English translation of PCT/JP2010/002662 as originally filed

DESCRIPTION

TITLE OF INVENTION Purging Apparatus and Purging Method

TECHNICAL FIELD

[0001]

The present invention relates to a purging apparatus and purging method, particularly a purging apparatus and purging method for purging a container having an openable lid by supplying and discharging a clean gas to and from the inside of the container.

BACKGROUND ART

[0002]

Conventionally a SMIF (standard mechanical interface) pod is a known example of a substrate holding container for transporting and storing substrates, such as photomasks, glass substrates, wafers, and reticles, in semiconductor manufacturing environments. The SMIF pod has a pod cover and an openable lid. During transport and storage, the pod cover is closed with the lid such that the SMIF pod is sealed and contaminants are prevented from entering the pod.

A latch mechanism is provided to lock the lid to the pod cover. Thus, the lid is locked in place with the latch mechanism when a substrate is transported or stored. When a substrate is to be removed, the latch mechanism is released such that the lid can be removed from the pod cover.

[0003]

Also known is an opening/closing device contrived to automatically open and close a SMIF pod when a substrate is loaded into or removed from the SMIF pod. The opening/closing device has a stage on which the SMIF pod is placed and an elevator driving mechanism for driving the stage up and down. The stage is provided with a pin for positioning the SMIF pod in a prescribed position. The opening/closing device also has a latch controlling mechanism

for controlling the latch mechanism, so as to lock and release the latch mechanism.

An opening/closing device inside a clean stocker is described in Patent Literature 1.

CITATION LIST

PATENT LITERATURE

[0004]

PATENT LITERATURE 1 Japanese Laid-open Patent Publication No. 2008-30914

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0005]

When a pod is placed on the stage, the opening/closing device first releases the latch of the latch mechanism using the latch controlling mechanism. The elevator driving mechanism then lowers the stage. As a result, the lid moves downward along with the substrate. When the lid has been lowered to a prescribed position, a robot moves the substrate toward a processing apparatus. After processing, the robot returns the substrate to the stage. The elevator driving mechanism then raises the stage. As a result, the lid moves upward along with the substrate. When the lid has been fitted into the pod cover, the latch controlling mechanism engages the latch of the latch mechanism.

[0006]

The opening/closing device also has a purging mechanism. The purging mechanism is a mechanism for replacing an atmosphere inside a pod with nitrogen or another inert gas. Purging suppresses the occurrence of organic contamination and such chemical changes as natural oxidation on a surface of the substrate.

The purge mechanism has a gas supply tank, a supply pipe, a discharge pipe, an on-off valve, and a flow regulating valve. The supply pipe is connected to a supply port of the pod and supplies gas from the gas supply tank to the inside of the pod. The discharge pipe is

connected to a discharge port of the pod and serves to discharge gas from inside the pod to the outside. The on-off valve and the flow regulating valve are provided on both the supply pipe and the discharge pipe as required.

After processing is finished, the substrate is placed on the lid and the substrate is raised together with the lid until the lid fits into the pod cover. The latch mechanism is then latched such that the lid is locked to the pod cover. The purge mechanism then purges the inside of the pod. As a result, a purge operation time is comparatively long and there are times when a pod containing a substrate cannot be transported to a downstream apparatus early enough to satisfy a demand.

[0007]

The object of the present invention is to shorten the purge operation time.

SOLUTION TO PROBLEM

[0008]

A means for solving the problem will now be explained. A plurality of aspects of the invention will now be explained. These aspects can be freely combined as needed.

A purging apparatus according to the present invention is an apparatus for purging a container having a container body and an openable lid using a clean gas. The purging apparatus has a detaching/attaching section, a moving mechanism, a locking member, a drive mechanism, and a gas supplying-discharging mechanism. The detaching/attaching section can attach the lid to the container body and remove the lid from the container body when it is possible to detach the lid. The moving mechanism is contrived to move the detaching/attaching section with respect to the container body. The locking member is contrived to lock the lid to the container body and release the locked state of the lid. The drive mechanism drives the locking member. The gas supplying-discharging mechanism starts purging the container during an operation of attaching the lid to the container body at a time before the drive mechanism

completes an operation of locking the lid to the container body with the locking member.

With this purging apparatus, the lid is attached to the container body shortly after the moving mechanism has moved the detaching/attaching section to the container body. The gas supplying-discharging mechanism starts purging the container before the drive mechanism completes an operation of locking the lid to the container body using the locking member. Thus, the inside of the container can be purged efficiently and a purge operation time during which the container is purged can be shortened.

It is also acceptable if the gas supplying-discharging mechanism starts a purge operation at any time before an operation of locking the locking member is completed.

[0009]

It is acceptable to contrive the apparatus such that the lid is attachable to and detachable from the container body along a vertical direction, and the lid includes a port connected to the gas supplying-discharging mechanism.

With this apparatus, a clean gas is supplied to the inside of the container through the port provided in the lid and also discharged through the port. Thus, purging can be executed efficiently even if purging is started before the operation of attaching the lid to the container body is completed.

[0010]

It is also acceptable to provide a first detector to detect a position of the lid and contrive the apparatus such that the gas supplying-discharging mechanism starts purging the container based on a position of the lid occurring before the moving mechanism completes an operation of attaching the lid to the container body.

[0011]

It is also acceptable to provide a first detector to detect a position of the lid and contrive the apparatus such that the gas supplying-discharging mechanism starts purging the container

when the moving mechanism completes an operation of attaching the lid to the container body.

[0012]

It is also acceptable to provide a second detector to detect a position of the locking member and contrive the apparatus such that the gas supplying-discharging mechanism starts purging the container based on a position of the locking member after the drive mechanism has driven the locking member.

[0013]

It is also acceptable to provide a second detector to detect a position of the locking member and contrive the apparatus such that the gas supplying-discharging mechanism starts purging the container based on a position of the locking member after the drive mechanism has driven the locking member.

[0014]

A purging method according to the present invention is a method of purging a container having a container body and an openable lid using a clean gas. The purge method comprises the following steps:

o an attaching step in which a lid is attached to the container body from a state in which the lid is separated from the container body

o a locking step in which the lid is locked to the container body after the attaching step

o a purge starting step in which purging of the container is started before the locking step is completed.

With this purging method, the lid is attached to the container in an attaching step. Afterwards, a locking step is executed, but purging of the container is started before the locking step is completed. Thus, the inside of the container can be purged efficiently and a purge operation time during which the container is purged can be shortened.

Thus, the purge operation can be started at any time so long as it is before the locking step is completed.

[0015]

It is also acceptable to start purging during the attaching step before the lid is attached to the container body.

[0016]

It is also acceptable to start purging when the lid becomes attached to the container body.

[0017]

It is also acceptable to start purging during the locking step.

ADVANTAGEOUS EFFECTS OF INVENTION

[0018]

A purge apparatus and purge method according to the present invention shorten the purge operation time.

BRIEF DESCRIPTION OF DRAWINGS

[0019]

Figure 1 is a perspective view of a reticle pod and a pod opener.

Figure 2 is an exploded perspective view of a pod cover and a bottom lid of the reticle pod.

Figure 3 is a bottom plan view of the reticle pod.

Figure 4 is a perspective view of the pod opener.

Figure 5 is a simple sketch illustrating an internal structure of the pod opener.

Figure 6 is a simple sketch illustrating an internal structure of the pod opener.

Figure 7 is a partially enlarged view of a latch mechanism.

Fig. 8 is a block diagram showing control features of the pod opener.

Figure 9 is a flowchart showing a control for a cover opening operation.

Figure 10 is a flowchart showing a control for a cover closing operation.

Figure 11 is a flowchart showing a control for a cover closing operation according to a second embodiment.

DESCRIPTION OF EMBODIMENTS

[0020]

A reticle pod 1 and a pod opener 21 according to an embodiment of the present invention will now be explained.

[0021]

(1)Reticle Pod

A reticle pod 1 will now be explained using Figures 1 to 3. Figure 1 is a perspective view of a reticle pod and a pod opener; Figure 2 is an exploded perspective view showing a pod cover and a bottom lid of the reticle pod; and Figure 3 is a bottom plan view of the reticle pod.

[0022]

The reticle pod 1 is a container for housing a reticle 3 in a sealed state, and is contrived to be transported by another device. The reticle 3 is a photomask used for exposing a circuit pattern onto a wafer in an LSI manufacturing process. The reticle pod 1 has a pod cover 5 and a bottom lid 7. The bottom lid 7 is detachable from the pod cover 5.

[0023]

More specifically, as shown in the figures, the pod cover 5 is a comparatively flat member shaped like a box with a top panel and side panels but open at a bottom portion. The bottom lid 7 fits into the pod cover 5 from below and serves to seal the pod cover 5 while forming a bottom portion of the pod cover 5. The bottom lid 7 can be attached and detached with respect to the pod cover 5 along a vertical direction.

[0024]

A reticle loading section 9, onto which the reticle 3 is to be loaded, is provided on an upper surface of the bottom lid 7. Three positioning holes 11 for inserting positioning pins 24 of the

pod opener 21 are provided in a bottom surface of the bottom lid 7.

[0025]

The reticle pod 1 also has a latch mechanism 13. The latch mechanism 13 comprises chiefly a latch member 15 that is provided on a perimeter section 14 serving as a bottom surface of the pod cover 5, and the latch member 15 is contrived such that it can slide inward. As shown in Figures 3 and 7, the latch member 15 is arranged inside a groove section 17 provided in the bottom surface of the pod cover 5 and can move inward and outward within a prescribed range. A groove section 19 is provided in a bottom surface of the bottom lid 7 in a position corresponding to the groove section 17. The latch member 15 can move into the groove section 19 when it moves inward. Thus, when the latch member 15 has been moved outward, the latch member 15 separates from the groove section 19 and, accordingly, the bottom lid 7 can be detached from the pod cover 5. Meanwhile, when the latch member 15 has been moved inward, a portion of the latch member 15 is inside the groove section 19 and accordingly the lid 7 cannot be detached from the container body. An engaging hole 20 (explained later) is also provided in the latch member 15. Additionally, the latch member 15 is constantly subjected to a force applied by a force applying means (not shown) in a direction towards causing engagement with the groove section 19.

[0026]

(2) Pod Opener

The pod opener 21 is used in a clean stocker installed in a clean room of, for example, a semiconductor plant or a liquid crystal plant. The pod opener 21 serves to open the bottom lid 7 of the reticle pod 1 such that a robot (not shown) can transport the reticle 3 to a processing apparatus. The pod opener 21 also serves to return the reticle 3 to the inside of the pod cover 5 after the reticle 3 has been processed and transported back to the pod opener 21 by the robot (not shown).

[0027]

The structure of the pod opener 21 will now be explained. The pod opener 21 has a box-shaped case 23 and a stage 25. A square opening 27 is provided in a top panel of the case 23. The stage 25 has a similar shape to the opening 27 and is arranged in such a position that it lies in substantially the same plane as an upper perimeter section 29 that defines the opening 27, as shown in Figure 4. Figure 4 is a perspective view of the pod opener.

A fan (not shown) is provided inside the case 23 and serves to keep the inside of the case 23 clean by drawing in clean air from inside the clean stocker.

[0028]

When the reticle pod 1 is placed on top of the pod opener 21, the bottom lid 7 is placed on an upper surface of the stage 25 and positioned through the positioning pins 24 engaging with the positioning holes 11, such that the perimeter section 14 serving as the bottom surface of the pod cover 5 rests on the upper perimeter section 29 of the case 23. In this state, a latch operating pin 64 of a latch driving mechanism 63 is inserted into the engaging hole 20 of the latch member 15. Another mechanism (not shown) of the latch driving mechanism 63 can move the latch operating pin 64 inward and outward and thereby move the latch member 15 inward and outward.

As shown in Figure 7, a first latch sensor 65 and a second latch sensor 66 are provided for detecting a movement state of the latch member 15. The first latch sensor 65 is a sensor for detecting if the latch member 15 has been moved outward such that the latched state is released. The second latch sensor 66 is a sensor for detecting if the latch member 15 has been moved inward such that the latched state is engaged.

[0029]

A first supply hole 31 and a first discharge hole 33 are formed through upper and lower surfaces of the bottom lid 7. The first supply hole 31 and the first discharge hole 33 are each

provided with a non-return valve and a filter to make it more difficult for contaminated external air to enter the apparatus. Additionally, a second supply hole 35 and a second discharge hole 37 are provided in the stage 25 in positions corresponding to the first supply hole 31 and the first discharge hole 33, respectively. The first supply hole 31 and the first discharge hole 33 are aligned with and connected to the second supply hole 35 and the second discharge hole 37 with a connection structure (not shown).

[0030]

A pod placement sensor 71 (Figure 8) is provided on the stage 25 to detect if a reticle pod 1 has been placed on the stage 25.

[0031]

The pod opener 21 has an elevator driving mechanism 41 for raising and lowering the stage 25. The elevator driving mechanism 41 is a cylinder mechanism having a rod 43 fixed to a bottom surface of the stage 25 and a cylinder drive section 45 contrived to drive the rod 43. The elevator driving mechanism 41 enables the stage 25 to be moved between an upper position, as shown in Figure 5, and a lower position, as shown in Figure 6. Figures 5 and 6 are simple sketches showing the internal structure of the pod opener.

[0032]

A first position sensor 67 and a second position sensor 69 are provided inside the case 23. The first position sensor 67 is a sensor for detecting if the stage 25 is in the upper position and the second position sensor 69 is a sensor for detecting if the stage 25 is in the lower position. More specifically, the first position sensor 67 generates a detection signal when the stage 25 is in a high position (i.e. a position where the bottom lid 7 is just about to be fitted into or has been fitted into the pod cover 5). The second position sensor 69 generates a detection signal when the stage 25 is in a lowest position (i.e. a position where a robot can transport the reticle 3).

[0033]

(3) Purge Apparatus

A supplying-discharging section 49 is a device that is incorporated into the pod opener 21 and serves to purge the inside of the reticle pod 1 with clean air.

[0034]

The supplying-discharging section 49 purges the inside of the reticle pod 1 with a prescribed air (e.g., clean dry air or an inert gas such as N_2). The supplying-discharging section 49 has an air supply tank 51 and an air supply pipe 53. The air supply tank 51 contains, for example, clean dry air. The air supply pipe 53 connects from the air supply tank 51 to the second supply hole 35 of the stage 25. Additionally, a flow regulating valve 55 and an on-off valve 57 are provided along the air supply pipe 53.

[0035]

In this embodiment, the second discharge hole 37 opens into the case 23. It is also acceptable to connect a discharge pipe to the second discharge hole 37 and discharge air to the outside of the case 23. It is further acceptable to connect a discharge pump to the discharge pipe to more vigorously discharge the air.

Although not shown in the drawings, seals are provided at contacting portions of the various members.

[0036]

(4) Control Configuration

Control configuration of the pod opener 21 will now be explained using Figure 8. Fig. 8 is a block diagram showing control configuration of the pod opener.

[0037]

A control section 61 is a computer that has such hardware as a CPU, a RAM, a ROM, and is contrived to perform various control operations by executing commands of a program. The

control section 61 has, as functional sections, an elevator drive section 61a, a gas supply/discharge control section 61b, and a latch control section 61c.

[0038]

The control section 61 is connected to the elevator driving mechanism 41, the flow regulating valve 55, the on-off valve 57, and the latch driving mechanism 63, and can transmit control signals to the same.

[0039]

The control section 61 is connected to the first latch sensor 65, the second latch sensor 66, the first position sensor 67, the second position sensor 69, the pod placement sensor 71, and a reticle placement sensor 73, and can receive detection signals from these sensors.

[0040]

(5) Control for Cover Opening Operation

Control operations executed to open the bottom lid 7 so that the reticle 3 can be transferred to a processing apparatus will now be explained using Figure 9. Figure 9 is a flowchart showing a control for the cover opening operation. The operation of the control section 61 will now be explained.

[0041]

Initially, the stage 25 is arranged at the highest position as shown in Figure 5.

In step S1, the control section 61 waits for the reticle pod 1 to be placed onto an upper surface of the pod opener 21. The control section 61 proceeds to step S2 when it receives a detection signal from the pod placement sensor 71.

[0042]

In step S2, the latch control section 61c of the control section 61 sends a latch release signal to the latch driving mechanism 63. In response, the latch driving mechanism 63 drives the latch member 15 and releases the latch.

[0043]

In step S3, the elevator drive section 61a of the control section 61 sends a lowering operation signal to the elevator driving mechanism 41. In response, the elevator driving mechanism 41 moves the stage 25 downward. The reticle 3 moves downward together with the stage 25 and is moved further downward from the pod cover 5.

[0044]

In step S4, the control section 61 waits for the stage 25 to reach a prescribed position. The control section 61 proceeds to step S4 when it receives a detection signal from the second position sensor 69.

[0045]

In step S5, the elevator drive section 61a of the control section 61 sends a lowering stop signal to the elevator driving mechanism 41. In response, the elevator driving mechanism 41 stops the lowering operation of the stage 25. As a result, the state shown in Figure 6 is achieved.

[0046]

From this state, a robot (not shown) transfers the reticle 3 to a processing apparatus and the processing apparatus processes the reticle 3.

[0047]

(6) Control for Cover Closing Operation

Control operations executed to close the bottom lid 7 so that the reticle 3 can be stored inside the reticle pod 1 will now be explained using Figure 10. Figure 10 is a flowchart showing a control for the cover closing operation.

[0048]

Initially, the stage 25 is arranged in the lowest position as shown in Figure 6. The bottom lid 7 is on the upper surface of the stage 25 but the reticle 3 has not been placed onto the

bottom lid 7.

In step S11, the control section 61 waits for the robot to return the reticle 3 to the bottom lid 7. The control section 61 proceeds to step S12 when it receives a reticle detection signal from the reticle placement sensor 73.

[0049]

In step S12, the elevator drive section 61a of the control section 61 sends a raising operation signal to the elevator driving mechanism 41. In response, the elevator drive mechanism 41 raises the stage 25.

[0050]

In step S13, the control section 61 waits for the first position sensor 67 to detect the stage 25. The control section 61 proceeds to step S14 when it receives a detection signal from the first position sensor 67.

[0051]

In step S14, the gas supply/discharge control section 61b of the control section 61 sends an opening operation signal to the on-off valve 57. In response, clean dry air starts being supplied to the inside of the reticle pod 1 from the air supply tank 51 of the supplying-discharging section 49. Thus, the purge operation is started before the bottom lid 7 fits into the pod cover 5.

[0052]

In step S15, the elevator drive section 61a of the control section 61 sends a raising operation stop signal to the elevator driving mechanism 41. In response, the elevator driving mechanism 41 stops the movement of the stage 25.

[0053]

In step S16, the latch control section 61c of the control section 61 sends a latch operation signal to the latch driving mechanism 63. In response, the latch driving mechanism 63 moves

the latch member 15 inward with the latch operating pin 64. Consequently, the latch member 15 engages with the groove section 19 of the bottom lid 7 and the bottom lid 7 is locked to the pod cover 5.

[0054]

In step S17, the control section 61 waits for a prescribed amount of time to elapse since the supply of clean dry air started. When the prescribed amount of time elapses, the control section 61 proceeds to step S18. It is also acceptable to configure the apparatus to measure the pressure inside the reticle pod 1 during the purge operation and to control the flow regulating valve 55 such that the pressure is adjusted to a prescribed value.

[0055]

In step S18, the gas supply/discharge control section 61b of the control section 61 sends a close signal to the on-off valve 57. In response, clean dry air stops being supplied to the inside of the reticle pod 1 from the air supply tank 51 of the supplying-discharging section 49.

[0056]

With the control operations explained above, the purge operation starts before the bottom lid 7 is fitted into the pod cover 5. Thus, the inside of the reticle pod 1 can be purged efficiently and the purge operation time during which the reticle pod 1 is purged can be shortened. As a result, the reticle pod 1 can be moved from the pod opener 21 to another apparatus sooner. Also, the amount of gas supplied can be reduced.

The purge start time can be set such that the purging starts at the moment the bottom lid 7 is fitted to the pod cover 5 or at a time occurring immediately before or several seconds before the bottom lid 7 is fitted to the pod cover 5.

[0057]

(7) Second Embodiment

Control operations executed according to another embodiment in order to close the bottom lid 7 so that the reticle 3 can be stored inside the reticle pod 1 will now be explained using Figure 11. Figure 11 is a flowchart showing a control for the cover closing operation according to a second embodiment. Steps that are the same as those shown in Figure 10 are indicated with the same step numbers.

[0058]

In step S11, the control section 61 waits for the robot to return the reticle 3 to the stage 25. The control section 61 proceeds to step S12 when it receives a reticle detection signal from the reticle placement sensor 73.

[0059]

In step S12, the elevator drive section 61a of the control section 61 sends a raising operation signal to the elevator driving mechanism 41. In response, the elevator drive mechanism 41 raises the stage 25.

[0060]

In step S19, the control section 61 waits for the first position sensor 67 to detect the stage 25. The control section 61 proceeds to step S15 when it receives a detection signal from the first position sensor 67.

[0061]

In step S15, the elevator drive section 61a of the control section 61 sends a raising operation stop signal to the elevator driving mechanism 41. In response, the elevator driving mechanism 41 stops the movement of the stage 25.

[0062]

In step S20, the latch control section 61c of the control section 61 sends a latch operation signal to the latch driving mechanism 63. In response, the latch driving mechanism 63 moves the latch member 15 inward with the latch operating pin 64. Consequently, the latch member

15 engages with the groove section 19 of the bottom lid 7 and the bottom lid 7 is locked to the pod cover 5.

[0063]

In step S14, the gas supplying-discharging section 61b of the control section 61 sends an opening operation signal to the on-off valve 57 before the above latching operation of the latch member 15 is completed (before the latch member 15 is moved to an inward-most position). More specifically, the gas supply/discharge control section 61b of the control section 61 opens the on-off valve 57 when it receives a detection signal from the second latch sensor 66 during the latching operation of the latch member 15. As a result, the supply of clean dry air from the air supply tank 51 of the supplying-discharging section 49 to the inside of the reticle pod 1 is started after the bottom lid 7 is fitted to the pod cover 5 but before the latching operation ends.

[0064]

In step S17, the control section 61 waits for a prescribed amount of time to elapse since the supply of clean dry air started. When the prescribed amount of time elapses, the control section 61 proceeds to step S18.

[0065]

In step S18, the gas supply/discharge control section 61b of the control section 61 sends a close signal to the on-off valve 57. In response, clean dry air stops being supplied to the inside of the reticle pod 1 from the air supply tank 51 of the supplying-discharging section 49.

[0066]

With the control operations explained above, the purge operation starts before the latching operation ends, albeit after the bottom lid 7 is fitted to the pod cover 5. Thus, the inside of the reticle pod 1 can be purged efficiently and the purge operation time during which the reticle

pod 1 is purged can be shortened. As a result, the reticle pod 1 can be moved from the pod opener 21 to another apparatus sooner. Also, the amount of gas supplied can be reduced.

[0067]

(8) Other Embodiments

The present invention is not limited to the embodiments explained heretofore. Various changes can be made without departing from the scope of the invention. In particular, the embodiments and variations presented heretofore can be combined freely as necessary.

[0068]

Although in the previously explained embodiments, the reticle pod is of a type contrived to hold one reticle, it is also acceptable for the pod to be contrived to hold a cassette that stores a plurality of reticles.

Although in the previously explained embodiments, the pod is a reticle pod, it is also acceptable for the pod to be contrived to store another type of article. Examples of other articles include photomasks, glass substrates, and semiconductor wafers.

Although in the previously explained embodiments, one supply hole and one discharge hole are provided in the cover, it is acceptable to provide a plurality of each.

The various sensors used in the previously explained embodiments can be photoelectric sensors, e.g., transparent or reflective type sensors, as well as proximity sensors or limit switches. There are no particular limitations on the type of sensor. INDUSTRIAL APPLICABILITY

[0069]

The present invention can be broadly applied to a purging apparatus and a purging method for purging a container having an openable lid by supplying and discharging a clean gas to and from the inside of the container.

REFERENCE SIGNS LIST

[0070]

1 reticle pod (container)

3 reticle

5 pod cover (container body)

7 bottom lid (lid)

9 reticle loading section

11 positioning hole

13 latch mechanism (drive mechanism)

14 perimeter section

15 latch member (locking member)

17 groove section

19 groove section

20 engaging hole

21 pod opener (purging apparatus)

23 case

24 positioning pin

25 stage (detaching/attaching section)

27 opening

29 upper perimeter section

31 first supply hole (port)

33 first discharge hole (port)

35 second supply hole

37 second discharge hole

41 elevator driving mechanism (moving mechanism)

43 rod

45 cylinder drive section

49 supplying-discharging section (gas supplying discharging mechanism)

51 air supply tank

53 air supply pipe

55 flow regulating valve

57 on-off valve

61 control section

63 latch drive mechanism

64 latch operating pin

65 first latch sensor

66 second latch sensor (detector)

67 first position sensor

69 second position sensor

71 pod placement sensor

73 reticle placement sensor

CLAIMS

1.

A purging apparatus for purging a container having a container body and an openable lid using a clean gas, comprising:

a detaching/attaching section contrived to attach the lid to the container body and remove the lid from the container body when it is possible to detach the lid;

a moving mechanism contrived to move the detaching/attaching section with respect to the container;

a locking member contrived to lock the lid to the container body and release the locked state of the lid;

a drive mechanism contrived to drive the locking member;

a gas supplying-discharging mechanism contrived to start purging the container during an operation of attaching the lid to the container body at a time before the drive mechanism completes an operation of locking the lid to the container body with the locking member.

2.

The purging apparatus according to claim 1, wherein

the lid is attachable to and detachable from the container body along a vertical direction; and

the lid includes a port connected to the gas supplying-discharging mechanism.

3.

The purging apparatus according to claim 1, wherein

a first detector contrived to detect a position of the lid is further provided; and

the gas supplying-discharging mechanism is contrived to start purging the container based on a position of the lid before the moving mechanism completes an operation of attaching the lid to the container body.

4.

The purging apparatus according to claim 1, wherein

a first detector contrived to detect a position of the lid is further provided; and

the gas supplying-discharging mechanism is contrived to start purging the container when the moving mechanism completes an operation of attaching the lid to the container body.

5.

The purging apparatus according to claim 2, wherein

a first detector contrived to detect a position of the lid is further provided; and

the gas supplying-discharging mechanism is contrived to start purging the container based on a position of the lid before the moving mechanism completes an operation of attaching the lid to the container body.

6.

The purging apparatus according to claim 2, wherein

a first detector contrived to detect a position of the lid is further provided; and

the gas supplying-discharging mechanism is contrived to start purging the container when the moving mechanism completes an operation of attaching the lid to the container body.

7.

The purging apparatus according to claim 1, wherein

a second detector contrived to detect a position of the locking member is further provided; and

the gas supplying-discharging mechanism is contrived to start purging the container based on a position of the locking member after the drive mechanism has driven the locking member.

8.

The purging apparatus according to claim 2, wherein

a second detector contrived to detect a position of the locking member is further provided; and

the gas supplying-discharging mechanism is contrived to start purging the container based on a position of the locking member after the drive mechanism has driven the locking member.

9.

A purging method for purging a container having a container body and an openable lid using a clean gas, comprising:

an attaching step in which the lid is attached to the container body from a state in which the lid is separated from the container body;

a locking step in which the lid is locked to the container body after the attaching step; and

a purge starting step in which purging of the container is started before the locking step is completed.

10.

The purging method according to claim 9, wherein

the purging is started during the attaching step before the lid is attached to the container body.

11.

The purging method according to claim 9, wherein

the purging is started when the lid becomes attached to the container body.

12.

The purging method according to claim 9, wherein

the purging is started during the locking step.

PURGING APPARATUS AND PURGING METHOD

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a purging apparatus and a purging method, and more particularly to a purging apparatus and a purging method for purging a container having an openable lid by supplying and discharging a clean gas to and from the inside of the container.

2. Description of the Related Art

[0002] Conventionally a SMIF (standard mechanical interface) pod is a known example of a substrate holding container for transporting and storing substrates, such as photomasks, glass substrates, wafers, and reticles, in semiconductor manufacturing environments. The SMIF pod has a pod cover and an openable lid. During transport and storage, the pod cover is closed by the lid such that the SMIF pod is sealed and contaminants are prevented from entering the pod.

[0003] A latch mechanism is provided to lock the lid to the pod cover. Thus, the lid is locked in place with the latch mechanism when

a substrate is transported or stored. When a substrate is to be removed, the latch mechanism is released such that the lid can be removed from the pod cover.

[0004] Also known is an opening/closing device configured to automatically open and close a SMIF pod when a substrate is loaded into or removed from the SMIF pod. The opening/closing device has a stage on which the SMIF pod is placed and an elevator driving mechanism for driving the stage up and down. The stage is provided with a pin for positioning the SMIF pod in a prescribed position. The opening/closing device also has a latch controlling mechanism for controlling the latch mechanism, so as to lock and release the latch mechanism.

[0005] An opening/closing device inside a clean stocker is described in Japanese Laid-open Patent Publication No. 2008-30914.

[0006] When a pod is placed on the stage, the opening/closing device first releases the latch of the latch mechanism using the latch controlling mechanism. The elevator driving mechanism then lowers the stage. As a result, the lid moves downward along with the substrate. When the lid has been lowered to a prescribed position, a robot moves the substrate toward a processing apparatus. After processing, the robot returns the substrate to the stage. The elevator driving mechanism

then raises the stage. As a result, the lid moves upward along with the substrate. When the lid has been fitted into the pod cover, the latch controlling mechanism engages the latch of the latch mechanism.

[0007] The opening/closing device also has a purging mechanism. The purging mechanism is a mechanism for replacing an atmosphere inside a pod with nitrogen or another inert gas. Purging suppresses the occurrence of organic contamination and chemical changes such as natural oxidation on a surface of the substrate.

[0008] The purge mechanism has a gas supply tank, a supply pipe, a discharge pipe, an on-off valve, and a flow regulating valve. The supply pipe is connected to a supply port of the pod and supplies gas from the gas supply tank to the inside of the pod. The discharge pipe is connected to a discharge port of the pod and discharges gas from inside the pod to the outside. The on-off valve and the flow regulating valve are provided on both the supply pipe and the discharge pipe as required.

[0009] After processing is finished, the substrate is placed on the lid and the substrate is raised together with the lid until the lid fits into the pod cover. The latch mechanism is then latched such that the lid is locked to the pod cover. The purge mechanism then purges the inside of the pod. As a result, a purge operation time is

comparatively long and there are times when a pod containing a substrate cannot be transported to a downstream apparatus early enough to satisfy a demand.

SUMMARY OF THE INVENTION

[0010] Preferred embodiments of the present invention provide a purging apparatus and a purging method that shorten a purge operation time.

[0011] A purging apparatus for purging a container including a container body and an openable lid using a clean gas according to a preferred embodiment includes a detaching/attaching section, a moving mechanism, a locking member, a drive mechanism, and a gas supplying-discharging mechanism. The detaching/attaching section attaches the lid to the container body and removes the lid from the container body when it is possible to detach the lid. The moving mechanism moves the detaching/attaching section with respect to the container body. The locking member locks the lid to the container body and releases the locked state of the lid. The drive mechanism drives the locking member. The gas supplying-discharging mechanism starts purging the container during an operation of attaching the lid to the container body at a time before the drive mechanism completes an operation of

locking the lid to the container body with the locking member.

[0012] With this purging apparatus, the lid is attached to the container body shortly after the moving mechanism has moved the detaching/attaching section to the container body. The gas supplying-discharging mechanism starts purging the container before the drive mechanism completes an operation of locking the lid to the container body using the locking member. Thus, the inside of the container can be purged efficiently and a purge operation time during which the container is purged is significantly shortened.

[0013] The gas supplying-discharging mechanism preferably starts a purge operation at any time before an operation of locking the locking member is completed.

[0014] The lid preferably is attachable to and detachable from the container body along a vertical direction, and the lid preferably includes a port connected to the gas supplying-discharging mechanism.

[0015] With this apparatus, a clean gas is supplied to the inside of the container through the port provided in the lid and also discharged through the port. Thus, purging can be executed efficiently even if purging is started before the operation of attaching the lid to the container body is completed.

[0016] A first detector is preferably provided to detect a position

of the lid and the gas supplying-discharging mechanism preferably starts purging the container based on a position of the lid occurring before the moving mechanism completes an operation of attaching the lid to the container body.

[0017] A first detector is preferably provided to detect a position of the lid and the gas supplying-discharging mechanism preferably starts purging the container when the moving mechanism completes an operation of attaching the lid to the container body.

[0018] A second detector may also be preferably provided to detect a position of the locking member and the gas supplying-discharging mechanism preferably starts purging the container based on a position of the locking member after the drive mechanism has driven the locking member.

[0019] A second detector may also be preferably provided to detect a position of the locking member and the gas supplying-discharging mechanism preferably starts purging the container based on a position of the locking member after the drive mechanism has driven the locking member.

[0020] A purging method for purging a container including a container body and an openable lid using a clean gas according to another preferred embodiment of the present invention includes an attaching

step in which a lid is attached to the container body from a state in which the lid is separated from the container body, a locking step in which the lid is locked to the container body after the attaching step, a purge starting step in which purging of the container is started before the locking step is completed.

[0021] With this purging method, the lid is attached to the container in an attaching step. Afterwards, a locking step is executed, but purging of the container is started before the locking step is completed. Thus, the inside of the container can be purged efficiently and a purge operation time during which the container is purged is significantly shortened.

[0022] Thus, the purge operation can be started at any time so long as it is before the locking step is completed.

[0023] It is preferable to start purging during the attaching step before the lid is attached to the container body.

[0024] It is also preferable to start purging when the lid becomes attached to the container body.

[0025] It is also preferable to start purging during the locking step.

[0026] A purge apparatus and purge method according to various preferred embodiments of the present invention shorten the purge

operation time.

[0027] The above and other elements, features, steps, characteristics and advantages of the present invention will become more apparent from the following detailed description of the preferred embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] Figure 1 is a perspective view of a reticle pod and a pod opener according to a preferred embodiment of the present invention.

[0029] Figure 2 is an exploded perspective view of a pod cover and a bottom lid of the reticle pod.

[0030] Figure 3 is a bottom plan view of the reticle pod.

[0031] Figure 4 is a perspective view of the pod opener.

[0032] Figure 5 is a simple sketch illustrating an internal structure of the pod opener.

[0033] Figure 6 is a simple sketch illustrating an internal structure of the pod opener.

[0034] Figure 7 is a partially enlarged view of a latch mechanism.

[0035] Fig. 8 is a block diagram showing control features of the pod opener.

[0036] Figure 9 is a flowchart showing a control for a cover opening

operation.

[0037] Figure 10 is a flowchart showing a control for a cover closing operation.

[0038] Figure 11 is a flowchart showing a control for a cover closing operation according to a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

First Preferred Embodiment

[0039] A reticle pod 1 and a pod opener 21 according to a first preferred embodiment of the present invention will now be explained.

[0040] A reticle pod 1 will now be explained with reference to Figures 1 to 3. Figure 1 is a perspective view of a reticle pod and a pod opener; Figure 2 is an exploded perspective view showing a pod cover and a bottom lid of the reticle pod; and Figure 3 is a bottom plan view of the reticle pod.

[0041] The reticle pod 1 is a container that houses a reticle 3 in a sealed state, and is transported by another device. The reticle 3 preferably is a photomask used for exposing a circuit pattern onto a wafer in an LSI manufacturing process, for example. The reticle pod 1 includes a pod cover 5 and a bottom lid 7. The bottom lid 7 is detachable from the pod cover 5.

[0042] More specifically, as shown in the figures, the pod cover 5 preferably is a comparatively flat member shaped like a box with a top panel and side panels but open at a bottom portion. The bottom lid 7 fits into the pod cover 5 from below and serves to seal the pod cover 5 while defining a bottom portion of the pod cover 5. The bottom lid 7 can be attached and detached with respect to the pod cover 5 along a vertical direction.

[0043] A reticle loading section 9, onto which the reticle 3 is to be loaded, is provided on an upper surface of the bottom lid 7. Three positioning holes 11 arranged to receive positioning pins 24 of the pod opener 21 are provided in a bottom surface of the bottom lid 7.

[0044] The reticle pod 1 also includes a latch mechanism 13. The latch mechanism 13 preferably includes a latch member 15 that is provided on a perimeter section 14 serving as a bottom surface of the pod cover 5, and the latch member 15 is arranged to slide inward. As shown in Figures 3 and 7, the latch member 15 is arranged inside a groove section 17 provided in the bottom surface of the pod cover 5 and can move inward and outward within a prescribed range. A groove section 19 is provided in a bottom surface of the bottom lid 7 in a position corresponding to the groove section 17. The latch member 15 can move into the groove

section 19 when it moves inward. Thus, when the latch member 15 has been moved outward, the latch member 15 separates from the groove section 19 and, accordingly, the bottom lid 7 can be detached from the pod cover 5. Meanwhile, when the latch member 15 has been moved inward, a portion of the latch member 15 is inside the groove section 19 and accordingly the lid 7 cannot be detached from the container body. An engaging hole 20 (explained later) is also provided in the latch member 15. Additionally, the latch member 15 is constantly subjected to a force applied by a force applying device (not shown) in a direction towards causing engagement with the groove section 19.

[0045] The pod opener 21 is preferably used in a clean stocker installed in a clean room of, for example, a semiconductor plant or a liquid crystal plant. The pod opener 21 serves to open the bottom lid 7 of the reticle pod 1 such that a robot (not shown) can transport the reticle 3 to a processing apparatus. The pod opener 21 also returns the reticle 3 to the inside of the pod cover 5 after the reticle 3 has been processed and transported back to the pod opener 21 by the robot (not shown).

[0046] The structure of the pod opener 21 will now be explained. The pod opener 21 has a box-shaped case 23 and a stage 25. A square opening 27 is provided in a top panel of the case 23. The stage 25

has a similar shape to the opening 27 and is arranged in such a position that it lies in substantially the same plane as an upper perimeter section 29 that defines the opening 27, as shown in Figure 4. Figure 4 is a perspective view of the pod opener.

[0047] A fan (not shown) is provided inside the case 23 and serves to keep the inside of the case 23 clean by drawing in clean air from inside the clean stocker.

[0048] When the reticle pod 1 is placed on top of the pod opener 21, the bottom lid 7 is placed on an upper surface of the stage 25 and positioned through the positioning pins 24 engaging with the positioning holes 11, such that the perimeter section 14 serving as the bottom surface of the pod cover 5 rests on the upper perimeter section 29 of the case 23. In this state, a latch operating pin 64 of a latch driving mechanism 63 is inserted into the engaging hole 20 of the latch member 15. Another mechanism (not shown) of the latch driving mechanism 63 can move the latch operating pin 64 inward and outward and thereby move the latch member 15 inward and outward.

[0049] As shown in Figure 7, a first latch sensor 65 and a second latch sensor 66 are preferably provided to detect a movement state of the latch member 15. The first latch sensor 65 is a sensor that detects if the latch member 15 has been moved outward such that the

latched state is released. The second latch sensor 66 is a sensor that detects if the latch member 15 has been moved inward such that the latched state is engaged.

[0050] A first supply hole 31 and a first discharge hole 33 are disposed to extend through upper and lower surfaces of the bottom lid 7. The first supply hole 31 and the first discharge hole 33 are each provided with a non-return valve and a filter to make it more difficult for contaminated external air to enter the apparatus. Additionally, a second supply hole 35 and a second discharge hole 37 are provided in the stage 25 in positions corresponding to the first supply hole 31 and the first discharge hole 33, respectively. The first supply hole 31 and the first discharge hole 33 are aligned with and connected to the second supply hole 35 and the second discharge hole 37 with a connection structure (not shown).

[0051] A pod placement sensor 71 (Figure 8) is provided on the stage 25 to detect if a reticle pod 1 has been placed on the stage 25.

[0052] The pod opener 21 includes an elevator driving mechanism 41 that raises and lowers the stage 25. The elevator driving mechanism 41 is a cylinder mechanism having a rod 43 fixed to a bottom surface of the stage 25 and a cylinder drive section 45 arranged to drive the rod 43. The elevator driving mechanism 41 enables the stage 25 to be

moved between an upper position, as shown in Figure 5, and a lower position, as shown in Figure 6. Figures 5 and 6 are simple sketches showing the internal structure of the pod opener.

[0053] A first position sensor 67 and a second position sensor 69 are provided inside the case 23. The first position sensor 67 is a sensor that detects if the stage 25 is in the upper position and the second position sensor 69 is a sensor that detects if the stage 25 is in the lower position. More specifically, the first position sensor 67 generates a detection signal when the stage 25 is in a high position (i.e., a position where the bottom lid 7 is just about to be fitted into or has been fitted into the pod cover 5). The second position sensor 69 generates a detection signal when the stage 25 is in a lowest position (i.e., a position where a robot can transport the reticle 3).

[0054] A supplying-discharging section 49 is a device that is incorporated into the pod opener 21 and serves to purge the inside of the reticle pod 1 with clean air.

[0055] The supplying-discharging section 49 purges the inside of the reticle pod 1 with a prescribed air (e.g., clean dry air or an inert gas such as N_2). The supplying-discharging section 49 includes an air supply tank 51 and an air supply pipe 53. The air supply tank

51 includes, for example, clean dry air. The air supply pipe 53 connects from the air supply tank 51 to the second supply hole 35 of the stage 25. Additionally, a flow regulating valve 55 and an on-off valve 57 are provided along the air supply pipe 53.

[0056] In this preferred embodiment, the second discharge hole 37 opens into the case 23. It is also acceptable to connect a discharge pipe to the second discharge hole 37 and discharge air to the outside of the case 23. It is further acceptable to connect a discharge pump to the discharge pipe to more vigorously discharge the air.

[0057] Although not shown in the drawings, seals are preferably provided at contacting portions of the various members.

[0058] A control configuration of the pod opener 21 will now be explained by referring to Figure 8. Fig. 8 is a block diagram showing a control configuration of the pod opener.

[0059] A control section 61 includes a computer that has hardware such as a CPU, a RAM, a ROM, and is programmed and arranged to perform various control operations by executing commands of a program. The control section 61 has, as functional sections, an elevator drive section 61a, a gas supply/discharge control section 61b, and a latch control section 61c.

[0060] The control section 61 is connected to the elevator driving

mechanism 41, the flow regulating valve 55, the on-off valve 57, and the latch driving mechanism 63, and can transmit control signals to the same.

[0061] The control section 61 is connected to the first latch sensor 65, the second latch sensor 66, the first position sensor 67, the second position sensor 69, the pod placement sensor 71, and a reticle placement sensor 73, and can receive detection signals from these sensors.

[0062] Control operations executed to open the bottom lid 7 so that the reticle 3 can be transferred to a processing apparatus will now be explained with reference to Figure 9. Figure 9 is a flowchart showing a control for the cover opening operation. The operation of the control section 61 will now be explained.

[0063] Initially, the stage 25 is arranged at the highest position as shown in Figure 5.

[0064] In step S1, the control section 61 waits for the reticle pod 1 to be placed onto an upper surface of the pod opener 21. The control section 61 proceeds to step S2 when it receives a detection signal from the pod placement sensor 71.

[0065] In step S2, the latch control section 61c of the control section 61 sends a latch release signal to the latch driving mechanism 63. In response, the latch driving mechanism 63 drives the latch member

15 and releases the latch.

[0066] In step S3, the elevator drive section 61a of the control section 61 sends a lowering operation signal to the elevator driving mechanism 41. In response, the elevator driving mechanism 41 moves the stage 25 downward. The reticle 3 moves downward together with the stage 25 and is moved further downward from the pod cover 5.

[0067] In step S4, the control section 61 waits for the stage 25 to reach a prescribed position. The control section 61 proceeds to step S5 when it receives a detection signal from the second position sensor 69.

[0068] In step S5, the elevator drive section 61a of the control section 61 sends a lowering stop signal to the elevator driving mechanism 41. In response, the elevator driving mechanism 41 stops the lowering operation of the stage 25. As a result, the state shown in Figure 6 is achieved.

[0069] From this state, a robot (not shown) transfers the reticle 3 to a processing apparatus and the processing apparatus processes the reticle 3.

[0070] Control operations executed to close the bottom lid 7 so that the reticle 3 can be stored inside the reticle pod 1 will now be explained by referring to Figure 10. Figure 10 is a flowchart showing

a control for the cover closing operation.

[0071] Initially, the stage 25 is arranged in the lowest position as shown in Figure 6. The bottom lid 7 is on the upper surface of the stage 25 but the reticle 3 has not been placed onto the bottom lid 7.

[0072] In step S11, the control section 61 waits for the robot to return the reticle 3 to the bottom lid 7. The control section 61 proceeds to step S12 when it receives a reticle detection signal from the reticle placement sensor 73.

[0073] In step S12, the elevator drive section 61a of the control section 61 sends a raising operation signal to the elevator driving mechanism 41. In response, the elevator drive mechanism 41 raises the stage 25.

[0074] In step S13, the control section 61 waits for the first position sensor 67 to detect the stage 25. The control section 61 proceeds to step S14 when it receives a detection signal from the first position sensor 67.

[0075] In step S14, the gas supply/discharge control section 61b of the control section 61 sends an opening operation signal to the on-off valve 57. In response, clean dry air starts being supplied to the inside of the reticle pod 1 from the air supply tank 51 of the

supplying-discharging section 49. Thus, the purge operation is started before the bottom lid 7 fits into the pod cover 5.

[0076] In step S15, the elevator drive section 61a of the control section 61 sends a raising operation stop signal to the elevator driving mechanism 41. In response, the elevator driving mechanism 41 stops the movement of the stage 25.

[0077] In step S16, the latch control section 61c of the control section 61 sends a latch operation signal to the latch driving mechanism 63. In response, the latch driving mechanism 63 moves the latch member 15 inward with the latch operating pin 64. Consequently, the latch member 15 engages with the groove section 19 of the bottom lid 7 and the bottom lid 7 is locked to the pod cover 5.

[0078] In step S17, the control section 61 waits for a prescribed amount of time to elapse since the supply of clean dry air started. When the prescribed amount of time elapses, the control section 61 proceeds to step S18. It is also acceptable to configure the apparatus to measure the pressure inside the reticle pod 1 during the purge operation and to control the flow regulating valve 55 such that the pressure is adjusted to a prescribed value.

[0079] In step S18, the gas supply/discharge control section 61b of the control section 61 sends a close signal to the on-off valve

57. In response, clean dry air stops being supplied to the inside of the reticle pod 1 from the air supply tank 51 of the supplying-discharging section 49.

[0080] With the control operations explained above, the purge operation starts before the bottom lid 7 is fitted into the pod cover 5. Thus, the inside of the reticle pod 1 can be purged efficiently and the purge operation time during which the reticle pod 1 is purged is significantly shortened. As a result, the reticle pod 1 can be moved from the pod opener 21 to another apparatus sooner. Also, the amount of gas supplied can be reduced.

[0081] The purge start time can be set such that the purging starts at the moment the bottom lid 7 is fitted to the pod cover 5 or at a time occurring immediately before or several seconds before the bottom lid 7 is fitted to the pod cover 5.

Second Preferred Embodiment

[0082] Control operations executed according to another preferred embodiment in order to close the bottom lid 7 so that the reticle 3 can be stored inside the reticle pod 1 will now be explained with reference to Figure 11. Figure 11 is a flowchart showing a control for the cover closing operation according to a second preferred

embodiment. Steps that are the same as those shown in Figure 10 are indicated with the same step numbers.

[0083] In step S11, the control section 61 waits for the robot to return the reticle 3 to the stage 25. The control section 61 proceeds to step S12 when it receives a reticle detection signal from the reticle placement sensor 73.

[0084] In step S12, the elevator drive section 61a of the control section 61 sends a raising operation signal to the elevator driving mechanism 41. In response, the elevator drive mechanism 41 raises the stage 25.

[0085] In step S19, the control section 61 waits for the first position sensor 67 to detect the stage 25. The control section 61 proceeds to step S15 when it receives a detection signal from the first position sensor 67.

[0086] In step S15, the elevator drive section 61a of the control section 61 sends a raising operation stop signal to the elevator driving mechanism 41. In response, the elevator driving mechanism 41 stops the movement of the stage 25.

[0087] In step S20, the latch control section 61c of the control section 61 sends a latch operation signal to the latch driving mechanism 63. In response, the latch driving mechanism 63 moves the latch member

15 inward with the latch operating pin 64. Consequently, the latch member 15 engages with the groove section 19 of the bottom lid 7 and the bottom lid 7 is locked to the pod cover 5.

[0088] In step S14, the gas supplying-discharging section 61b of the control section 61 sends an opening operation signal to the on-off valve 57 before the above latching operation of the latch member 15 is completed (before the latch member 15 is moved to an inward-most position). More specifically, the gas supply/discharge control section 61b of the control section 61 opens the on-off valve 57 when it receives a detection signal from the second latch sensor 66 during the latching operation of the latch member 15. As a result, the supply of clean dry air from the air supply tank 51 of the supplying-discharging section 49 to the inside of the reticle pod 1 is started after the bottom lid 7 is fitted to the pod cover 5 but before the latching operation ends.

[0089] In step S17, the control section 61 waits for a prescribed amount of time to elapse since the supply of clean dry air started. When the prescribed amount of time elapses, the control section 61 proceeds to step S18.

[0090] In step S18, the gas supply/discharge control section 61b of the control section 61 sends a close signal to the on-off valve 57. In response, clean dry air stops being supplied to the inside of

the reticle pod 1 from the air supply tank 51 of the supplying-discharging section 49.

[0091] With the control operations explained above, the purge operation starts before the latching operation ends, albeit after the bottom lid 7 is fitted to the pod cover 5. Thus, the inside of the reticle pod 1 can be purged efficiently and the purge operation time during which the reticle pod 1 is purged can be shortened. As a result, the reticle pod 1 can be moved from the pod opener 21 to another apparatus sooner. Also, the amount of gas supplied can be reduced.

Other Preferred Embodiments

[0092] The present invention is not limited to the preferred embodiments described above. Various changes can be made without departing from the scope of the present invention. In particular, the preferred embodiments and variations thereof can be combined freely as necessary.

[0093] Although in the previously explained preferred embodiments, the reticle pod preferably is configured to hold one reticle, it is also acceptable for the pod to be configured to hold a cassette that stores a plurality of reticles.

[0094] Although in the previously explained preferred embodiments,

the pod preferably is a reticle pod, it is also acceptable for the pod to be configured to store another type of article. Examples of other articles include photomasks, glass substrates, and semiconductor wafers.

[0095] Although in the previously explained preferred embodiments, one supply hole and one discharge hole are preferably provided in the cover, it is acceptable to provide a plurality of each.

[0096] The various sensors used in the previously explained preferred embodiments can be photoelectric sensors, e.g., transparent or reflective type sensors, as well as proximity sensors or limit switches, for example. There are no particular limitations on the type of sensor.

[0097] Various preferred embodiments of the present invention can be broadly applied to a purging apparatus and a purging method for purging a container having an openable lid by supplying and discharging a clean gas to and from the inside of the container.

[0098] While preferred embodiments of the present invention have been described above, it is to be understood that variations and modifications will be apparent to those skilled in the art without departing from the scope and spirit of the present invention. The scope of the present invention, therefore, is to be determined solely by

the following claims.

The invention claimed is:

1. A purging apparatus for purging a container including a container body and an openable lid using a clean gas, the purging apparatus comprising:

a detaching/attaching section that attaches the lid to the container body and removes the lid from the container body when it is possible to detach the lid;

a moving mechanism that moves the detaching/attaching section with respect to the container;

a locking member that locks the lid to the container body and releases the locked state of the lid;

a drive mechanism that drives the locking member;

a gas supplying-discharging mechanism;

a first detector arranged to detect a position of the lid; and

a control section programmed to control the moving mechanism, the drive mechanism, and the gas supplying-discharging mechanism; wherein

the control section controls the gas supplying-discharging mechanism to start purging the container, based on the position of the lid detected by the first detector, while the control section controls the moving mechanism to move the detaching/attaching section and the lid toward the container body; and

the control section controls the gas supplying-discharging

mechanism to start purging the container before the control section controls the drive mechanism to drive the locking member to lock the lid to the container body.

2. The purging apparatus according to claim 1, wherein the lid is attachable to and detachable from the container body along a vertical direction, and the lid includes a port connected to the gas supplying-discharging mechanism.

3. The purging apparatus according to claim 1, wherein the gas supplying-discharging mechanism starts purging the container before the moving mechanism completes an operation of attaching the lid to the container body.

4. The purging apparatus according to claim 1, wherein the gas supplying-discharging mechanism starts purging the container when the moving mechanism completes an operation of attaching the lid to the container body.

5. The purging apparatus according to claim 2, wherein the gas supplying-discharging mechanism starts purging the container before the moving mechanism completes an operation of attaching the lid to the container body.

6. The purging apparatus according to claim 2, wherein the gas supplying-discharging mechanism starts purging the container when the moving mechanism completes an operation of attaching the lid to the container body.

7. The purging apparatus according to claim 1, further comprising a second detector that detects a position of the locking member, wherein the gas supplying-discharging mechanism starts purging the container based on a position of the locking member after the drive mechanism has driven the locking member.

8. The purging apparatus according to claim 2, further comprising a second detector that detects a position of the locking member, wherein the gas supplying-discharging mechanism starts purging the container based on a position of the locking member after the drive mechanism has driven the locking member.

9. A purging method for purging a container including a container body and an openable lid using a clean gas, the method comprising:

an attaching step in which the lid is attached to the container body from a state in which the lid is separated from the container body;

a detecting step in which a position of the lid is detected;

a locking step in which the lid is locked to the container body

after the attaching step; and

a purge starting step in which purging of the container is started based on the position of the lid detected by the detecting step and before the locking step is completed.

10. The purging method according to claim 9, wherein the purging is started during the attaching step before the lid is attached to the container body.

11. The purging method according to claim 9, wherein the purging is started when the lid becomes attached to the container body.

12. The purging method according to claim 9, wherein the purging is started during the locking step.