extending in the conveying direction and being configured to transfer the plate-shaped member in a standing state in the conveying direction, and a transporting mechanism configured to cause the flip rotating mechanism and the conveying mechanism to move in the arrangement direction; and the conveying mechanism is configured such that the plate-shaped member in the standing state is ~~transferred between the rack and the flip by the feed portion.~~

[0010] According to an aspect, there is provided a plate-shaped member transfer facility comprising:

a rack configured to store a plurality of plate-shaped members such that the plurality of plate-shaped members are arranged in an arrangement direction intersecting with a conveying direction, the plurality of plate-shaped members being supported by supporting portions and standing to extend in the conveying direction, the rack further configured such that the plurality of plate-shaped members are able to be carried therein in the conveying direction and carried out therefrom in the conveying direction; and

a plate-shaped member transfer mechanism configured to carry the plate-shaped members in the rack in the conveying direction and carry the plate-shaped members out from the rack in the conveying direction, wherein:

the plate-shaped member transfer mechanism includes

a flip rotating mechanism including a flip and configured to cause the flip to rotate to stand or lay the plate-shaped member, the flip being configured to support the plate-shaped member and be rotatable about a rotation axis line parallel to the conveying direction,

a conveying mechanism including a conveyance body in which a feed portion is formed, the feed portion extending in the conveying direction and being configured to transfer the plate-shaped member in a standing state in the conveying direction, and

a transporting mechanism configured to cause the flip rotating mechanism and the conveying mechanism to move in the arrangement direction; and

the conveying mechanism is configured to cause the conveyance body to move in the conveying direction from the flip to extend into the rack and is configured such that the plate-shaped member in the standing state is transferred between the rack and the flip by the feed portion.

[0011] According to embodiments of the present invention, the plate-shaped member transfer mechanism can cause the flip to rotate by the flip rotating mechanism to stand the plate-shaped member supported by the flip. Further, the plate-shaped member transfer mechanism can cause the flip rotating mechanism and the conveying mechanism to move in the arrangement direction of the rack to an arbitrary position and causes the plate-shaped member in a standing state to move in the conveying direction by a feed portion to carry and store the plate-shaped member in the rack. As above, the plate-shaped member transfer mechanism can stand the horizontal-state plate-shaped

member and insert and store the plate-shaped member in the rack. In embodiments of the present invention, the "horizontal state" denotes not only a completely horizontal state but also a slightly inclined state relative to the completely horizontal state.

[0012] In embodiments of the present invention, by causing the flip rotating mechanism and the conveying mechanism to move to the arbitrary position of the rack and driving the feed portion, the plate-shaped member stored in the rack can be caused to move in the conveying direction to be returned onto the flip. After the plate-shaped member is mounted on the flip serving as an end effector, the flip rotating mechanism causes the flip to rotate and be laid. Thus, the plate-shaped member can be laid in the horizontal state. As above, the plate-shaped member transfer mechanism can take out the plate-shaped member stored in the rack in a standing state and be laid in the horizontal state.

[0013] As above, in embodiments of the present invention, the plate-shaped member is caused to move in the conveying direction by the feed portion to be transferred. Therefore, when the plate-shaped member is carried in the rack or carried out from the rack, it is unnecessary to directly insert the conveyance body and the flip into a substrate storage portion of the rack. With this, even if the interval between the plate-shaped members is reduced, that is, the storage pitch between the plate-shaped members in the arrangement direction is shortened in order to reduce the installation area of the facility, the plate-shaped member can be carried in between two plate-shaped members, and any one of the plurality of plate-shaped members stored in the rack can be carried out without causing a problem in which the stored plate-shaped member and the end effector contact each other to be damaged as in the prior art. Therefore, the plate-shaped member can be surely, quickly carried in the rack and carried out from the rack.

[0014] In an embodiment of the above invention, it is preferable that the conveying mechanism be configured to be able to cause the conveyance body to move in the conveying direction

from the flip to extend into the rack.

[0015] According to the above configuration, by causing the conveyance body to extend into the rack, the plate-shaped member can be caused to move to the back side in the rack by the feed portion. With this, it becomes unnecessary to provide a conveying mechanism in the rack. Thus, the number of components can be reduced. On this account, the manufacturing cost can be reduced.

[0016] In an embodiment of the above invention, it is preferable that the conveying mechanism be configured to be able to cause the conveyance body to move in the upper-lower direction.

[0017] According to the above configuration, by causing the conveyance body to move in the upper-lower direction in accordance with the position of the rack, the difference in height between the conveyance body and the rack when transferring the plate-shaped member can be eliminated. Thus, the plate-shaped member can be prevented from falling down in the rack due to the difference in height to be damaged.

[0018] In an embodiment of the above invention, it is preferable that: the plurality of supporting portions be arranged in the rack so as to be spaced apart from one another in the conveying direction; the feed portion of the conveyance body include a plurality of driving members arranged in the conveyance body so as to be scattered in the conveying direction and configured to transfer the plate-shaped member in the conveying direction; and a plurality of recesses be formed on the conveyance body so as to correspond to the plurality of supporting portions, and the at least one driving member be provided at a convex portion formed between the adjacent recesses.

[0019] According to the above configuration, when the conveyance body is caused to extend into the rack, and the supporting portion is inserted in the recess of the conveyance body, the driving members attached to the convex portion can be exposed from between the adjacent supporting portions. By exposing the driving members from

between the supporting portions, the plate-shaped member can be caused to move smoothly in the rack by the driving members.

[0020] In an embodiment of the above invention, it is preferable that the conveying mechanism be configured to: position the conveyance body such that an upper end of the convex portion is lower in position than the supporting portions of the rack at a reference position at which the conveyance body is located on a conveying-direction near side of the rack; causes the conveyance body to move in the conveying direction from the reference position to position the recess under the supporting portions of the rack; and cause the conveyance position to move upward such that upper ends of the driving members are higher in position than the supporting portions of the rack.

[0021] According to the above configuration, the supporting portion can be inserted in the recess of the conveyance body, and the driving members provided on the convex portions can be caused to be exposed from between the supporting portions.

[0022] In an embodiment of the above invention, it is preferable that: the flip include a supporting portion configured to support the plate-shaped member when the flip stands; and the conveying mechanism be configured such that when the conveyance body is moved upward, the plate-shaped member supported by the supporting portion of the flip is mounted on the driving members.

[0023] According to the above configuration, by causing the conveyance body to move upward, the plate-shaped member is mounted on the driving members. By causing the flip to stand and causing the conveyance body to move upward, the plate-shaped member can be mounted on the driving members. Therefore, the plate-shaped member can be easily transferred between the flip and the driving members.

[0024] In an embodiment of the above invention, it is preferable that the flip include a plurality of spherical rollers configured to be able to roll and be configured to support a rear surface

of the plate-shaped member by the plurality of spherical rollers.

[0025] According to the above configuration, the plate-shaped member is supported by the spherical rollers configured to roll. Therefore, when the plate-shaped member is caused to move by a feed portion, the plate-shaped member can be caused to move smoothly with the plate-shaped member leaning on the flip. With this, when transferring the plate-shaped member between the rack and the flip, the plate-shaped member can be caused to slide along the flip, and the flip can be prevented from falling.

[0026] In an embodiment of the above invention, it is preferable that the flip rotating mechanism be configured to, when the flip rotating mechanism moves, cause the flip to rotate to lay the plate-shaped member supported by the flip.

[0027] According to the above configuration, the flip rotating mechanism is caused to move with the plate-shaped member laid. Therefore, the air flow rate of wind generated by the movement of the plate-shaped member can be reduced. The wind generated by the movement may cause the clattering of the plate-shaped members arranged and stored in the rack and the damages of the plate-shaped members. However, since the wind can be suppressed in embodiments of the present invention, the clattering of the plate-shaped members can be suppressed, and the damages of the plate-shaped members can be prevented.

Advantageous Effects of Invention

[0028] Embodiments of the~~The~~ present invention can carry the plate-shaped member in between two spaced-apart plate-shaped members between which the storage pitch is short and carry any one of a plurality of plate-shaped members out from the rack without inserting the end effector in the substrate storage portion of the rack.

Brief Description of Drawings