

CONVEYING MECHANISM

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a conveying mechanism that is installed in a processing apparatus and is used for conveying a workpiece.

Description of the Related Art

As a related art, as disclosed in Japanese Patent Laid-open No. 2011-159823, for example, a conveying mechanism to which a lid that closes an opening of a cleaning mechanism is attached is known in conveying mechanisms of a processing apparatus that convey a processed workpiece to the cleaning mechanism. Disposing a lid for closing the opening in the conveying mechanism makes it unnecessary to separately dispose this lid, and hence, simplification of the apparatus can be sought.

On the other hand, as disclosed in Japanese Patent Laid-open No. 2020-032477, for example, typically in a processing apparatus that executes cutting processing, a processing liquid is continuously supplied in processing for cooling a cutting blade and a workpiece and for washing away processing dust. As the processing liquid, purified water is widely used. Besides, a processing

liquid to which a surfactant, glycerin, or the like is added is also used. The processing liquid supplied to the cutting blade that rotates at high speed becomes a mist and is scattered in the processing apparatus.

Japanese Patent Laid-open No. 2020-032477 discloses a technique for discharging the mist to the outside of the cutting apparatus through a gas discharge duct since adherence of the scattered mist to a constituent element in the processing apparatus leads to the occurrence of rust and breakdown of electronic equipment.

SUMMARY OF THE INVENTION

When a lid for closing an opening of a cleaning mechanism is disposed in a conveying mechanism as disclosed in Japanese Patent Laid-open No. 2011-159823, adherence of a scattered mist to the back side of this lid is of concern.

Even with the technique of Japanese Patent Laid-open No. 2020-032477, for example, when a processing liquid of such a type as to be difficult to evaporate is used or when the mist is not sufficiently sucked due to performance of a suction source to which the gas discharge duct is connected, there is a fear that the mist remains inside the processing apparatus and a large

amount of mist adheres to also the back side of the lid.

When the mist adheres to the back side of the lid and is accumulated thereon, there are fears that an accumulated substance drops when the conveying mechanism moves in the processing apparatus and rust is caused in another constituent element and that an accumulated substance drops onto a workpiece and contaminates the workpiece.

Accordingly, an object of the present invention is to provide a conveying mechanism that can prevent adherence and accumulation of a mist onto a lid in a configuration in which a lid that closes an opening of a cleaning mechanism is disposed in the conveying mechanism.

In accordance with an aspect of the present invention, there is provided a conveying mechanism disposed in a processing apparatus. The processing apparatus includes a holding table that holds a workpiece, a processing unit that processes the workpiece held by the holding table, and a cleaning mechanism that cleans the workpiece for which processing has been executed by the processing unit. The cleaning mechanism includes a cleaning table that holds the workpiece, a cleaning nozzle that supplies a cleaning liquid to the

workpiece held by the cleaning table, and a casing in which an opening that permits taking-out and putting-in of the workpiece is formed and in which the cleaning table and the cleaning nozzle are housed. The conveying mechanism is used to convey the workpiece from the holding table to the cleaning mechanism. The conveying mechanism includes a holding part that holds the workpiece, a cover part that covers the opening of the casing of the cleaning mechanism, a movement unit that moves the holding part and the cover part integrally relative to the cleaning mechanism, and a gas jet mechanism that jets gas toward the cover part to prevent liquid from adhering to the cover part.

Preferably, the gas jet mechanism jets gas toward the inside of the cover part in a state in which the opening of the casing is closed by the cover part.

According to the present invention, disposing the gas jet mechanism makes it possible to prevent adherence and accumulation of a mist onto the cover part can be prevented, and to also prevent the occurrence of the situation in which the mist is accumulated and drops to cause rust in another constituent element and the occurrence of the situation in which an accumulated substance drops onto the workpiece and contaminates the

workpiece.

Furthermore, by jetting gas in the state in which the opening of the casing is closed by the cover part, accumulated substances of a mist can be caused to drop into the casing of the cleaning mechanism and be captured.

The above and other objects, features and advantages of the present invention and the manner of realizing them will become more apparent, and the invention itself will best be understood from a study of the following description and appended claims with reference to the attached drawings showing a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a processing apparatus according to an embodiment of the present invention;

FIG. 2 is a perspective view of the back surface side of the processing apparatus illustrated in FIG. 1;

FIG. 3 is an enlarged perspective view illustrating a part of a first conveying mechanism and a second conveying mechanism;

FIG. 4 is a perspective view illustrating a

configuration of a cleaning mechanism;

FIG. 5 is a side sectional view illustrating a configuration of the cleaning mechanism and the second conveying mechanism;

FIG. 6A is a perspective view illustrating a gas jet mechanism;

FIG. 6B is a perspective view of a state in which an air blow is being made by the gas jet mechanism;

FIG. 7 is a side sectional view illustrating a state in which the cleaning mechanism is closed by a cover part;

FIG. 8A is a perspective view illustrating another embodiment of the gas jet mechanism; and

FIG. 8B is a perspective view illustrating an embodiment in which the gas jet mechanism is disposed outside the cover part.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of the present invention will be described in detail below with reference to the drawings. FIG. 1 and FIG. 2 are appearance perspective views of a processing apparatus 2 to which the present invention is applied. As illustrated in FIG. 1 and FIG. 2, a mechanical part of the processing apparatus 2 is housed

in an exterior cover 4 formed by combining multiple panels.

The processing apparatus 2 has a holding table 6 that holds a workpiece. The holding table 6 is disposed rotatably in a θ direction around a Z-axis by an unillustrated rotational drive mechanism that is disposed under the holding table 6. Moreover, the holding table 6 is configured to be movable in an X-axis direction that is a processing feed direction by an unillustrated processing feed mechanism that is disposed under the holding table 6. Clamps 7 that clamp an annular frame F of a wafer unit U are disposed around the holding table 6.

The processing apparatus 2 has a first cutting unit 10 and a second cutting unit 20 that are processing units that process the workpiece held by the holding table 6. The first cutting unit 10 and the second cutting unit 20 are disposed opposite in a Y-axis direction and configure an opposed-type cutting mechanism, so that the processing apparatus 2 is configured as a dual dicing saw. The first cutting unit 10 and the second cutting unit 20 are disposed to be movable in the Y-axis direction and to be movable also in the Z-axis direction. The present invention can be applied also in a configuration having

only one cutting unit as the processing unit.

The first cutting unit 10 and the second cutting unit 20 each include a spindle rotationally driven by a motor, a cutting blade fixed to the tip of the spindle, a processing liquid nozzle for supplying a processing liquid to the point of processing by the cutting blade in processing, and so forth and are used to execute cutting processing along planned dividing lines set in the workpiece.

The processing apparatus 2 has a cassette placement pedestal 14 on which a cassette 13 inside which multiple wafers W are housed is placed. The cassette placement pedestal 14 is configured to be movable in the upward-downward direction (Z-axis direction).

The wafer unit U that becomes a workpiece to be housed in the cassette 13 includes the wafer W, an adhesive tape T to which the wafer W is stuck, and the annular frame F stuck to the adhesive tape T in such a manner as to surround the wafer W. The wafer W is a semiconductor wafer, optical device wafer, or the like and is not particularly limited to any kind.

The processing apparatus 2 has a first conveying mechanism 40 made through disposing a clamp mechanism 42 and a holding mechanism 44 on an L-shaped lower arm 45.

The clamp mechanism 42 is used for grasping the frame F of the wafer unit U and carrying out and in the wafer unit U between the cassette 13 and guide rails 12. The holding mechanism 44 is used for moving the wafer unit U that is yet to be processed and is placed on the guide rails 12 onto the holding table 6 and for moving the wafer unit U that has been cleaned and is placed in a cleaning mechanism 60 onto the guide rails 12.

The processing apparatus 2 has a second conveying mechanism 50 made through disposing a holding mechanism 54 on an L-shaped upper arm 55. The holding mechanism 54 is used for moving the wafer unit U that has been processed and is placed on the holding table 6 onto the cleaning mechanism 60.

The processing apparatus 2 has a display monitor 8 of a touch panel type. An operator can input an operation command for the apparatus through the display monitor 8. In addition, the operation status of the apparatus is displayed on the display monitor 8.

The processing apparatus 2 includes a controller 80 for executing automatic control of the above-described various kinds of apparatuses. By control of the controller 80, the wafer unit U housed in the cassette 13 is grasped by the clamp mechanism 42 of the first

conveying mechanism 40 and is carried in onto the guide rails 12, to be held by the holding mechanism 44 of the first conveying mechanism 40 and carried in onto the holding table 6. The wafer unit U held by the holding table 6 is subjected to cutting processing by the first cutting unit 10 and the second cutting unit 20 while the processing liquid is supplied from the unillustrated processing liquid nozzles.

After the cutting processing, the wafer unit U is held by the holding mechanism 54 of the second conveying mechanism 50 and is moved to the cleaning mechanism 60 to be cleaned. Thereafter, the wafer unit U is held by the holding mechanism 44 of the first conveying mechanism 40 and is moved onto the guide rails 12. Then, the wafer unit U is grasped by the clamp mechanism 42 of the first conveying mechanism 40 and is carried out to the cassette 13.

FIG. 3 is an enlarged perspective view illustrating the part of the first conveying mechanism 40 and the second conveying mechanism 50. The first conveying mechanism 40 includes the clamp mechanism 42 and the holding mechanism 44.

The clamp mechanism 42 of the first conveying mechanism 40 is disposed on a horizontal part of the

lower part of the substantially L-shaped lower arm 45 that moves in the Y-axis direction and the Z-axis direction. The perpendicular part of the lower arm 45 is connected to a first moving part 47 that moves in the Y-axis direction along a front surface 4a of the exterior cover 4, through a raising-lowering mechanism 48.

The first moving part 47 moves in the Y-axis direction by a first Y-axis direction movement mechanism 46. The first Y-axis direction movement mechanism 46 includes a ball screw 46a that extends in the horizontal direction, a pulse motor 46b that drives the ball screw 46a, and a pair of guide rails 46c that extend in the horizontal direction on the upper and lower sides of the ball screw 46a.

On the horizontal part of the lower arm 45, the holding mechanism 44 that holds the wafer unit U (FIG. 1) when the wafer unit U (FIG. 1) is moved between the guide rails 12 and the holding table 6 is configured.

The holding mechanism 44 includes a cover part 44a with a circular disc shape, two arm parts 44b disposed under the cover part 44a, and holding parts 44c disposed at both ends of the arm parts 44b. The holding parts 44c are disposed at four places in total and are connected to an unillustrated suction source, to hold the annular

frame F (see FIG. 1) of the wafer unit U (FIG. 1) by suction adhesion.

The second conveying mechanism 50 is disposed with the height position thereof made different from that of the first conveying mechanism 40. The second conveying mechanism 50 includes the holding mechanism 54. The holding mechanism 54 of the second conveying mechanism 50 is disposed on a horizontal part of the lower part of the substantially L-shaped upper arm 55 that moves in the Y-axis direction and the Z-axis direction. The perpendicular part of the upper arm 55 is connected to a second moving part 57 that moves in the Y-axis direction along the front surface 4a of the exterior cover 4, through a raising-lowering mechanism 58.

The second moving part 57 moves in the Y-axis direction by a second Y-axis direction movement mechanism 56. The second Y-axis direction movement mechanism 56 includes a ball screw 56a that extends in the horizontal direction, a pulse motor 56b that drives the ball screw 56a, and a pair of guide rails 56c that extend in the horizontal direction on the upper and lower sides of the ball screw 56a.

On the horizontal part of the upper arm 55, the holding mechanism 54 that holds the wafer unit U (FIG. 1)

when the wafer unit U (FIG. 1) is moved between the holding table 6 and the cleaning mechanism 60 is disposed.

The holding mechanism 54 includes a cover part 54a with a circular disc shape, two arm parts 54b disposed under the cover part 54a, and holding parts 54c disposed at both ends of the arm parts 54b. The holding parts 54c are disposed at four places in total and are connected to an unillustrated suction source, to hold the annular frame F (see FIG. 1) of the wafer unit U (FIG. 1) by suction adhesion.

In the above second conveying mechanism 50, a movement unit that moves the holding parts 54c and the cover part 54a integrally relative to the cleaning mechanism 60 is configured. In the present embodiment example, the movement unit includes the upper arm 55, the raising-lowering mechanism 58, the second moving part 57, and the second Y-axis direction movement mechanism 56.

FIG. 4 is a perspective view illustrating the configuration of the cleaning mechanism. FIG. 5 is a side sectional view illustrating the configuration of the cleaning mechanism and the second conveying mechanism. The cleaning mechanism 60 is used for cleaning the workpiece for which processing has been executed by the

first cutting unit 10 and the second cutting unit 20 that are processing units.

The cleaning mechanism 60 includes a cleaning table 62 that holds the wafer unit U, a cleaning nozzle 63 that supplies a cleaning liquid to the wafer unit U held by the cleaning table 62, and a casing 61 in which an opening 61a that permits taking-out and putting-in of the wafer unit U is formed and in which the cleaning table 62 and the cleaning nozzle 63 are housed. The opening 61a is opened and closed by the cover part 54a of the second conveying mechanism 50 (FIG. 5).

The upper surface of the cleaning table 62 is configured by a circular suction adhesion holding surface 62a. The cleaning table 62 is rotationally driven by a rotational drive mechanism 62b. At the outer circumferential edge part of the cleaning table 62 around the suction adhesion holding surface 62a, multiple clamps 62c that hold the annular frame F of the wafer unit U (FIG. 5) in an attachable and detachable manner are disposed at equal intervals. The clamps 62c operate to hold down the annular frame F from the upper side when the cleaning table 62 rotates and a centrifugal force is generated.

The cleaning table 62 rises and lowers between a

unit transfer position near the height of the opening 61a of the casing 61 and a cleaning position at a lower part in the casing 61 by an unillustrated raising-lowering mechanism such as an air cylinder.

The cleaning nozzle 63 is horizontally pivotally supported by a nozzle base part 66 disposed between the cleaning table 62 and the inner surface of the casing 61. The cleaning liquid for cleaning is jetted from the cleaning nozzle 63. As the cleaning liquid to be used, there is purified water and so forth, for example.

A drying nozzle 64 is disposed in parallel to the cleaning nozzle 63. Dry air for an air blow is jetted from the drying nozzle 64. The cleaning mechanism 60 may be equipped with, for example, a nozzle that supplies a protective film agent for forming a protective film layer on a surface of the wafer W (FIG. 1) in addition to the above-described two nozzles.

FIG. 6A and FIG. 6B are perspective views illustrating the configuration of a gas jet mechanism 51 of the second conveying mechanism 50. The gas jet mechanism 51 is used for jetting gas toward the cover part 54a to prevent liquid from adhering to the cover part 54a. The gas to be used is dry air, for example.

As illustrated in FIG. 6A, in the present

embodiment example, the cover part 54a is fixed to a horizontal part 55a of the upper arm 55, and two nozzles 51a connected to an unillustrated air supply source are disposed at the tip of the horizontal part 55a. The gas jet mechanism 51 is configured by the nozzles 51a.

The cover part 54a includes a flat plate part 54d with a circular disc shape and a circumferential wall part 54e disposed to droop downward from the outer circumferential part of the flat plate part 54d, and the gas jetted from each nozzle 51a is jetted toward the inside of the circumferential wall part 54e. The gas that impinges on the circumferential wall part 54e flows along the circumferential wall part 54e in such a manner as to go along the inside of the circumferential wall part 54e, and an air curtain is formed by this flow of the gas.

By the above configuration, as illustrated in FIG. 7, when the wafer unit U is cleaned or dried in the cleaning mechanism 60, the opening 61a of the cleaning mechanism 60 is closed by the cover part 54a of the second conveying mechanism 50. In addition, the cleaning liquid or dry air is supplied to the wafer unit U while the cleaning table 62 is rotated. At this time, the cleaning liquid becomes a mist and is scattered in the casing 61.

In the situation in which the mist is scattered as described above, an air curtain is formed inside the cover part 54a by the gas jet mechanism 51. This can prevent mist from adhering to the lower surface of the flat plate part 54d of the cover part 54a and the inside of the circumferential wall part 54e. Moreover, adherence of the mist to the arm parts 54b and the holding parts 54c, which are disposed inside the cover part 54a and are used for holding the wafer unit U, can also be prevented.

Further, as illustrated in FIG. 6B, for example, after cleaning or after drying, the mist that has adhered to the cover part 54a, the arm parts 54b, and so forth can be caused to drop into the casing 61 and be removed by making an air blow by the gas jet mechanism 51.

In addition, as illustrated in FIG. 6B, even in the case in which not only the mist generated in the cleaning mechanism 60 but a mist generated from the processing liquid used at the time of cutting by the first cutting unit 10 (FIG. 1) and the second cutting unit 20 (FIG. 1) adheres to the cover part 54a, the arm parts 54b, and so forth, the mist can be removed by making an air blow by the gas jet mechanism 51, and the mist can be prevented from dropping through accumulation. For example, it is possible that periodically the second conveying mechanism

50 is moved to the upper side of the cleaning mechanism 60 and an air blow is made to cause accumulated substances to drop into the casing 61.

FIG. 8A is a perspective view illustrating another embodiment example of the gas jet mechanism disposed in the second conveying mechanism 50. This gas jet mechanism denoted by 51A has such a configuration that a circular annular pipe component 51n is disposed inside the cover part 54a and nozzles 51m are disposed at multiple places on the pipe component 51n.

An air curtain may be formed inside the cover part 54a by jetting dry air from multiple places in the circumferential direction by such a gas jet mechanism 51A. This form is particularly preferable in a configuration in which the circumferential wall part 54e is not provided in the cover part 54a.

FIG. 8B is a perspective view illustrating another embodiment example of the gas jet mechanism disposed in the second conveying mechanism 50. This gas jet mechanism denoted by 51B has such a configuration that nozzles 51x for supplying dry air toward the outside of the cover part 54a are disposed.

By jetting dry air to the outside surface of the cover part 54a by such a gas jet mechanism 51B, a mist of

the cleaning liquid and a mist of the processing liquid adhering to the outside surface of the cover part 54a can be removed by the air blow, and dropping of them through accumulation can be prevented.

The gas jet mechanisms described above may be implemented alone or may be implemented in combination. Moreover, besides disposing the gas jet mechanism only for the cover part 54a of the second conveying mechanism 50, the gas jet mechanism may be disposed also for the cover part 44a (FIG. 3) of the first conveying mechanism 40.

As described above, as illustrated in FIG. 6A and FIG. 6B, the disposing the gas jet mechanism 51 for the cover part 54a of the second conveying mechanism 50 that closes the opening 61a of the cleaning mechanism 60 makes it possible to prevent adherence and accumulation of a mist onto the cover part 54a, and also to prevent the occurrence of the situation in which the mist is accumulated and drops to cause rust in another constituent element and the occurrence of the situation in which an accumulated substance drops onto a workpiece and contaminates the workpiece.

Furthermore, as illustrated in FIG. 6B and FIG. 7, by jetting gas in the state in which the opening 61a of

the casing 61 is closed by the cover part 54a, accumulated substances of a mist can be caused to drop into the casing 61 of the cleaning mechanism 60 and be captured.

The present invention is not limited to the details of the above described preferred embodiment. The scope of the invention is defined by the appended claims and all changes and modifications as fall within the equivalence of the scope of the claims are therefore to be embraced by the invention.

WHAT IS CLAIMED IS:

1. A conveying mechanism disposed in a processing apparatus,

the processing apparatus including

a holding table that holds a workpiece,

a processing unit that processes the workpiece held by the holding table, and

a cleaning mechanism that cleans the workpiece for which processing has been executed by the processing unit,

the cleaning mechanism including

a cleaning table that holds the workpiece,

a cleaning nozzle that supplies a cleaning liquid to the workpiece held by the cleaning table, and

a casing in which an opening that permits taking-out and putting-in of the workpiece is formed and in which the cleaning table and the cleaning nozzle are housed,

the conveying mechanism being used to convey the workpiece from the holding table to the cleaning mechanism,

the conveying mechanism comprising:

a holding part that holds the workpiece;

a cover part that covers the opening of the casing

of the cleaning mechanism;

a movement unit that moves the holding part and the cover part integrally relative to the cleaning mechanism; and

a gas jet mechanism that jets gas toward the cover part to prevent liquid from adhering to the cover part.

2. The conveying mechanism according to claim 1, wherein

the gas jet mechanism jets gas toward inside of the cover part in a state in which the opening of the casing is closed by the cover part.