DESCRIPTION

MACHINING APPARATUS AND MACHINED ARTICLE MANUFACTURING METHOD

Technical Field

[0001]

The present invention relates to a machining apparatus and a machined article manufacturing method.

Background Art

[0002]

Conventionally, as disclosed in Patent Literature 1, in a cutting apparatus for manufacturing a plurality of products singulated by cutting a to-be-cut object, it is considered that a suction jig is configured to be detachable from a cutting table.

Citation List

Patent Literature

[0003]

Patent Literature 1: JP 2016-040060 A

[0004]

However, in the cutting apparatus described above, the suction jig is simply made attachable to and detachable from the cutting table, and the operator needs to perform the work when actually replacing the suction jig. Therefore, there is a problem that not only labor cost of an operator is required, but also a mounting state varies. In addition, it takes time to perform the replacement work, and the productivity of the cutting apparatus is lowered.

Summary of Invention

Technical Problem

[0005]

Therefore, the present invention has been made to solve the above problems, and a main object thereof is to automatically replace a holding plate for holding an object to be machined.

Solution to Problem

[0006]

That is, a machining apparatus according to the present invention is a machining apparatus that holds an object to be machined on a machining table and machines the object to be machined with a machining mechanism while moving the machining table, the machining apparatus including: a plate housing portion that houses a holding plate for holding the object to be machined; a holding base portion to which the holding plate is detachably attached, the holding base portion holding the object to be machined using the holding plate; and a plate conveying mechanism that conveys the holding plate between the plate housing portion and the holding base portion, in which the plate conveying mechanism conveys the holding plate detached from the holding base portion to the plate housing portion, and conveys the holding plate in the plate housing portion to the holding base portion.

Advantageous Effects of Invention

[0007]

According to the present invention configured as described above, the holding plate for holding an object to be machined can be automatically replaced.

Brief Description of Drawings

[0008]

FIG. 1 is a view schematically illustrating a configuration of a cutting

apparatus (tray housing) according to an embodiment of the present invention.

FIG. 2 is a schematic diagram illustrating an operation of the cutting apparatus according to the embodiment.

FIG. 3 is a schematic view illustrating a configuration of a holding plate and a holding base portion of the embodiment.

FIG. 4 is a perspective view illustrating a plate conveying mechanism (plate taking in and out mechanism) and a plate housing portion of the embodiment.

FIG. 5 is a cross-sectional view schematically illustrating a configuration of a fixing mechanism of the embodiment.

FIG. 6 is a perspective view illustrating a holding base portion of a second holding mechanism of the embodiment.

FIG. 7 is a view illustrating a replacement operation of the holding plate of the embodiment.

FIG. 8 is a view illustrating a replacement operation of the holding plate of the embodiment.

FIG. 9 is a diagram schematically illustrating a configuration of a cutting apparatus according to a modified embodiment.

FIG. 10 is a view schematically illustrating a configuration of a cutting apparatus (ring housing) according to a modified embodiment.

FIG. 11(a) is a plan view schematically showing a configuration of an attaching member, FIG. 11(b) is a cross-sectional view, and FIG. 11(c) is a partially enlarged cross-sectional view.

FIG. 12 is a view schematically illustrating a configuration of a cutting apparatus (tube housing) according to a modified embodiment.

FIG. 13(a) is a perspective view schematically showing a configuration of a

cylindrical container, and FIG. 13(b) is a cross-sectional view thereof.

FIG. 14 is a view schematically illustrating a configuration of a cutting apparatus (bulk housing) according to a modified embodiment.

FIG. 15 is a view illustrating a replacement operation of the holding plate of the embodiment.

Description of Embodiments

[0009]

Next, the present invention will be described in more detail with reference to examples. However, the present invention is not limited by the following description.

[0010]

As described above, a machining apparatus of the present invention is a machining apparatus that holds an object to be machined on a machining table and machines the object to be machined with a machining mechanism while moving the machining table, the machining apparatus including: a plate housing portion that houses a holding plate for holding the object to be machined; a holding base portion to which the holding plate is detachably attached, the holding base portion holding the object to be machined using the holding plate; and a plate conveying mechanism that conveys the holding plate between the plate housing portion and the holding base portion, in which the plate conveying mechanism conveys the holding plate detached from the holding base portion to the plate housing portion, and conveys the holding plate in the plate housing portion to the holding base portion.

This machining apparatus includes the plate conveying mechanism that conveys the holding plate detached from the holding base portion to the plate housing portion and conveys the holding plate in the plate housing portion to the holding base portion, so that the holding plate can be automatically replaced with respect to the

holding base portion. As a result, labor costs for replacing the holding plate can be reduced. In addition, since the holding plate is automatically replaced, it is possible to reduce variations in the attachment state of the holding plate to the holding base portion. Furthermore, since the holding plate is automatically replaced, the replacement time of the holding plate can be shortened, and the productivity of the machining apparatus can be improved.

[0011]

It is desirable that the plate conveying mechanism raise and convey the holding plate.

With this configuration, when the holding plate is conveyed, the holding plate can be easily conveyed while avoiding interference between the holding plate and other members.

[0012]

It is desirable that the plate conveying mechanism convey at least one of: a holding plate of the machining table; a holding plate of a drying table for drying the object to be machined after the machining; a holding plate of an inspection table for inspecting the object to be machined after the machining; a holding plate of a transfer table on which the object to be machined after the machining is placed before being housed; or a holding plate of a conveyance holding mechanism that holds the object to be machined for conveying the object to be machined.

With this configuration, the holding plate of each of the machining table, the inspection table, the transfer table, and the conveyance holding mechanism can be automatically replaced.

[0013]

The machining apparatus of the present invention further includes an object to

be machined conveying mechanism that conveys the object to be machined.

In order to reduce the cost of the apparatus while simplifying the configuration of the apparatus while enabling automatic replacement of the holding plate in this configuration, it is desirable that the plate conveying mechanism be configured using the object to be machined conveying mechanism. That is, the plate conveying mechanism has a function of conveying an object to be machined after machining.

[0014]

As a specific embodiment for simplifying the configuration of the apparatus, it is desirable that the machining apparatus of the present invention further include: a first holding mechanism that holds the object to be machined for conveying the object to be machined to the machining table; a second holding mechanism that holds the object to be machined after the machining for conveying the object to be machined after the machining from the machining table; and a conveyance moving mechanism that moves the first holding mechanism and the second holding mechanism.

In this configuration, in order to reduce the cost of the apparatus while simplifying the configuration of the apparatus while enabling automatic replacement of the holding plate, it is desirable that the plate conveying mechanism be configured using the second holding mechanism and the conveyance moving mechanism.

[0015]

In addition, it is conceivable that the machining apparatus of the present invention further includes a transfer table on which the object to be machined after the machining is placed before being housed, and a transfer moving mechanism that moves the transfer table.

In this configuration, in order to reduce the cost of the apparatus while

simplifying the configuration of the apparatus while enabling automatic replacement of the holding plate, it is desirable that the plate conveying mechanism be configured using the transfer table and the transfer moving mechanism.

[0016]

When the plate conveying mechanism is configured using the transfer table and the transfer moving mechanism, it is desirable that the plate conveying mechanism further include a plate taking in and out mechanism that conveys the holding plate between the plate housing portion and the transfer table.

[0017]

The machining apparatus of the present invention can be configured to be able to house (also called “tray housing”) the object to be machined after machining in a tray. The machining apparatus further includes a tray conveying mechanism that conveys a tray into which the object to be machined singulated by the machining mechanism is sorted, and houses the singulated object to be machined in the tray.

In the present invention, in the machining apparatus that performs tray housing in this manner, the holding plate for holding the object to be machined can be automatically replaced.

[0018]

In addition, the machining apparatus of the present invention can be configured to be able to attach and house (also called “ring housing”) the singulated object to be machined to an attaching member having an adhesive surface. The machining apparatus further includes a placement table on which an attaching member, which has an adhesive surface to which the object to be machined singulated by the machining mechanism is attached, is placed, and the singulated object to be machined is attached to the attaching member and housed.

In the present invention, in the machining apparatus that performs ring housing in this manner, the holding plate for holding the object to be machined can be automatically replaced.

[0019]

Furthermore, the machining apparatus of the present invention can be configured to be able to house (also called “tube housing”) the singulated object to be machined in the cylindrical container. The cylindrical container may be referred to as a tube, a magazine stick, a stick magazine, a stick, or the like. The machining apparatus further includes a container installing portion in which a cylindrical container that houses the object to be machined singulated by the machining mechanism from one end opening is installed, and houses the singulated object to be machined in the cylindrical container.

In the present invention, in the machining apparatus that performs tube housing in this manner, the holding plate for holding the object to be machined can be automatically replaced.

[0020]

In addition, the machining apparatus of the present invention can be configured to be able to house (also called “bulk housing”) the singulated objects to be machined in a state of being separated. The machining apparatus further includes a housing box in which the object to be machined singulated by the machining mechanism is dropped and housed, and houses the singulated object to be machined in the housing box.

In the machining apparatus that performs bulk housing in this manner, the holding plate for holding the object to be machined can be automatically replaced.

[0021]

In order to automatically inspect whether the holding plate is accurately fixed, it is desirable that the machining apparatus of the present invention further include an inspection mechanism that inspects an attachment state of the holding plate with respect to the holding base portion.

[0022]

As a specific embodiment of the inspection mechanism, it is desirable that the inspection mechanism include: an inspection flow path that opens to a mounting surface on which the holding plate is mounted; and a detection sensor that is provided in the inspection flow path and detects leakage of a fluid from the opening. Here, the detection sensor detects leakage of the fluid from the opening by measuring a pressure or a flow rate of the fluid.

[0023]

In order to simplify a structure for fixing the holding plate to the holding base portion, it is desirable that the holding base portion include a fixing cylinder portion to be inserted into a fixing insertion hole formed in the holding plate,

the fixing cylinder portion includes a cylinder body to be inserted into the fixing insertion hole, a mover provided movably at a position protruding from an outer peripheral surface of the cylinder body and a position retracting from the outer peripheral surface of the cylinder body, and an elastic body that applies a force so that the mover is at a position protruding from the cylinder body, and

the holding plate be fixed to the holding base portion by bringing the mover into the protruding position in a state where the fixing cylinder portion is inserted into the fixing insertion hole.

[0024]

In addition, in order to simplify the attachment/detachment structure of the

holding plate to/from the plate conveying mechanism, it is desirable that the plate conveying mechanism includes a conveyance cylinder portion inserted into a conveyance holding hole formed in the holding plate, the conveyance cylinder portion has a cylinder body inserted into the conveyance holding hole, a mover provided movably at a position protruding from an outer peripheral surface of the cylinder body and a position retracted from the outer peripheral surface of the cylinder body, and an elastic body that applies a force so that the mover is at a position protruding from the cylinder body, and the plate conveying mechanism hold the holding plate by bringing the mover into the protruding position in a state where the conveyance cylinder portion is inserted into the conveyance insertion hole.

[0025]

A machined article manufacturing method for manufacturing a machined article by using the machining apparatus is also an aspect of the present invention.

[0026]

<Embodiments of the present invention>

Hereinafter, embodiments of a machining apparatus according to the present invention will be described with reference to the drawings. Note that any of the drawings shown below is schematically omitted or exaggerated as appropriate for easy understanding. The same components are denoted by the same reference numerals, and the description thereof will be omitted as appropriate.

[0027]

<Overall configuration of machining apparatus>

The machining apparatus 100 of the present embodiment is a cutting apparatus that singulates a plurality of products P, which are machined articles, by cutting the sealed substrate W, which is an object to be machined.

[0028]

Here, the sealed substrate W is obtained by resin molding a substrate to which an electronic element such as a semiconductor chip, a resistance element, or a capacitor element is connected such that at least the electronic element is resin-sealed. As the substrate constituting the sealed substrate W, a lead frame and a printed wiring board can be used, and in addition to these, a semiconductor substrate (including a semiconductor wafer such as a silicon wafer), a metal substrate, a ceramic substrate, a glass substrate, a resin substrate, and the like can be used. In addition, the substrate constituting the sealed substrate W may or may not be provided with wiring.

[0029]

In the sealed substrate W and the product P of the present embodiment, one surface is a mounting surface to be mounted later. In the description of the present embodiment, one surface to be mounted later will be referred to as a “mounting surface”, and the opposite surface will be referred to as a “mark surface”.

[0030]

Specifically, as illustrated in FIG. 1, the cutting apparatus 100 includes two cutting tables (machining tables) 2A and 2B that hold the sealed substrate W, a first holding mechanism 3 that holds the sealed substrate W to convey the sealed substrate W to the cutting tables 2A and 2B, a cutting mechanism (machining mechanism) 4 that cuts the sealed substrate W held on the cutting tables 2A and 2B, a transfer table 5 to which a plurality of products P are transferred, a second holding mechanism 6 that holds the plurality of products P to convey the plurality of products P from the cutting tables 2A and 2B to the transfer table 5, and a conveyance moving mechanism 7 that moves the first holding mechanism 3 and the second holding mechanism 6. Note that the first holding mechanism 3 and the conveyance moving mechanism 7 constitute a conveyance

mechanism (loader) that conveys the sealed substrate W, and the second holding mechanism 6 and the conveyance moving mechanism 7 constitute a conveyance mechanism (unloader) that conveys the plurality of products P.

[0031]

In the following description, directions orthogonal to each other in a plane (horizontal plane) along the upper surfaces of the cutting tables 2A and 2B are referred to as an X direction and a Y direction, respectively, and a vertical direction orthogonal to the X direction and the Y direction is referred to as a Z direction. Specifically, the horizontal direction in FIG. 1 is defined as an X direction, and the vertical direction is defined as a Y direction.

[0032]

The two cutting tables 2A and 2B suck and hold the sealed substrate W, and are provided to be movable at least in the Y direction. The cutting table 2A is movable in the Y direction by a cutting moving mechanism 8A and is rotatable in a θ direction by a rotating mechanism 9A. The cutting table 2B is movable in the Y direction by a cutting moving mechanism 8B and is rotatable in a θ direction by a rotating mechanism 9B.

[0033]

As illustrated in FIG. 1, the first holding mechanism 3 holds the sealed substrate W in order to convey the sealed substrate W from a substrate supplying mechanism 10 to the cutting tables 2A and 2B. The first holding mechanism 3 includes a plurality of suction portions (not illustrated) for sucking and holding the sealed substrate W. Then, the first holding mechanism 3 is moved to a desired position by a conveyance moving mechanism 7 described later or the like to convey the sealed substrate W from the substrate supplying mechanism 10 to the cutting tables 2A and 2B.

[0034]

As illustrated in FIG. 1, the substrate supplying mechanism 10 includes a substrate housing unit 10a in which a plurality of the sealed substrates W are housed from the outside, and a substrate supplying unit 10b that moves the sealed substrate W housed in the substrate housing unit 10a to a holding position RP sucked and held by the first holding mechanism 3.

[0035]

As illustrated in FIG. 1, the cutting mechanism 4 includes two rotating tools 40 including blades 41A and 41B and two spindle portions 42A and 42B. The two spindle portions 42A and 42B are provided such that their rotation axes are along the X direction, and the blades 41A and 41B attached thereto are arranged to face each other (see FIG. 1). Further, the two spindle portions 42A and 42B are configured to be movable independently of each other in the X direction and the Z direction by a spindle moving mechanism 11. Furthermore, the cutting mechanism 4 is provided with imaging cameras 12 and 27 for alignment, and the imaging cameras 12 and 27 perform alignment of the sealed substrate W before cutting and alignment of the sealed substrate W after being cut in one of the vertical and horizontal directions and rotated by the rotating mechanism 9B.

[0036]

Then, in the cutting on the cutting table 2A, the sealed substrate W is cut and singulated by relatively moving the cutting table 2A and the two spindle portions 42A and 42B. Further, in the cutting on the cutting table 2B, the sealed substrate W is cut and singulated by relatively moving the cutting table 2B and the two spindle portions 42A and 42B. The blade 41A of the spindle portion 42A and the blade 41B of the spindle portion 42B rotate in a plane including the Y direction and the Z direction to cut

the sealed substrate W held on each of the tables 2A and 2B. Note that cutting processing in the cutting table 2A and cutting processing in the cutting table 2B can be alternately performed.

[0037]

The spindle moving mechanism 11 is provided with a first cleaning mechanism 13 that cleans the upper surface side (mounting surface) of the plurality of products P held on the cutting tables 2A and 2B. The first cleaning mechanism 13 is provided on a support 11a extending in the X direction that supports the spindle portions 42A and 42B in the spindle moving mechanism 11. The first cleaning mechanism 13 sprays cleaning liquid and/or compressed air to the upper surfaces of the plurality of products P held on the cutting tables 2A and 2B to clean the upper surface side (mounting surface) of the products P. Note that the first cleaning mechanism 13 may use a brush.

[0038]

As illustrated in FIG. 1, the transfer table 5 of the present embodiment is a table to which a plurality of products P inspected by an inspection unit 14 described later are transferred. The transfer table 5 is a so-called index table, and a plurality of products P are temporarily placed before the plurality of products P is sorted and housed in various trays 21. Further, the transfer table 5 is provided to be movable back and forth along the Y direction. The transfer table 5 is moved by the transfer moving mechanism 15 between a transfer position X1 where the plurality of products P is placed by the second holding mechanism 6 and a taking out position X2 where the plurality of products P is conveyed by a sorting mechanism 20. The transfer moving mechanism 15 includes a guide rail 15a that guides the transfer table along the Y direction, and a driving unit (not illustrated) that moves the transfer table on the guide

rail 15a.

[0039]

The plurality of products P placed on the transfer table 5 are sorted into the various trays 21 by the sorting mechanism 20 according to the inspection result (non-defective, defective, etc.) by the inspection unit 14. The various trays 21 are conveyed from a tray housing portion 23 to a desired taking out position X2 by the tray moving mechanism 22, and the products P to be sorted by the sorting mechanism 20 are placed on the various trays. After being sorted, the various trays 21 are housed in the tray housing portion 23 by the tray moving mechanism 22. In the present embodiment, the tray housing portion 23 is configured to house three types of trays, for example, a tray 21 before housing the product P, a tray 21 housing the non-defective product P, and a tray 21 housing the defective product P requiring rework. The tray moving mechanism 22 includes a tray placing portion 22a on which the tray 21 is placed, a guide rail 22b that guides the tray placing portion 22a along the Y direction, a moving mechanism (not illustrated) that moves the various trays 21 in the X direction, a moving mechanism (not illustrated) that is provided for each of the various trays 21 and moves the various trays 21 in the Z direction, and a driving unit (not illustrated) that drives these to move the tray placing portion 22a.

[0040]

Here, as illustrated in FIG. 1, the inspection unit 14 is provided between the cutting tables 2A and 2B and the transfer table 5, and inspects a plurality of products P held by the second holding mechanism 6. The inspection unit 14 of the present embodiment includes a first inspection unit 141 that inspects the mark surface of the product P and a second inspection unit 142 that inspects the mounting surface of the product P. The first inspection unit 141 is an imaging camera having an optical system

for inspecting a mark surface, and the second inspection unit 142 is an imaging camera having an optical system for inspecting a mounting surface. Note that the first inspection unit 141 and the second inspection unit 142 may be common.

[0041]

In addition, a reversing mechanism 16 that reverses the plurality of products P is provided in order to allow the inspection unit 14 to inspect both surfaces of the plurality of products P (see FIG. 1). The reversing mechanism 16 includes a support table 161 that holds a plurality of products P, and a reversing unit 162 such as a motor that reverses the support table 161 so that the front and back are reversed. Further, the reversing mechanism 16 is movable to the transfer table 5 by a reversing moving mechanism 17 that moves the reversing mechanism 16 in the X direction. Note that the reversing moving mechanism 17 includes a guide rail 17a that guides the reversing mechanism 16 along the X direction, and a driving unit (not illustrated) that moves the reversing mechanism 16 on the guide rail 17a.

[0042]

When the second holding mechanism 6 holds the plurality of products P from the cutting tables 2A and 2B, the mark surface of the product P faces downward. In this state, while the plurality of products P is conveyed from the cutting tables 2A and 2B to the reversing mechanism 16, the mark surface of the product P is inspected by the first inspection unit 141. Thereafter, the plurality of products P held by the second holding mechanism 6 are reversed by the reversing mechanism 16, and thereafter, the reversing mechanism 16 is moved to the position of the transfer table 5 by the reversing moving mechanism 17. During this movement, the mounting surface of the product P facing downward is inspected by the second inspection unit 142. Thereafter, the product P is delivered to the transfer table 5.

[0043]

As illustrated in FIG. 1, the second holding mechanism 6 holds a plurality of products P for conveying the plurality of products P from the cutting tables 2A and 2B to the reversing mechanism 16. The second holding mechanism 6 includes a plurality of suction portions (not illustrated) for sucking and holding a plurality of products P. Then, the second holding mechanism 6 is moved to a desired position by the conveyance moving mechanism 7 described later or the like to convey the plurality of products P from the cutting tables 2A and 2B to the support table 161.

[0044]

As illustrated in FIG. 1, the conveyance moving mechanism 7 moves the first holding mechanism 3 at least between the substrate supplying mechanism 10 and the cutting tables 2A and 2B, and moves the second holding mechanism 6 at least between the cutting tables 2A and 2B and the support table 161.

[0045]

As illustrated in FIG. 1, the conveyance moving mechanism 7 extends in a straight line along the arrangement direction (X direction) of the two cutting tables 2A and 2B and the transfer table 5, and has a common transfer shaft 71 for moving the first holding mechanism 3 and the second holding mechanism 6. The transfer shaft 71 is provided in a range in which the first holding mechanism 3 can move above the substrate supplying unit 10b of the substrate supplying mechanism 10 and the second holding mechanism 6 can move above the support table 161 (see FIG. 1). Note that the transfer shaft 71 may be provided individually for each of the first holding mechanism 3 and the second holding mechanism 6.

[0046]

Further, the conveyance moving mechanism 7 is configured to be able to

move the first holding mechanism 3 and the second holding mechanism 6 in each of the X direction and the Z direction with respect to the transfer shaft 71. The moving mechanism in each direction may use, for example, a rack and pinion mechanism, a ball screw mechanism, an air cylinder, or a linear motor.

[0047]

In addition, as illustrated in FIG. 1, the cutting apparatus 100 of the present invention further includes a second cleaning mechanism 18 that cleans the lower surface side (mark surface) of the plurality of products P held by the second holding mechanism 6. The second cleaning mechanism 18 is provided between the cutting table 2B and the inspection unit 14, and cleans the lower surface side (mark surface) of the products P by spraying the cleaning liquid and/or the compressed air to the lower surfaces of the plurality of products P held by the second holding mechanism 6. That is, while the second holding mechanism 6 is being moved along the transfer shaft 71, the second cleaning mechanism 18 cleans the lower surface side (mark surface) of the product P. The second cleaning mechanism 18 may use a brush.

[0048]

<Example of operation of cutting apparatus 100>

Next, an example of the operation of the cutting apparatus 100 will be described. FIG. 2 illustrates a movement path of the first holding mechanism 3 and a movement path of the second holding mechanism 6 in the operation of the cutting apparatus 100. In the present embodiment, all operations and controls of the cutting apparatus 100, such as conveyance of the sealed substrate W, cutting of the sealed substrate W, inspection of the product P, and replacement of a holding plate M1 to be described later, are performed by a control unit CTL (see FIG. 1).

[0049]

The substrate supplying unit 10b of the substrate supplying mechanism 10 moves the sealed substrate W housed in the substrate housing unit 10a toward the holding position RP held by the first holding mechanism 3.

[0050]

Next, the conveyance moving mechanism 7 moves the first holding mechanism 3 to the holding position RP, and the first holding mechanism 3 sucks and holds the sealed substrate W. Thereafter, the conveyance moving mechanism 7 moves the first holding mechanism 3 holding the sealed substrate W to the cutting tables 2A and 2B, and the first holding mechanism 3 releases the sucking and holding to place the sealed substrate W on the cutting tables 2A and 2B. Then, the cutting tables 2A and 2B suck and hold the sealed substrate W.

[0051]

In this state, the cutting moving mechanisms 8A and 8B move the cutting tables 2A and 2B to predetermined cutting positions (the back side of the transfer shaft 71). At this cutting position, the cutting tables 2A and 2B and the two spindle portions 42A and 42B are relatively moved in the X direction and the Y direction by the cutting moving mechanisms 8A and 8B and the spindle moving mechanism 11, and the sealed substrate W is cut and singulated in a lattice shape by rotating the cutting tables 2A and 2B by the rotating mechanisms 9A and 9B.

[0052]

After the cutting, the upper surface side (mounting surface) of the plurality of products P held on the cutting tables 2A and 2B is cleaned by the first cleaning mechanism 13. After this cleaning, the cutting moving mechanisms 8A and 8B move the cutting tables 2A and 2B to predetermined conveyance positions (the front side of the transfer shaft 71).

[0053]

Next, the conveyance moving mechanism 7 moves the second holding mechanism 6 to the cutting tables 2A and 2B after cutting, and the second holding mechanism 6 sucks and holds the plurality of products P. Thereafter, the conveyance moving mechanism 7 moves the second holding mechanism 6 holding the plurality of products P to the second cleaning mechanism 18. As a result, the second cleaning mechanism 18 cleans the lower surface side (mark surface) of the plurality of products P held by the second holding mechanism 6.

[0054]

After the cleaning, the plurality of products P held by the second holding mechanism 6 are inspected on the lower surface side thereof (mark surface) by the inspection unit 141, then delivered to the reversing mechanism 16, and reversed after the mark surface is sucked and held by the reversing mechanism 16. After the reversing, the reversing mechanism 16 is moved by the reversing moving mechanism 17, and the mounting surface of the product P is inspected by the inspection unit 142. After the inspection is performed on both surfaces as described above, the product P is delivered from the reversing mechanism 16 to the transfer table 5. The transfer table 5 on which the product P is placed is moved to the taking-out position by the transfer moving mechanism 15. Then, the plurality of products P placed on the transfer table 5 are sorted into the various trays 21 by the sorting mechanism 20 according to the inspection result (non-defective, defective, etc.) by the inspection unit 14.

[0055]

<Automatic replacement function of holding plate M1>

Furthermore, the cutting apparatus 100 of the present embodiment has a function of automatically replacing the holding plate M1 for holding the sealed

substrate W or the product P.

[0056]

In the present embodiment, as illustrated in FIG. 3, each of the cutting tables 2A and 2B for cutting the sealed substrate W, the inspection table (support table 161) for inspecting the product P, the transfer table 5 on which the product P is placed before sorting (before housing), and the conveyance holding mechanism (second holding mechanism 6) that holds the product P for conveying includes a replaceable holding plate M1 and a holding base portion M2 to which the holding plate M1 is detachably attached and which holds the sealed substrate W or the product P using the holding plate M1. Although the holding plate M1 and the holding base portion M2 of the cutting tables 2A and 2B are illustrated as representatives in FIG. 3, each of the support table 161, the transfer table 5, and the second holding mechanism 6 also has the same configuration including the holding plate M1 and the holding base portion M2.

[0057]

Specifically, as illustrated in FIGS. 1 and 4, the cutting apparatus 100 includes a plate housing portion 24 that accommodates the holding plate M1, and a plate conveying mechanism 25 that conveys the holding plate M1 between the plate housing portion 24 and the holding base portion M2.

[0058]

A suction portion (suction hole) (not illustrated) for sucking the sealed substrate W or the product P is formed in the holding plate M1, and the holding plate M1 is attached to the holding base portion M2 to suck the sealed substrate W or the product P through the suction flow path M21 provided in the holding base portion M2 (see FIG. 3). The holding plate M1 is used for the cutting tables 2A and 2B, the support table 161, the transfer table 5, and the second holding mechanism 6, and is

different in shape, configuration of the suction portion, or the like. The holding plate M1 is used for the cutting tables 2A and 2B, the support table 161, the transfer table 5, and the second holding mechanism 6, and may be commonalized and have the same shape or the same configuration of the suction portion. Furthermore, the various holding plates M1 are different in shape, configuration of a suction portion, or the like for each sealed substrate W or product P, and are selected in accordance with the sealed substrate W or product P.

[0059]

Further, as illustrated in FIG. 3, the cutting apparatus 100 is provided with a fixing mechanism 26 for configuring the holding plate M1 to be detachable from the holding base portion M2. Specifically, the fixing mechanism 26 includes a fixing insertion hole 261 formed in the holding plate M1 and a fixing cylinder portion 262 provided in the holding base portion M2 and inserted into the fixing insertion hole 261 formed in the holding plate M1.

[0060]

The fixing cylinder portion 262 is a so-called chuck cylinder, and as illustrated in FIG. 5, includes a cylinder body 262a inserted into the fixing insertion hole 261, a spherical mover 262b provided movably at a position protruding from an outer peripheral surface of the cylinder body 262a and a position retracted from the outer peripheral surface of the cylinder body 262a, and an elastic body 262c that applies a force so that the mover 262b is at a position protruding from the cylinder body 262a, and is configured to be switched between a position where the mover 262b protrudes (FIG. 5(a)) and a position where the movable element is retracted (FIG. 5(b)) by supplying compressed air.

[0061]

Further, the fixing cylinder portion 262 includes a piston portion 262d. The piston portion 262d is interposed between the mover 262b and the elastic body 262c inside the cylinder body 262a, and moves inside the cylinder body 262a by the compressed air to switch between the protruding position and the retracted position of the mover 262b. When the supply of the compressed air is started, the piston portion 262d moves inside the cylinder body 262a against the force received from the elastic body 262c, and moves the mover 262b to the retracted position (FIG. 5(b)). When the supply of the compressed air is stopped, the piston portion 262d moves inside the cylinder body 262a by the force received from the elastic body 262c, and moves the mover 262b to the protruding position (FIG. 5(a)).

[0062]

In addition, as illustrated in FIG. 5, the fixing insertion hole 261 formed in the holding plate M1 has a convex portion 261a that catches the mover 262b and prevents the fixing cylinder portion 262 from coming off when the mover 262b is at a protruding position in a state where the fixing cylinder portion 262 is inserted. The convex portion 261a catches the mover 262b at the protruding position, and does not catch the mover 262b at the retracted position. Therefore, when the mover 262b is located at the protruding position in a state where the fixing cylinder portion 262 is inserted into the fixing insertion hole 261, the holding plate M1 is fixed to the holding base portion M2 (see FIG. 5(a)). On the other hand, when the mover 262b is brought into the retracted position in a state where the fixing cylinder portion 262 is inserted into the fixing insertion hole 261, fixing of the holding plate M1 to the holding base portion M2 is released (see FIG. 5(b)).

[0063]

The plate housing portion 24 houses the holding plate M1 before and after

replacement (before and after use), and is provided on the back side of the transfer shaft 71 and on the back side of the transfer table 5 at the taking out position X2 in the present embodiment. In addition, the plate housing portion 24 is provided capable of elevating and moving by an elevating and moving mechanism 240 in order to facilitate the taking in and out of the holding plate M1 by a plate taking in and out mechanism 25d to be described later (see FIG. 1). As illustrated in FIG. 4, the plate housing portion 24 has a slide shelf portion 241 on which each holding plate M1 is placed. In the present embodiment, the slide shelf portions 241 of the upper plurality of stages house the new holding plate M1 before replacement, and the slide shelf portions 241 of the lower plurality of stages house the old holding plate M1 after replacement. In the plate housing portion 24, for example, when the target slide shelf portion 241 is slid forward by the plate conveying mechanism 25, the old holding plate M1 after use is placed on the slide shelf portion 241, or the new holding plate M1 before use is taken out. Note that a hook portion 241a is provided on a front side portion of the slide shelf portion 241, and the holding plate is pulled out using the hook portion 241a.

[0064]

<Plate conveying mechanism 25>

The plate conveying mechanism 25 conveys the holding plate M1 detached from the holding base portion M2 to the plate housing portion 24, and conveys the holding plate M1 in the plate housing portion 24 to the holding base portion M2.

[0065]

Specifically, as illustrated in FIGS. 1 and 4, the plate conveying mechanism 25 includes a first conveying mechanism 25a configured using the second holding mechanism 6 and the conveyance moving mechanism 7, a second conveying mechanism 25b configured using the reversing mechanism 16 and the reversing moving

mechanism 17, a third conveying mechanism 25c configured using the transfer table 5 and the transfer moving mechanism 15, and a plate taking in and out mechanism 25d that conveys the holding plate M1 between the plate housing portion 24 and the transfer table 5.

[0066]

The first conveying mechanism 25a is configured using the second holding mechanism 6 and the conveyance moving mechanism 7, and conveys the holding plate M1 between the holding base portion M2 of the cutting tables 2A and 2B or the support table 161 and the support table 161 of the reversing mechanism 16.

[0067]

As illustrated in FIG. 6, the second holding mechanism 6 to be the first conveying mechanism 25a includes a conveyance cylinder portion 282 to be inserted into a conveyance holding hole 281 (see FIG. 3) formed in the holding plate M1. In the present embodiment, the conveyance cylinder portion 282 is configured using the fixing cylinder portion 262 of the holding base portion M2 of the second holding mechanism 6. The conveyance holding hole 281 has the same configuration as the fixing insertion hole 261 of the fixing mechanism 26 described above. The conveyance holding hole 281 and the fixing insertion hole 261 are upside down. The second holding mechanism 6 may use a holding claw that is hooked to the edge portion of the holding plate M1 to hold the holding plate M1 instead of the conveyance cylinder portion 282. The second holding mechanism 6 is configured capable of elevating a portion holding the holding plate M1, and can convey the holding plate M1 in a state where the portion holding the holding plate M1 is raised to be in the raised position. Here, the “raised position” means a position at a height where the holding plate M1 is raised from the position of the holding plate M1 attached to the holding base portion M2

to be replaced or the lowest position of the holding plate M1 that can be taken during conveyance.

[0068]

The second conveying mechanism 25b is configured using the reversing mechanism 16 and the reversing moving mechanism 17, and conveys the holding plate M1 between the second holding mechanism 6 and the transfer table 5. When the holding plate M1 is conveyed by the second conveying mechanism 25b, the transfer table 5 is at the transfer position X1 where the product P is delivered.

[0069]

The third conveying mechanism 25c is configured using the transfer table 5 and the transfer moving mechanism 15, and moves the holding plate M1 to a position where the holding plate M1 is taken in and out by the plate taking in and out mechanism 25d to be described later. Specifically, the transfer moving mechanism 15 constituting the third conveying mechanism 25c moves the holding base portion M2 of the transfer table 5 between the transfer position X1 and a taking in and out position X3. Note that the taking in and out position X3 may be the same position as the taking out position X2 described above, or may be a different position.

[0070]

The plate taking in and out mechanism 25d conveys the holding plate M1 between the holding base portion M2 of the transfer table 5 at the taking in and out position X3 and the plate housing portion 24. The plate taking in and out mechanism 25d includes a plate holding mechanism 251 that holds the holding plate M1 and a taking in and out moving mechanism 252 that moves the plate holding mechanism 251. The plate holding mechanism 251 may have a conveyance cylinder portion to be inserted into a conveyance holding hole 281 (see FIG. 3) formed in the holding plate

M1, may have a holding claw that is hooked to the edge portion of the holding plate M1 to hold the holding plate M1, or may have a suction portion to suck and hold the holding plate M1.

[0071]

As illustrated in FIG. 4, the taking in and out moving mechanism 252 includes a Y-direction moving portion 252a that moves the plate holding mechanism 251 in the Y direction and a Z-direction moving portion 252b that moves the plate holding mechanism 251 in the Z direction. The taking in and out moving mechanism 252 may include an X-direction moving portion that moves the plate holding mechanism 251 in the X direction. Each of the moving portions 252a and 252b may use, for example, a rack and pinion mechanism, a ball screw mechanism, an air cylinder, or a linear motor.

[0072]

<Inspection mechanism 29 of Holding plate M1>

As illustrated in FIGS. 3 and 6, the cutting apparatus 100 of the present embodiment further includes an inspection mechanism 29 that inspects the attached state of the holding plate M1 to the holding base portion M2.

[0073]

The inspection mechanism 29 includes an inspection flow path 29a that opens to a mounting surface M22 on which the holding plate M1 is mounted, and a detection sensor (not illustrated) that is provided in the inspection flow path 29a and detects leakage of the fluid from the opening. The inspection flow path 29a has an opening formed in the mounting surface M22 of the holding base portion M2, and is supplied with compressed air. The detection sensor detects leakage of the compressed air from the opening by detecting a pressure or a flow rate of the compressed air flowing through the inspection flow path 29a. The inspection mechanism 29 determines whether or not

the holding plate M1 is fixed in close contact with the mounting surface M22 of the holding base portion M2. When the holding plate M1 is not in close contact with the mounting surface M22 of the holding base portion M2 by the inspection mechanism 29, the fixing can be released by the fixing mechanism 26, and the holding plate M1 can be attached again.

[0074]

<Replacement operation of holding plate M1>

Next, a replacement operation of the holding plate M1 by the plate conveying mechanism 25 of the present embodiment will be described with reference to FIGS. 7 and 8.

[0075]

In the following replacement operation, when the holding plate M1 is taken out from the plate housing portion 24, the holding plate M1 is determined by reading an identifier such as an RFID provided in the holding plate M1 by an identifier reader (not illustrated) provided in the plate conveying mechanism 25 (plate taking in and out mechanism 25d).

[0076]

(1) Replacement operation of holding plate M1 of transfer table 5 (see FIG. 7(a))

[0077]

The transfer table 5 at the transfer position X1 is moved to the taking in and out position X3 by the transfer moving mechanism 15. Then, the holding plate M1 of the transfer table 5 is removed. When the holding plate M1 of the transfer table 5 is removed, compressed air is supplied to the fixing cylinder portion 262 to bring the mover 262b into the retracted position, and fixing of the fixing mechanism 26 is

released.

[0078]

The plate taking in and out mechanism 25d receives the holding plate M1 of the transfer table 5 from the transfer table 5 at the taking in and out position X3, and places and houses the holding plate M1 on the slide shelf portion 241 of the plate housing portion 24.

[0079]

Next, the plate taking in and out mechanism 25d takes out a new holding plate M1 from the plate housing portion 24, conveys the new holding plate M1 to the holding base portion M2 of the transfer table 5, and lowers and places the holding plate M1. In this state, when the compressed air is supplied to the fixing cylinder portion 262 to bring the mover 262b into the retracted position, the holding plate M1 lowers and the fixing cylinder portion 262 enters the fixing insertion hole 261 of the holding plate M1. Thereafter, when the supply of the compressed air is stopped, the mover 262b comes into the protruding position, and the holding plate M1 is fixed to the holding base portion M2 of the transfer table 5.

[0080]

(2) Replacement operation of holding plate M1 of support table 161 (see FIG. 7 (b))

When the holding plate M1 of the support table 161 is replaced, the holding plate M1 of the transfer table 5 is removed in advance.

[0081]

The support table 161 is moved to the transfer table 5 at the transfer position X1 by the reversing moving mechanism 17. Then, the holding plate M1 of the support table 161 is removed, and the holding plate M1 is delivered to the transfer table 5.

When the holding plate M1 of the support table 161 is removed, compressed air is supplied to the fixing cylinder portion 262 to bring the mover 262b into the retracted position, and fixing of the fixing mechanism 26 is released.

[0082]

Next, the transfer table 5 to which the holding plate M1 of the support table 161 has been delivered is moved from the transfer position X1 to the taking in and out position X3 by the transfer moving mechanism 15. Then, the plate taking in and out mechanism 25d receives the holding plate M1 of the support table 161 from the transfer table 5 at the taking in and out position X3, and places and houses the holding plate M1 on the slide shelf portion 241 of the plate housing portion 24.

[0083]

Next, the plate taking in and out mechanism 25d takes out a new holding plate M1 from the plate housing portion 24, conveys the new holding plate M1 to the transfer table 5, and lowers and places the holding plate M1. The transfer table 5 on which the holding plate M1 is placed is moved from the taking in and out position X3 to the transfer position X1 by the transfer moving mechanism 15.

[0084]

Then, the holding base portion M2 of the support table 161 is moved to the transfer table 5 at the transfer position X1 by the reversing moving mechanism 17. Then, the holding base portion M2 of the support table 161 receives the holding plate M1 from the transfer table 5. Here, when the compressed air is supplied to the fixing cylinder portion 262 to bring the mover 262b into the retracted position, the fixing cylinder portion 262 enters the fixing insertion hole 261 of the holding plate M1, and thereafter, when the supply of the compressed air is stopped, the mover 262b comes into the protruding position, and the holding plate M1 is fixed to the holding base portion

M2 of the support table 161.

[0085]

(3) Replacement operation of holding plate M1 of second holding mechanism 6 (see FIG. 8(a))

When the holding plate M1 of the second holding mechanism 6 is replaced, the holding plate M1 of the transfer table 5 and the holding plate M1 of the support table 161 are removed in advance.

[0086]

The second holding mechanism 6 is moved to the support table 161 by the conveyance moving mechanism 7, the holding plate M1 is lowered and removed, and the holding plate M1 is placed on the support table 161. When the holding plate M1 of the second holding mechanism 6 is removed, compressed air is supplied to the fixing cylinder portion 262 to bring the mover 262b into the retracted position, and fixing of the fixing mechanism 26 is released.

[0087]

The support table 161 on which the holding plate M1 of the second holding mechanism 6 is placed is moved to the transfer table 5 at the transfer position X1 by the reversing moving mechanism 17, and the holding plate is delivered to the transfer table 5.

[0088]

Next, the transfer table 5 to which the holding plate M1 of the second holding mechanism 6 is delivered is moved from the transfer position X1 to the taking in and out position X3 by the transfer moving mechanism 15. Then, the plate taking in and out mechanism 25d receives the holding plate M1 of the second holding mechanism 6 from the transfer table 5 at the taking in and out position X3, and places and houses the

holding plate M1 on the slide shelf portion 241 of the plate housing portion 24.

[0089]

Next, the plate taking in and out mechanism 25d takes out a new holding plate M1 from the plate housing portion 24, conveys the new holding plate M1 to the transfer table 5, and lowers and places the holding plate M1. The transfer table 5 on which the holding plate M1 is placed is moved from the taking in and out position X3 to the transfer position X1 by the transfer moving mechanism 15.

[0090]

Then, the holding base portion M2 of the support table 161 is moved to the transfer table 5 at the transfer position X1 by the reversing moving mechanism 17. Then, the support table 161 receives the new holding plate M1 from the transfer table 5 and moves to a position to deliver the new holding plate M1 to the second holding mechanism 6.

[0091]

Thereafter, the second holding mechanism 6 is moved to the support table 161 by the conveyance moving mechanism 7, the holding base portion M2 is lowered, and the new holding plate M1 placed on the support table 161 is attached. Here, the fixing cylinder portion 262 provided in the holding base portion M2 of the second holding mechanism 6 is inserted into the fixing insertion hole 261 formed in the holding plate M1 by the conveyance moving mechanism 7. In this state, when the compressed air is supplied to the fixing cylinder portion 262 to bring the mover 262b into the retracted position, the fixing cylinder portion 262 enters the fixing insertion hole 261 of the holding plate M1, and thereafter, when the supply of the compressed air is stopped, the mover 262b comes into the protruding position, and the holding plate M1 is fixed to the holding base portion M2 of the second holding mechanism 6.

[0092]

The replacement operation of the holding plate M1 of the second holding mechanism 6 can also be performed by directly moving the second holding mechanism 6 to the transfer table 5 by the conveyance moving mechanism 7 without using the support table 161.

[0093]

(4) Replacement operation of holding plates M1 of cutting tables 2A, 2B (see FIG. 8(b))

When the holding plate M1 of the cutting tables 2A and 2B is replaced, the holding plate M1 of the transfer table 5, the holding plate M1 of the support table 161, and the holding plate M1 of the second holding mechanism 6 are removed in advance.

[0094]

The holding plate M1 of the cutting tables 2A and 2B is removed, the holding plate M1 is conveyed to the support table 161 in a state of being raised to the raised position by the first conveying mechanism 25a (the conveyance moving mechanism 7 and the second holding mechanism 6), and the holding plate M1 is lowered and placed. When the holding plate M1 of the cutting tables 2A and 2B is removed, compressed air is supplied to the fixing cylinder portion 262 to bring the mover 262b into a retracted position, and fixing of the fixing mechanism 26 is released.

[0095]

The support table 161 on which the holding plate M1 of the cutting tables 2A and 2B is placed is moved to the transfer table 5 at the transfer position X1 by the reversing moving mechanism 17, and the holding plate M1 is delivered to the transfer table 5.

[0096]

Next, the transfer table 5 to which the holding plate M1 of the cutting tables 2A and 2B has been delivered is moved from the transfer position X1 to the taking in and out position X3 by the transfer moving mechanism 15. Then, the plate taking in and out mechanism 25d receives the holding plate M1 of the cutting tables 2A and 2B from the transfer table 5 at the taking in and out position X3, and places and houses the holding plate M1 on the slide shelf portion 241 of the plate housing portion 24.

[0097]

Next, the plate taking in and out mechanism 25d takes out a new holding plate M1 from the plate housing portion 24, conveys the new holding plate M1 to the transfer table 5, and lowers and places the holding plate M1. The transfer table 5 on which the holding plate M1 is placed is moved from the taking in and out position X3 to the transfer position X1 by the transfer moving mechanism 15.

[0098]

Then, the holding base portion M2 of the support table 161 is moved to the transfer table 5 at the transfer position X1 by the reversing moving mechanism 17. Then, the support table 161 receives the new holding plate M1 from the transfer table 5 and moves to a position to deliver the new holding plate M1 to the second holding mechanism 6.

[0099]

Thereafter, the second conveying mechanism 25b (the conveyance moving mechanism 7 and the second holding mechanism 6) conveys the holding plate M1 in a state where the holding plate M1 is at the raised position on the holding base portion M2 of the cutting tables 2A and 2B, and lowers and places the holding plate M1. In this state, when the compressed air is supplied to the fixing cylinder portion 262 to bring the mover 262b into the retracted position, the fixing cylinder portion 262 enters

the fixing insertion hole 261 of the holding plate M1, and thereafter, when the supply of the compressed air is stopped, the mover 262b comes into the protruding position, and the holding plate M1 is fixed to the holding base portion M2 of the cutting tables 2A and 2B.

[0100]

The replacement operation of the holding plate M1 of the cutting tables 2A and 2B can also be performed by directly moving the second holding mechanism 6 to the transfer table 5 by the conveyance moving mechanism 7 without using the support table 161.

[0101]

Furthermore, replacement of the transfer table 5, the support table 161, the cutting tables 2A and 2B, and the holding plate M1 of the second holding mechanism 6 may be performed also as a series of operations. For example, it is conceivable that the transfer table 5, the support table 161, the second holding mechanism 6, and the holding plate M1 of the cutting tables 2A and 2B are removed in this order, and then the cutting tables 2A and 2B, the second holding mechanism 6, the support table 161, and the holding plate M1 of the transfer table 5 are attached in this order.

[0102]

<Effects of present embodiment>

According to the cutting apparatus 100 of the present embodiment, since the plate conveying mechanism 25 that conveys the holding plate M1 detached from the holding base portion M2 to the plate housing portion 24 and conveys the holding plate M1 in the plate housing portion 24 to the holding base portion M2 is provided, the holding plate M1 can be automatically replaced with respect to the holding base portion M2. As a result, labor costs for replacing the holding plate M1 can be reduced. In

addition, since the holding plate M1 is automatically replaced, the replacement time of the holding plate M1 can be shortened, and the productivity of the cutting apparatus 100 can be improved. Further, it is possible to reduce variations in the attachment state of the holding plate M1 to the holding base portion M2.

[0103]

<Modified embodiment of present Invention>

For example, in the first embodiment, the holding plate M1 for each of the cutting tables 2A and 2B, the inspection table (support table 161), the transfer table 5, and the conveyance holding mechanism (second holding mechanism 6) is automatically replaced, but at least one of the cutting tables 2A and 2B, the inspection table (support table 161), the transfer table 5, and the conveyance holding mechanism (second holding mechanism 6) may be automatically replaced.

[0104]

The plate conveying mechanism 25 of the above embodiment may be configured not to use the second holding mechanism 6 and the conveyance moving mechanism 7, may be configured not to use the transfer table 5 and the transfer moving mechanism 15, or may be configured not to use the reversing mechanism 16 and the reversing moving mechanism 17.

[0105]

For example, in the case of a configuration not using the transfer table 5 and the transfer moving mechanism 15 or a configuration not using the reversing mechanism 16 and the reversing moving mechanism 17, by arranging the plate housing portion 24 at a position accessible by the second holding mechanism 6 (for example, between the reversing mechanism 16 and the transfer table 5), the plate conveying mechanism 25 can be configured by the second holding mechanism 6 and the

conveyance moving mechanism 7 without using the transfer table 5 and the transfer moving mechanism 15 or the reversing mechanism 16 and the reversing moving mechanism 17.

[0106]

As illustrated in FIG. 9, the tray housing portion 23 may be disposed on the front side of the transfer shaft 71, and the transfer shaft 71 may be extended to a position where the second holding mechanism 6 can move to the tray housing portion 23. With this configuration, the plate conveying mechanism 25 can be configured using the second holding mechanism 6 and the conveyance moving mechanism 7. In this configuration, by providing the guide rail 22b of the tray moving mechanism 22 below the plate housing portion 24, the plate housing portion 24 and the tray moving mechanism 22 do not interfere with each other.

[0107]

The plate housing portion 24 of the first embodiment houses the holding plate M1 for each of the cutting tables 2A and 2B, the inspection table (the support table 161), the transfer table 5, and the conveyance holding mechanism (the second holding mechanism 6). However, a plurality of dedicated plate housing portions 24 may be provided according to the type of the holding plate M1.

[0108]

The plate housing portion 24 and the plate taking in and out mechanism 25d of the above embodiment may be unitized. By unitizing the plate housing portion 24 and the plate taking in and out mechanism 25d in this manner, it is possible to externally attach the plate housing portion and the plate taking in and out mechanism to an existing cutting apparatus.

[0109]

Although the above embodiment is the cutting apparatus that performs tray housing, the present invention is not limited to the tray housing, and the following housing may be performed.

[0110]

For example, as illustrated in FIG. 10, the cutting apparatus 100 may be configured to attach a plurality of products P to an attaching member 101 having an adhesive surface 101x and house (also called “ring housing”) the products P. The automatic replacement function of the holding plate M1 in the cutting apparatus 100 that performs ring housing is the same as that in the above embodiment.

[0111]

Specifically, as illustrated in FIG. 11, the attaching member includes, for example, a frame member 101a having an annular or rectangular shape, and a resin sheet 101b having an adhesive surface 101x disposed inside the frame member 101a. The frame member 101a is made of metal such as stainless steel, for example. Further, the resin sheet 101b includes, for example, a sheet-shaped substrate 101b1 made of a resin and an adhesive layer (adhesive layer) 101b2 made of an adhesive applied to the upper surface of the sheet-shaped substrate 101b1. An upper surface of the adhesive layer (adhesive layer) 101b2 becomes an adhesive surface 101x.

[0112]

In this case, the plurality of products P is temporarily placed on the transfer table 5 before the plurality of products P is attached to the attaching member 101. Then, the transfer table 5 is moved by the transfer moving mechanism 15 between a transfer position X1 where the plurality of products P is placed by the second holding mechanism 6 and a taking out position X2 where the plurality of products P is conveyed by an attaching conveying mechanism 102.

[0113]

The plurality of products P placed on the transfer table 5 are stuck to the attaching member 101 by the attaching conveying mechanism 102 according to the inspection result (non-defective, defective, etc.) by the inspection unit 14. The attaching member 101 is placed on a placement table 103. As illustrated in FIG. 10, the placement table 103 is provided to be movable along the Y direction. Then, the placement table 103 is moved by a placing moving mechanism 104 between an attaching member conveying position X4 where the attaching member 101 is conveyed by an attaching member conveying mechanism 105 and an attaching position X5 where the plurality of products P is conveyed by the attaching conveying mechanism 102. The placing moving mechanism 104 includes a guide rail 104a that guides the placement table 103 along the Y direction, and a driving unit (not illustrated) that moves the placement table 103 on the guide rail 104a. Further, the attaching member conveying mechanism 105 conveys the attaching member 101 between the placement table 103 at the attaching member conveying position X4 and an attaching member housing portion 106 that houses the attaching member 101. The attaching member conveying mechanism 105 sucks and holds the frame member 101a of the attaching member 101.

[0114]

As illustrated in FIG. 12, the cutting apparatus 100 is configured to be able to house (also called “tube housing”) a plurality of products P in a cylindrical container 107. The cylindrical container 107 may be referred to as a tube, a magazine stick, a stick magazine, a stick, or the like. The automatic replacement function of the holding plate M1 in the cutting apparatus 100 that performs tube housing is the same as that in the above embodiment.

[0115]

Specifically, as illustrated in FIG. 13, the cylindrical container 107 houses a plurality of products P in a state of being aligned in a row. Specifically, the cylindrical container 107 has a linearly extending shape and has a space for housing the products P therein. The cross-sectional shape orthogonal to the longitudinal direction of the cylindrical container 107 corresponds to the cross-sectional shape of the product P. The product P is inserted from a one end opening 107x of the cylindrical container 107 by a conveying and housing mechanism 108. Although the cylindrical container 107 illustrated in FIG. 13 has a configuration in which a part of side peripheral wall extending along the longitudinal direction is empty, the side peripheral wall may be closed. In addition to the configuration in which the plurality of products P is housed in a state of being aligned in one row, the cylindrical container 107 may be configured to house the plurality of products P in a state of being aligned in a plurality of rows. Furthermore, the cylindrical container 107 may be made of resin or metal. In addition, although FIG. 13 illustrates a form in which there is a lead as the product P, a non-lead type such as a QFN may be used.

[0116]

In this case, the plurality of products P is temporarily placed on the transfer table 5 before the plurality of products P is housed in the cylindrical container 107. The transfer table 5 is moved by the transfer moving mechanism 15 between the transfer position X1 where the plurality of products P is placed by the second holding mechanism 6 and the taking-out position X2 where the plurality of products P is conveyed by the conveying and housing mechanism 108.

[0117]

The plurality of products P placed on the transfer table 5 are housed in the

cylindrical container 107 by the conveying and housing mechanism 108 according to the inspection result (non-defective, defective, etc.) by the inspection unit 14. The cylindrical container 107 is placed on a container installing portion 109. Note that the container installing portion 109 in FIG. 12 includes a portion for housing the empty cylindrical container 107, a portion for arranging the empty cylindrical container 107 into which the product P is inserted from the one end opening 107x, and a portion for housing the housed cylindrical container 107 that is full of the products P or houses a desired number of the products P. The conveying and housing mechanism 108 conveys a plurality of products P from the transfer table 5 at the taking-out position X2 to an intermediate table 108a, and conveys and houses the products P from the intermediate table 108a to the cylindrical container 107.

[0118]

As illustrated in FIG. 14, the cutting apparatus 100 may house (also called "bulk housing") the plurality of products P in the housing box in a state of being separated.

[0119]

Unlike the above embodiment, the cutting apparatus 100 includes a drying table 110 and a housing box 111 instead of the transfer table 5, the sorting mechanism 20, the inspection unit 14, and the like, and the transfer shaft 71 is provided in a range in which the second holding mechanism 6 can move above the housing box 111. Then, the second holding mechanism 6 causes the conveyance moving mechanism 7 to convey the plurality of products P from the cutting tables 2A and 2B to the drying table 110, and from the drying table 110 to the housing box 111. The drying table 110 is for further drying the plurality of products P cleaned by the second cleaning mechanism 18. In the drying table 110, a plurality of products P are conveyed and placed by the second

holding mechanism 6 and the conveyance moving mechanism 7. The drying table 110 sucks and holds a plurality of products P. The drying table 110 includes a drying mechanism (not illustrated) that dries the plurality of products P placed on the drying table 110. The drying mechanism sprays compressed air as gas from above the drying table 110 to dry the plurality of products P sucked and held on the drying table 110.

[0120]

The housing box 111 houses the plurality of products P in a state of being separated, and includes a scraping member 112 made of, for example, resin that scrapes the plurality of products P from the second holding mechanism 6. Then, by moving the second holding mechanism 6 in the X direction with respect to the scraping member 112, the product P is scraped and dropped to be housed in the housing box 111. It is also possible to adopt a configuration in which the plurality of products P is dropped by spraying gas from the second holding mechanism 6 after releasing the sucking and holding by the second holding mechanism 6 without providing the scraping member 112. In addition to the configuration in which the scraping member 112 is fixed to the housing box 111, the scraping member 112 may be fixed to another member, or the scraping member 112 may be configured to be movable and move with respect to the second holding mechanism 6 to scrape the plurality of products P.

[0121]

Then, the plate conveying mechanism 25 in the cutting apparatus 100 for bulk housing is configured using the second holding mechanism 6 and the conveyance moving mechanism 7, which is different from each of the above embodiments. Here, as in the first embodiment, the second holding mechanism 6 constituting the plate conveying mechanism 25 has a conveyance cylinder portion 282 to be inserted into a conveyance holding hole 281 (see FIG. 3) formed in the holding plate M1 (see FIG. 6).

[0122]

As illustrated in FIG. 15, the plate conveying mechanism 25 (the second holding mechanism 6 and the conveyance moving mechanism 7) performs a replacement operation of the holding plate M1 of the second holding mechanism 6, the holding plate M1 of the drying table 110, and the holding plates M1 of the cutting tables 2A and 2B.

[0123]

Here, when the replacement operation of the holding plates M1 of the cutting tables 2A and 2B and the replacement operation of the holding plate M1 of the drying table 110 are performed, the holding plate M1 of the second holding mechanism 6 constituting the plate conveying mechanism 25 is removed in advance. Either the replacement operation of the holding plate M1 of the cutting tables 2A and 2B or the replacement operation of the holding plate M1 of the drying table 110 may be performed first. Alternatively, the holding plate M1 may be removed from the holding base portion M2 of the cutting tables 2A and 2B and the drying table 110, and then a new holding plate M1 may be attached to the holding base portion M2 of the cutting tables 2A and 2B and the drying table 110.

[0124]

Furthermore, replacement of the holding plate M1 of the second holding mechanism 6, the cutting tables 2A and 2B, and the drying table 110 may be performed in a series of operations, or replacement of the holding plate M1 in at least one of the second holding mechanism 6, the cutting tables 2A and 2B, or the drying table 110 may be performed individually. At this time, when the holding plate M1 of the cutting tables 2A and 2B or the drying table 110 is replaced, the holding plate M1 of the second holding mechanism 6 constituting the plate conveying mechanism 25 is removed in

advance.

[0125]

In each of the above embodiments, the cutting apparatus of the twin-cut table system having the twin-spindle configuration has been described, but the present invention is not limited thereto, and the cutting apparatus of the single-cut table system having the single-spindle configuration, the cutting apparatus of the single-cut table system having the twin-spindle configuration, or the like may be used.

[0126]

In addition, the cutting apparatus (machining apparatus) 100 can have a module configuration that can be separated and coupled (detachable) between the second cleaning mechanism 18 and the inspection unit 14 or the drying table 110. In this case, for example, a module that performs an inspection of a type different from the inspection in the inspection unit 14 can be added between the module on the second cleaning mechanism 18 side and the module on the inspection unit 14 side or the module on the drying table 110 side. In addition to the configuration exemplified here, the cutting apparatus (machining apparatus) 100 may have a module configuration that can be separated and coupled (detachable) anywhere, and an added module may be a module of various functions other than inspection.

[0127]

In addition, the machining apparatus of the present invention may perform machining other than cutting, and for example, may perform other machining such as cutting and grinding.

[0128]

In addition, the present invention is not limited to the above embodiment, and it goes without saying that various modifications can be made within a range not

deviating from the spirit of the invention.

Industrial Applicability

[0129]

According to the present invention, the holding plate for holding an object to be machined can be automatically replaced.

Reference Signs List

[0130]

100	cutting apparatus (machining apparatus)
W	sealed substrate (object to be machined)
P	product (machined article)
2A, 2B	cutting table (machining table)
4	cutting mechanism (machining mechanism)
5	transfer table (plate conveying mechanism)
6	second holding mechanism (conveyance holding mechanism and plate conveying mechanism)
7	conveyance moving mechanism (plate conveying mechanism)
15	transfer moving mechanism (plate conveying mechanism)
161	support table (inspection table)
M2	holding base portion
M1	holding plate
21	tray
22	tray moving mechanism
24	plate housing portion
25	plate conveying mechanism
25d	plate taking in and out mechanism

261	fixing insertion hole
262	fixing cylinder portion
262a	cylinder body
262b	mover
262c	elastic body
281	conveyance holding hole
282	conveyance cylinder portion
29	inspection mechanism
29a	inspection flow path
101	attaching member
101x..	adhesive surface
103	placement table
107	cylindrical container
107x	one end opening
109	container installing portion
111	housing box

CLAIMS

1. A machining apparatus that holds an object to be machined on a machining table and machines the object to be machined by a machining mechanism while moving the machining table, the machining apparatus comprising:

a plate housing portion that houses a holding plate for holding the object to be machined;

a holding base portion to which the holding plate is detachably attached, the holding base portion holding the object to be machined using the holding plate; and

a plate conveying mechanism that conveys the holding plate between the plate housing portion and the holding base portion, wherein

the plate conveying mechanism conveys the holding plate detached from the holding base portion to the plate housing portion, and conveys the holding plate in the plate housing portion to the holding base portion.

2. The machining apparatus according to claim 1, wherein the plate conveying mechanism raises and conveys the holding plate.

3. The machining apparatus according to claim 1 or 2, wherein the plate conveying mechanism conveys at least one of:

a holding plate of the machining table;

a holding plate of a drying table for drying the object to be machined after the machining;

a holding plate of an inspection table for inspecting the object to be machined after the machining;

a holding plate of a transfer table on which the object to be machined after the machining is placed before being housed; or

a holding plate of a conveyance holding mechanism that holds the object to be

machined after the machining for conveying the object to be machined.

4. The machining apparatus according to any one of claims 1 to 3, wherein the plate conveying mechanism is capable of conveying the object to be machined after the machining.

5. The machining apparatus according to any one of claims 1 to 4, further comprising:

a first holding mechanism that holds the object to be machined for conveying the object to be machined to the machining table;

a second holding mechanism that holds the object to be machined after the machining for conveying the object to be machined after the machining from the machining table; and

a conveyance moving mechanism that moves the first holding mechanism and the second holding mechanism, wherein

the plate conveying mechanism includes the second holding mechanism and the conveyance moving mechanism.

6. The machining apparatus according to any one of claims 1 to 5, further comprising:

a transfer table on which the object to be machined after the machining is placed before being housed; and

a transfer moving mechanism that moves the transfer table, wherein

the plate conveying mechanism includes the transfer table and the transfer moving mechanism.

7. The machining apparatus according to claim 6, wherein the plate conveying mechanism further includes a plate taking in and out mechanism that conveys the holding plate between the plate housing portion and the transfer table.

8. The machining apparatus according to any one of claims 1 to 7, further comprising a tray conveying mechanism that conveys a tray into which the object to be machined singulated by the machining mechanism is sorted, wherein

the singulated object to be machined is housed in the tray.

9. The machining apparatus according to any one of claims 1 to 7, further comprising a placement table on which an attaching member is placed, the attaching member having an adhesive surface to which the object to be machined singulated by the machining mechanism is attached, wherein

the singulated object to be machined is attached to the attaching member and housed.

10. The machining apparatus according to any one of claims 1 to 7, further comprising a container installing portion, in which a cylindrical container that houses the object to be machined singulated by the machining mechanism from one end opening, is installed, wherein

the singulated object to be machined is housed in the cylindrical container.

11. The machining apparatus according to any one of claims 1 to 7, further comprising a housing box in which the object to be machined singulated by the machining mechanism is dropped and housed, wherein

the singulated object to be machined is housed in the housing box.

12. The machining apparatus according to any one of claims 1 to 11, further comprising an inspection mechanism that inspects an attachment state of the holding plate to the holding base portion.

13. The machining apparatus according to claim 12, wherein

the inspection mechanism includes:

an inspection flow path that opens to a mounting surface on which the holding

plate is mounted; and

a detection sensor provided in the inspection flow path and configured to detect leakage of fluid from the opening.

14. The machining apparatus according to any one of claims 1 to 13, wherein

the holding base portion includes a fixing cylinder portion to be inserted into a fixing insertion hole formed in the holding plate,

the fixing cylinder portion includes a cylinder body to be inserted into the fixing insertion hole, a mover provided movably at a position protruding from an outer peripheral surface of the cylinder body and a position retracting from the outer peripheral surface of the cylinder body, and an elastic body that applies a force so that the mover is at a position protruding from the cylinder body, and

the holding plate is fixed to the holding base portion by bringing the mover into a protruding state in a state where the fixing cylinder portion is inserted into the fixing insertion hole.

15. The machining apparatus according to any one of claims 1 to 14, wherein

the plate conveying mechanism includes a conveyance cylinder portion to be inserted into a conveyance holding hole formed in the holding plate,

the conveyance cylinder portion includes a cylinder body inserted into the conveyance holding hole, a mover provided movably at a position protruding from an outer peripheral surface of the cylinder body and a position retracting from the outer peripheral surface of the cylinder body, and an elastic body that applies a force so that the mover is at a position protruding from the cylinder body, and

the holding plate is held by the plate conveying mechanism when the mover protrudes in a state where the conveyance cylinder portion is inserted into the conveyance insertion hole.

16. A machined article manufacturing method for manufacturing a machined article by using the machining apparatus according to any one of claims 1 to 15.