

APPARATUS AND METHOD FOR LOADING AND UNLOADING TWO-CHAMBER COATING DEVICE

TECHNICAL FIELD

[0001] The present disclosure relates to the field of vacuum coating and, particularly to an apparatus and a method for loading and unloading two-chamber coating device.

BACKGROUND

[0002] The coating efficiency of the coating device can be improved by setting up a double chamber. At present, the loading and unloading of coated products between the chambers of a two-chamber vacuum coating device employs a loading and unloading device that combines a magnetic arm with a rotating hook. This loading and unloading device not only lacks sufficient magnetic transmission torque, but also tends to be unstable due to the jittering at the front end that occurs when the magnetic arm extends, leading to frequent faults. In addition, a rotating hook is employed to connect the magnetic arm to the substrate turntable trolley. This connection is a rigid connection. If the rotating hook is not rotated into place, the loading and unloading of the entire substrate turntable trolley cannot be completed. This structure is unstable and leads to an increase in the failure rate of the loading and unloading device.

SUMMARY

[0003] A primary object of the present application is an apparatus for loading and unloading two-chamber coating device, which can be employed to solve the above problems and improve the stability of loading and unloading.

[0004] The technical solution adopted in the present application is as follows:

[0005] An apparatus for loading and unloading two-chamber coating device includes a first chamber, a second chamber, and a loading device configured to load a workpiece to be coated, the loading device is movably mounted between the first chamber and the second chamber, a connecting channel configured for moving the loading device is provided between the first chamber and the second chamber, the connecting channel is provided with a first adjusting device configured to adjust a communication state of the connecting channel, and a second adjusting

device configured to adjust the loading device to be moved between the first chamber and the second chamber, the loading device is provided with a first connecting part, the second adjusting device is provided with a second connecting part, one of the first connecting part and the second connecting part is an electromagnet connector, the other thereof is a magnetic connector, and the magnetic connector and the electromagnet connector form a magnetically detachable connection structure.

[0006] Further options are: the first chamber and the second chamber are provided with a first sensor and a second sensor respectively that are configured to detect a position of the loading device.

[0007] The second chamber is a coating chamber, and the first chamber is further provided with a third sensor configured to detect a position of the first connecting part.

[0008] The second adjusting device is provided with a fourth sensor configured to detect a connecting state between the first connecting part and the second connecting part.

[0009] The first connecting part is the electromagnet connector, and the second connecting part is the magnetic connector.

[0010] The magnetic connector is made of iron.

[0011] The first connecting part is floatingly mounted on the loading device in a first direction through a spring, the first direction is a distance direction between the first connecting part and the second connecting part, and the spring drives the first connecting part to move close toward the second connecting part.

[0012] The second adjusting device is a vacuum electric cylinder, the vacuum electric cylinder is mounted on the first chamber, the first chamber is located between the second chamber and the vacuum electric cylinder, a piston rod of the vacuum electric cylinder is arranged in the first direction, and both the second connecting part and the fourth sensor are mounted on a push end of the piston rod.

[0013] The first adjusting device is a gate valve provided on the connecting channel, the first chamber is a loading chamber configured to load the workpiece to be coated to the loading device, and the loading device is driven to move by using a servo motor on the vacuum electric cylinder.

[0014] Provided in the present application is further a method for loading and unloading a two-

chamber coating device, including the following steps.

[0015] Loading the workpiece to be coated to the loading device in the first chamber;
 adjusting the first adjusting device to allow the connecting channel to be in a connected state;
 powering on the electromagnet connector to be assembled with the magnetic connector;
 adjusting the second adjusting device to move the loading device into the second chamber when it is detected that the electromagnet connector is finished in being assembled with the magnetic connector;
 powering off the electromagnet connector to be detached from the magnetic connector and
 adjusting the electromagnet connector to move into the first chamber, when it is detected that the loading device is finished in movement; and
 adjusting the first adjusting device to allow the connecting channel to be in a closed state and
 performing a coating process on the workpiece on the loading device in the second chamber, when it is detected that the electromagnet connector is finished in movement.

[0016] Adjusting the first adjusting device to allow the connecting channel to be in the connected state when the workpiece is finished in performing the coating process;
 initiating the second adjusting device to allow the electromagnet connector to move into the second chamber;
 powering on the electromagnet connector to be assembled with the magnetic connector when it is detected that the electromagnet connector is finished in movement;
 initiating the second adjusting device to allow the loading device to move into the first chamber when it is detected that the electromagnet connector is finished in being assembled with the magnetic connector; and
 adjusting the first adjusting device to allow the connecting channel to be in the closed state and
 unloading the workpiece after coating when it is detected that the loading device is finished in movement.

[0017] The aforementioned solution provided in the present application employs a magnetically separable connection structure formed between a magnetic connector and an electromagnet connector. This structure is more stable, reducing the failure rate of loading and unloading devices and thereby improving the efficiency of the coating process.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] Fig. 1 is a schematic structural diagram of the present application.

[0019] Fig. 2 is a schematic assembly diagram of the second adjusting device and the loading device.

[0020] The corresponding relationship between the labels and parts is: 11 first chamber; 12 second chamber; 13 first adjusting device; 14 second adjusting device; 15 servo motor; 21 first sensor; 22 second sensor; 23 third sensor; 24 fourth sensor; 30 loading device; 31 magnetic connector; 32 spring; 41 electromagnet connector.

DETAILED DESCRIPTION

[0021] In order to describe the purpose and advantages more clearly, the present disclosure is described in detail below in conjunction with embodiments. It is to be understood that the following description is merely one or more specific embodiments of the present disclosure, but does not strictly limit the scope of protection of the specific claims of the present disclosure.

[0022] As shown in Figs. 1 and 2, an apparatus for loading and unloading two-chamber coating device includes a first chamber 11, a second chamber 12, and a loading device 30 configured to load a workpiece to be coated, the loading device 30 is movably mounted between the first chamber 11 and the second chamber 12, a connecting channel configured for moving the loading device 30 is provided between the first chamber 11 and the second chamber 12, the connecting channel is provided with a first adjusting device 13 configured to adjust a communication state of the connecting channel, and a second adjusting device 14 configured to adjust the loading device 30 to be moved between the first chamber 11 and the second chamber 12, the loading device 30 is provided with a first connecting part, the second adjusting device 14 is provided with a second connecting part, one of the first connecting part and the second connecting part is an electromagnet connector 41, the other thereof is a magnetic connector 31, and the magnetic connector 31 and the electromagnet connector 41 form a magnetically detachable connection structure. The magnetic connector 31 refers to a part that can be attracted by an electromagnet.

[0023] The above solution provided by the present application employs a magnet-type detachable connection structure between the magnetic connector 31 and the electromagnet connector 41, which is more stable and reduces the failure rate of the loading and unloading device,

and thus improves the production efficiency of the coating.

[0024] Further options are: the first chamber 11 and the second chamber 12 are provided with a first sensor 21 and a second sensor 22 respectively that are configured to detect a position of the loading device 30. The second chamber 12 is a coating chamber, and the first chamber 11 is further provided with a third sensor 23 configured to detect a position of the first connecting part. The second adjusting device 14 is provided with a fourth sensor 24 configured to detect a connecting state between the first connecting part and the second connecting part. The first connecting part is the electromagnet connector 41, and the second connecting part is the magnetic connector 31. The magnetic connector 31 is made of iron. The first sensor 21, the second sensor 22, the third sensor 23, and the fourth sensor 24 are all contact sensors. The loading device 30 may specifically be a substrate turntable trolley, and the loading device 30 may be slidably mounted or rollably mounted thereon. Slide rails or traveling tracks are provided between the first chamber 11 and the second chamber 12, and the slide rails and traveling tracks are provided with a vacant segment corresponding to the first adjusting device 13, so as to reliably and conveniently adjust the loading device 30 for sliding or traveling. The first chamber 11 and the second chamber 12 may be provided with a first locking assembly and a second locking assembly, respectively, configured to lock the loading device 30 after it is moved into place. Alternatively, the loading device 30 is provided with a locking structure directly on the loading device 30, and the locking structure is provided to lock the loading device 30 as it moves into place.

[0025] Further, the first connecting part is floatably mounted on the loading device 30 in a first direction through a spring 32, the first direction is a distance direction between the first connecting part and the second connecting part, the spring 32 drives the first connecting part to move close toward the second connecting part. A distance direction between the first chamber 11 and second chamber 12 is identical to the first direction. The second adjusting device 14 is a vacuum electric cylinder, the vacuum electric cylinder is mounted on the first chamber 11, the first chamber 11 is located between the second chamber 12 and the vacuum electric cylinder, a piston rod of the vacuum electric cylinder is arranged in the first direction, and both the second connecting part and the fourth sensor 24 are mounted on a push end of the piston rod. The first adjusting device 13 is

a gate valve provided on the connecting channel, the first chamber 11 is a loading chamber 30 configured to load the workpiece to be coated to the loading device, and the loading device 30 is driven to move by using a servo motor 15 on the vacuum electric cylinder. Through the drive of the servo motor 15, the loading device 30 is achieved to move reciprocally and precisely between the first chamber 11 and the second chamber 12, and the front end of the piston rod of the vacuum electric cylinder is mounted with the electromagnet connector 41, which can be specifically a high-strength electromagnet, and the electromagnet connector 41 generates a magnetic force to attract the iron block on the loading device 30 (substrate turntable trolley) when it is energized. The iron block is mounted on the loading device 30 through the spring 32 to avoid rigid assembly connection, and the elastic connection has better deformation ability and shock resistance within a certain range, and the electromagnet connector 41 and the iron block are detected whether they are completely attracted or not by the fourth sensor 24 (contact sensor) at the front end of the vacuum electric cylinder. The loading and unloading of the substrate turntable trolley between the loading chamber and the coating chamber is realized by the setting of the vacuum electric cylinder, the electromagnet connector 41 and a plurality of sensors.

[0026] By employing the method for loading and unloading two-chamber coating device, following steps are included. The workpiece to be coated to the loading device 30 is loaded in the first chamber 11; the first adjusting device 13 is adjusted to allow the connecting channel to be in a connected state; the electromagnet connector 41 is powered on to be assembled with the magnetic connector 31; the second adjusting device 14 is adjusted to move the loading device 30 into the second chamber 12 when it is detected that the electromagnet connector 41 is finished in being assembled with the magnetic connector 31; the electromagnet connector 41 is powered off to be detached from the magnetic connector 31 and adjusting the electromagnet connector 41 to move into the first chamber 11, when it is detected that the loading device 30 is finished in movement; and the first adjusting device 13 is adjusted to allow the connecting channel to be in a closed state and a coating process is performed on the workpiece on the loading device 30 in the second chamber 12, when it is detected that the electromagnet connector 41 is finished in movement. The first adjusting device 13 is adjusted to allow the connecting channel to be in the connected state when the workpiece is finished in performing the coating process;

the second adjusting device 14 is initiated to allow the electromagnet connector 41 to move into the second chamber 12; the electromagnet connector 41 is powered on to be assembled with the magnetic connector 31 when it is detected that the electromagnet connector 41 is finished in movement; the second adjusting device 14 is initiated to allow the loading device 30 to move into the first chamber 11 when it is detected that the electromagnet connector 41 is finished in being assembled with the magnetic connector 31; and the first adjusting device 13 is adjusted to allow the connecting channel to be in the closed state and unloading the workpiece after coating when it is detected that the loading device is finished in movement.

[0027] For details, the workpiece is first loaded onto the loading device 30 (substrate turntable trolley) when the workpiece (coated product) is to be loaded for coating, at which time the loading device 30 is in the loading chamber, the first sensor 21 detects that the loading device 30 is in the preset position within the loading chamber, and the vacuum electric cylinder is in the initial position. The gate valve between the loading chamber and the coating chamber opens when the product loading button is pressed, and the electromagnet connector 41 at the front end of the vacuum electric cylinder is energized to attract the loading device 30, and at the same time, the fourth sensor 24 at the front end of the vacuum electric cylinder detects that the electromagnet connector 41 is completely attracted to the loading device 30, and the vacuum electric cylinder, driven by the servo motor 15, begins to push the loading device 30 to move forward and gradually leave the loading chamber. The vacuum electric cylinder stops when the loading device 30 moves into the coating chamber and the second sensor 22 in the coating chamber detects that the loading device 30 moves into place, at this time, the electromagnet connector 41 loses power and magnetic force, the vacuum electric cylinder starts to regulate that the loading device 30 moves backward and returns to the initial position, and the vacuum electric cylinder stops, the gate valve is closed, and the loading of the loading device 30 is completed, after the third sensor 21 detects that the first connecting part (electromagnet connector 41) returns to the initial position. When the workpiece needs to be unloaded after completing the coating, the product unloading button is pressed, the second sensor 22 detects that the loading device 30 is in the coating chamber, the gate valve is adjusted to open, the vacuum electric cylinder is initiated, and the electromagnet connector 41 is adjusted to move toward the coating chamber. When the electromagnet connector moves into place,

the electromagnet connector 41 is energized to attract the loading device 30, the fourth sensor 24 detects that the electromagnet connector 41 is fully attracted to the iron block, the vacuum electric cylinder is initiated, and the vacuum electric cylinder pulls the loading device 30 back from the coating chamber to the loading chamber. When the first sensor 21 detects that the loading device 30 returns to place and the third sensor 23 detects that the electromagnet connector 41 returns to place, the vacuum electric cylinder is stopped, the gate valve is closed, and the coated workpiece on the loading device 30 is unloaded. The servo motor 15 is a part of the vacuum electric cylinder and is a power source of the vacuum electric cylinder to drive the vacuum electric cylinder to move, and the servo motor 15 drives the rotation of the threads to push the piston rod of the vacuum electric cylinder to move, and linear motion is achieved by the rotational motion of the servo motor 15, and the electromagnet connector 41 is mounted at the front end of the piston rod of the vacuum electric cylinder through the threaded structural device, and moves with the piston rod. The electromagnet connector 41 itself has an electromagnetic coil, which is energized and de-energized by a PLC (control device). Magnetic force is generated when the electromagnetic coil is energized and disappears when the electromagnetic coil is de-energized.

[0028] The above solution provided by the present application employs a magnet-type detachable connection structure between the magnetic connector 31 and the electromagnet connector 41, which is more stable and reduces the failure rate of the loading and unloading device, and thus improves the production efficiency of the coating.

[0029] The above described is only a preferred embodiment of the present disclosure. It should be noted that for those skilled in the art, a plurality of improvements and modifications may be made without departing from the principles of the present disclosure, which should also be considered as the scope of protection of the present disclosure. The structures, mechanisms, and operations not specifically described and explained in the present disclosure, if not specifically stated and limited, are carried out according to the art's conventional means.

CLAIMS

1. An apparatus for loading and unloading a two-chamber coating device, comprising a first chamber, a second chamber, and a loading device configured to load a workpiece to be coated, wherein the loading device is movably mounted between the first chamber and the second chamber, a connecting channel configured for moving the loading device is provided between the first chamber and the second chamber, the connecting channel is provided with a first adjusting device configured to adjust a communication state of the connecting channel, and a second adjusting device configured to adjust the loading device to be moved between the first chamber and the second chamber, the loading device is provided with a first connecting part, the second adjusting device is provided with a second connecting part, one of the first connecting part and the second connecting part is an electromagnet connector, the other thereof is a magnetic connector, and the magnetic connector and the electromagnet connector form a magnetically detachable connection structure.

2. The apparatus for loading and unloading the two-chamber coating device according to claim 1, wherein the first chamber and the second chamber are provided with a first sensor and a second sensor respectively that are configured to detect a position of the loading device.

3. The apparatus for loading and unloading the two-chamber coating device according to claim 1, wherein the second chamber is a coating chamber, and the first chamber is further provided with a third sensor configured to detect a position of the first connecting part.

4. The apparatus for loading and unloading the two-chamber coating device according to claim 1, wherein the second adjusting device is provided with a fourth sensor configured to detect a connecting state between the first connecting part and the second connecting part.

5. The apparatus for loading and unloading the two-chamber coating device according to any one of claims 1-4, wherein the first connecting part is the electromagnet connector, and the second connecting part is the magnetic connector.

6. The apparatus for loading and unloading the two-chamber coating device according to any one of claims 1-4, wherein the magnetic connector is made of iron.

7. The apparatus for loading and unloading the two-chamber coating device according to claim 6, wherein the first connecting part is floatingly mounted on the loading device in a first direction through a spring, the first direction is a distance direction between the first connecting part and the second connecting part, and the spring drives the first connecting part to move close toward the second connecting part.

8. The apparatus for loading and unloading the two-chamber coating device according to claim 3, wherein the second adjusting device is a vacuum electric cylinder, the vacuum electric cylinder is mounted on the first chamber, the first chamber is located between the second chamber and the vacuum electric cylinder, a piston rod of the vacuum electric cylinder is arranged in the first direction, and both the second connecting part and the fourth sensor are mounted on a push end of the piston rod.

9. The apparatus for loading and unloading the two-chamber coating device according to claim 8, wherein the first adjusting device is a gate valve provided on the connecting channel, the first chamber is a loading chamber configured to load the workpiece to be coated to the loading device, and the loading device is driven to move by using a servo motor on the vacuum electric cylinder.

10. A method operated in an apparatus for loading and unloading a two-chamber coating device according to claim 8, comprising following steps:

loading the workpiece to be coated to the loading device in the first chamber;

adjusting the first adjusting device to allow the connecting channel to be in a connected state;

powering on the electromagnet connector to be assembled with the magnetic connector;

adjusting the second adjusting device to move the loading device into the second chamber when it is detected that the electromagnet connector is finished in being assembled with the magnetic connector;

powering off the electromagnet connector to be detached from the magnetic connector and adjusting the electromagnet connector to move into the first chamber, when it is detected that the loading device is finished in movement;

adjusting the first adjusting device to allow the connecting channel to be in a closed state and performing a coating process on the workpiece on the loading device in the second chamber, when it is detected that the electromagnet connector is finished in movement;

adjusting the first adjusting device to allow the connecting channel to be in the connected state when the workpiece is finished in performing the coating process;
initiating the second adjusting device to allow the electromagnet connector to move into the second chamber;

powering on the electromagnet connector to be assembled with the magnetic connector when it is detected that the electromagnet connector is finished in movement;

initiating the second adjusting device to allow the loading device to move into the first chamber when it is detected that the electromagnet connector is finished in being assembled with the magnetic connector; and

adjusting the first adjusting device to allow the connecting channel to be in the closed state and unloading the workpiece after coating when it is detected that the loading device is finished in movement.