

PROCESSING APPARATUS

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a processing apparatus, and particularly to a processing apparatus that centers a workpiece.

Description of the Related Art

A conveying mechanism is known which extracts one workpiece from a cassette housing a plurality of workpieces, positions the workpiece at a predetermined position while temporarily placing the workpiece on guide rails, and thereafter makes a chuck table hold the workpiece.

In particular, a processing apparatus (cutting apparatus) that conveys a workpiece to a chuck table by rotating the bottom portions of guide rails and thereby opening and closing the bottom portions of the guide rails, and raising and lowering the guide rails has been developed as a mechanism that makes it possible to achieve a cost reduction by reducing a unit raising and lowering the workpiece (see Japanese Patent Laid-Open No. 2016-207808, for example). However, in the processing apparatus illustrated in Japanese Patent Laid-Open No.

2016-207808, the workpiece temporarily placed on the pair of guide rails is positionally displaced by a few millimeters in an X-axis direction (interval direction of the guide rails).

Accordingly, a processing apparatus has been proposed which positions the workpiece at a predetermined position in the X-axis direction by enlarging or reducing an interval between the guide rails (see Japanese Patent Laid-Open No. Hei 11-204461, for example).

SUMMARY OF THE INVENTION

The processing apparatus illustrated in Japanese Patent Laid-Open No. Hei 11-204461 described above needs a unit that controls the interval between the guide rails. The number of parts is consequently increased. There is thus a desire to achieve a reduction in cost and a reduction in weight.

It is accordingly an object of the present invention to provide a processing apparatus that can achieve a reduction in cost and a reduction in weight.

In accordance with an aspect of the present invention, there is provided a processing apparatus including: a cassette mounting unit on which a cassette housing a plurality of workpieces is mounted; carrying

in/out means for carrying out a workpiece from the cassette mounted on the cassette mounting unit and carrying the workpiece into the cassette; a temporary placement unit in which the workpiece carried out by the carrying in/out means is temporarily placed; a chuck table configured to hold the workpiece transferred from the temporary placement unit; a processing unit configured to process the workpiece held by the chuck table; and a processing feed unit configured to processing-feed the chuck table in an X-axis direction, in which the cassette mounting unit and the temporary placement unit are disposed so as to be substantially aligned with each other in a Y-axis direction orthogonal to the X-axis direction, the carrying in/out means includes a holding unit configured to hold the workpiece housed in the cassette and a moving unit configured to move the holding unit in the Y-axis direction, the temporary placement unit includes a pair of guide rails having a bottom portion and a side wall portion extending in the Y-axis direction and supporting the workpiece, the bottom portion opening and closing in a double-door manner, a raising and lowering unit configured to raise and lower the guide rails, and an abutting unit configured to position the workpiece at a predetermined

position in the X-axis direction by pressing the workpiece from an outside to a center so as to be interlocked with rotation of the bottom portions of the guide rails, and the guide rails are lowered toward the chuck table positioned directly below the workpiece supported by the guide rails, and the workpiece is mounted onto the chuck table by opening the bottom portions of the guide rails while the workpiece is positioned at the predetermined position in the X-axis direction.

Preferably, the workpiece is a frame unit having the workpiece fixed in an opening of an annular frame by a tape, and with a diameter smaller than an interval between the pair of guide rails, the chuck table fixes the frame unit.

Preferably, the abutting unit includes an abutting block set so as to be movable from a periphery of the workpiece supported by the guide rails toward a center of the workpiece, a biasing unit configured to position the abutting block at a retracted position at which the abutting block is retracted to an outside of the workpiece in the X-axis direction, and an action unit fixed to the bottom portions of the guide rails, the action unit retracting from the abutting block when the

bottom portions are closed, and pressing the abutting block toward the workpiece with a force exceeding a biasing force of the biasing unit when the bottom portions are opened.

Preferably, the temporary placement unit further includes a movement assistance unit configured to assist movement of the workpiece by the abutting unit by jetting a gas from the bottom portions of the guide rails.

The present invention produces an effect of being able to achieve a reduction in cost and a reduction in weight of the processing apparatus.

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 illustrating an example of a configuration of a processing apparatus according to an embodiment;

FIG. 2 is a perspective view illustrating principal

parts of a temporary placement unit of the processing apparatus illustrated in FIG. 1;

FIG. 3 is another perspective view illustrating principal parts of the temporary placement unit of the processing apparatus illustrated in FIG. 1;

FIG. 4 is a front view of the temporary placement unit of the processing apparatus illustrated in FIG. 1 as viewed from a cassette side;

FIG. 5 is a sectional view taken along a line V-V in FIG. 2;

FIG. 6 is a front view as viewed from the cassette side, the front view schematically illustrating a state in which guide rails of the temporary placement unit of the processing apparatus illustrated in FIG. 1 support a workpiece carried out from a cassette by a carrying-in/out unit;

FIG. 7 is a perspective view illustrating principal parts of the temporary placement unit illustrated in FIG. 6;

FIG. 8 is another perspective view illustrating principal parts of the temporary placement unit illustrated in FIG. 6;

FIG. 9 is a front view of the temporary placement unit illustrated in FIG. 6 as viewed from the cassette

side;

FIG. 10 is a front view as viewed from the cassette side, the front view schematically illustrating a state in which the workpiece supported by the guide rails illustrated in FIG. 6 is mounted on the holding surface of the chuck table;

FIG. 11 is a perspective view illustrating principal parts, in which perspective view the bottom portion of the temporary placement unit illustrated in FIG. 7 is rotated toward an opened state;

FIG. 12 is another perspective view illustrating principal parts of the temporary placement unit illustrated in FIG. 11;

FIG. 13 is a front view of the temporary placement unit illustrated in FIG. 11 as viewed from the cassette side;

FIG. 14 is a perspective view illustrating principal parts, in which perspective view the bottom portion of the temporary placement unit illustrated in FIG. 7 is positioned in the opened state;

FIG. 15 is another perspective view illustrating principal parts of the temporary placement unit illustrated in FIG. 14;

FIG. 16 is a front view of the temporary placement

unit illustrated in FIG. 14 as viewed from the cassette side;

FIG. 17 is a sectional view taken along a line XVII-XVII in FIG. 14;

FIG. 18 is a front view as viewed from the cassette side, the front view schematically illustrating a state in which the bottom portion of the guide rail illustrated in FIG. 7 is positioned in the opened state; and

FIG. 19 is a front view as viewed from the cassette side, the front view schematically illustrating a state in which the guide rails illustrated in FIG. 18 are raised.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of the present invention will hereinafter be described in detail with reference to the drawings. The present invention is not limited by contents described in the following embodiment. In addition, constituent elements to be described in the following include constituent elements readily conceivable by those skilled in the art and essentially identical constituent elements. Further, configurations to be described in the following can be combined with each other as appropriate. In addition, various omissions,

replacements, or modifications of configurations can be performed without departing from the spirit of the present invention.

[Embodiment]

A processing apparatus according to an embodiment of the present invention will be described with reference to the drawings. FIG. 1 is a perspective view illustrating an example of a configuration of the processing apparatus according to the embodiment. FIG. 2 is a perspective view illustrating principal parts of a temporary placement unit of the processing apparatus illustrated in FIG. 1. FIG. 3 is another perspective view illustrating principal parts of the temporary placement unit of the processing apparatus illustrated in FIG. 1. FIG. 4 is a front view of the temporary placement unit of the processing apparatus illustrated in FIG. 1 as viewed from a cassette side. FIG. 5 is a sectional view taken along a line V-V in FIG. 2.

A processing apparatus 1 illustrated in FIG. 1 according to an embodiment is a cutting apparatus that cuts (equivalent to processing) a work 210 of a workpiece 200. In the embodiment, the work 210 is a wafer such as a disk-shaped semiconductor wafer having silicon, sapphire, gallium, or the like as a base material, an optical

device wafer. The work 210 has devices 203 formed in regions demarcated in a lattice manner by a plurality of planned dividing lines 202 formed on a top surface 201 in a lattice manner.

In addition, the work 210 of the present invention may be what is called a TAIKO (registered trademark) wafer having a thinned central portion and having a thick portion formed as an outer circumferential portion of the wafer, or may be not only a wafer but also a rectangular package substrate having a plurality of devices sealed by a resin, a ceramic substrate, a ferrite substrate, a substrate including at least one of nickel and iron, or the like. In the embodiment, the workpiece 200 is a frame unit in which an undersurface 204 of the work 210 is affixed to a tape 205 having an annular frame 206 fitted to an outer peripheral edge of the tape 205 and the work 210 is fixed in an opening 207 of the annular frame 206 by the tape 205.

The processing apparatus 1 illustrated in FIG. 1 is an apparatus that holds the work 210 of the workpiece 200 by a chuck table 30, and cuts the work 210 by a cutting blade 41 along the planned dividing lines 202. As illustrated in FIG. 1, the processing apparatus 1 includes a cassette elevator 8 as a cassette mounting

unit on which a cassette 7 is mounted, a carrying-in/out unit 10 as unloading means, a temporary placement unit 20, a chuck table 30, a cutting unit 40 as a processing unit, a camera unit 50, a cleaning unit 60, a conveying unit not illustrated in the figure, and a control unit 100.

In addition, as illustrated in FIG. 1, the processing apparatus 1 includes: an X-axis moving unit 70 as a processing feed unit that moves the chuck table 30 and the cutting unit 40 relative to each other in an X-axis direction parallel with a holding surface 31 of the chuck table 30; a Y-axis moving unit 80 as an indexing feed unit that moves the chuck table 30 and the cutting unit 40 relative to each other in a Y-axis direction parallel with the holding surface 31 and orthogonal to the X-axis direction; and a Z-axis moving unit 90 as a cutting feed unit that moves the chuck table 30 and the cutting unit 40 relative to each other in a Z-axis direction orthogonal to the holding surface 31 and parallel with a vertical direction. As illustrated in FIG. 1, the processing apparatus 1 is what is called a facing dual type cutting apparatus having two cutting units 40, that is, a twin spindle dicer.

A cassette 7 is a housing container formed in a box shape, and housing a plurality of workpieces 200 at

intervals in the Z-axis direction. The cassette 7 has an opening 7-1 through which the workpieces 200 are taken in and out. The opening 7-1 is opposed to the temporary placement unit 20. The cassette elevator 8 in the embodiment has the cassette 7 mounted on a top surface of the cassette elevator 8, and raises and lowers the cassette 7 in the Z-axis direction by a motor not illustrated in the figure.

The carrying-in/out unit 10 carries out a workpiece 200 from the cassette 7 mounted on the cassette elevator 8, and carries a workpiece 200 into the cassette 7. The carrying-in/out unit 10 includes a gripping unit 11 that grips a workpiece 200 housed in the cassette 7 and a moving unit 12 that moves the gripping unit 11 in the Y-axis direction. The gripping unit 11 is opposed to the opening 7-1 of the cassette 7 in the Y-axis direction. In the embodiment, the gripping unit 11 grips the annular frame 206 of the workpiece 200. The moving unit 12 includes an arm portion 13 having the gripping unit 11 attached to a lower end of the arm portion 13 and a moving unit not illustrated, which moves the arm portion 13 in the Y-axis direction. The moving unit, for example, includes a driving roller, a driven roller spaced from the driving roller in the Y-axis direction, and an

endless belt that is stretched over these rollers and circularly travels around the peripheries of these rollers, and to which endless belt the arm portion 13 is attached.

The temporary placement unit 20 temporarily places a workpiece 200 carried out from the cassette 7 by the carrying-in/out unit 10, and temporarily places a workpiece 200 cleaned by the cleaning unit 60. The temporary placement unit 20 is disposed at a position opposed to the opening 7-1 of the cassette 7 in the Y-axis direction. That is, the cassette elevator 8 and the temporary placement unit 20 are arranged in the Y-axis direction. The temporary placement unit 20 includes a pair of guide rails 21, coupling members 22 coupling the pair of guide rails 21 to each other, and a raising and lowering portion 23.

The guide rails 21 linearly extend in parallel with the Y-axis direction, and can support a workpiece 200. The guide rails 21 are opposed to edges in the X-axis direction of the opening 7-1 of the cassette 7. In the embodiment, the guide rails 21 can support the annular frame 206 of the workpiece 200. The coupling members 22 each couple both end portions in the Y-axis direction of the pair of guide rails 21 to each other. The raising and

lowering portion 23 raises and lowers the guide rails 21 in the Z-axis direction. In the embodiment, the raising and lowering portion 23 includes air cylinders 24 that raise and lower the guide rails 21 in the Z-axis direction. In the embodiment, the air cylinders 24 raise and lower the coupling members 22 in the Z-axis direction. Incidentally, a detailed configuration of the temporary placement unit 20, particularly the guide rails 21, will be described later.

The chuck table 30 sucks and holds, by the holding surface 31, the work 210 of the workpiece 200 transferred from the temporary placement unit 20. The chuck table 30 has a disk shape. The holding surface 31 holding the work 210 is formed of a porous ceramic or the like. The chuck table 30 has a diameter smaller than an interval between the pair of guide rails 21. In addition, the chuck table 30 is provided so as to be movable in the X-axis direction by the X-axis moving unit 70 over a processing region below the cutting units 40 and a carrying-in-and-out region that is spaced from below the cutting units 40 and into and out of which a workpiece 200 is carried, and the chuck table 30 is provided so as to be rotatable about an axis parallel with the Z-axis direction by a rotation-driving source. The chuck table 30 is connected

to a vacuum suction source not illustrated in the figure. The chuck table 30 sucks and holds the work 210 mounted on the holding surface 31 by being sucked by the vacuum suction source, and thus fixes the workpiece 200, that is, the frame unit. In the embodiment, the chuck table 30 sucks and holds the undersurface 204 side of the work 210 with the tape 205.

The cutting units 40 cut (equivalent to processing) the work 210 held on the chuck table 30. Each of the cutting units 40 is provided so as to be movable in the Y-axis direction by the Y-axis moving unit 80 with respect to the work 210 held on the chuck table 30, and is provided so as to be movable in the Z-axis direction by the Z-axis moving unit 90.

As illustrated in FIG. 1, one cutting unit 40 is provided to one column portion 4 of a gate-shaped supporting frame 3 erected from an apparatus main body 2 via the Y-axis moving unit 80, the Z-axis moving unit 90, and the like. As illustrated in FIG. 1, the other cutting unit 40 is provided to another column portion 5 of the supporting frame 3 via the Y-axis moving unit 80, the Z-axis moving unit 90, and the like. Incidentally, the supporting frame 3 couples upper ends of the column portions 4 and 5 to each other by a horizontal beam 6.

The cutting units 40 can position the cutting blades 41 at arbitrary positions of the holding surface 31 of the chuck table 30 by the Y-axis moving unit 80 and the Z-axis moving units 90. The cutting units 40 each include: a spindle housing 43 provided so as to be movable in the Y-axis direction and the Z-axis direction by the Y-axis moving unit 80 and the Z-axis moving unit 90; and a spindle 42 provided in the spindle housing 43 so as to be rotatable about an axis and rotated by a motor, and having the cutting blade 41 fitted to an end of the spindle 42. The cutting blade 41 is a very thin cutting grindstone having a substantially ring shape.

The camera unit 50 images the work 210 held on the holding surface 31 of the chuck table 30. In the embodiment, the camera unit 50 is fixed to the cutting unit 40 so as to move integrally with the cutting unit 40. The camera unit 50 includes an imaging element that images a region to be divided in the work 210 before cutting which work is held on the chuck table 30. The imaging element is, for example, a charge-coupled device (CCD) imaging element or a complementary metal oxide semiconductor (CMOS) imaging element. The camera unit 50 obtains an image for carrying out alignment that aligns the work 210 and the cutting blade 41 with each other,

for example, by imaging the work 210 held on the chuck table 30. The camera unit 50 outputs the obtained image to the control unit 100.

The X-axis moving unit 70 processing-feeds the chuck table 30 in the X-axis direction as a processing feed direction. The Y-axis moving unit 80 indexing-feeds the cutting units 40 in the Y-axis direction as an indexing feed direction. The Z-axis moving units 90 cutting-feed the cutting units 40 in the Z-axis direction as a cutting feed direction.

The X-axis moving unit 70, the Y-axis moving unit 80, and the Z-axis moving units 90 include: well-known ball screws 81 and 91 provided so as to be rotatable about axes; well-known pulse motors 82 and 92 that rotate the ball screws 81 and 91 about the axes; and well-known guide rails 83 and 93 that movably support the chuck table 30 or the cutting units 40 in the X-axis direction, the Y-axis direction, or the Z-axis direction.

In addition, the processing apparatus 1 includes: an X-axis direction position detecting unit, not illustrated, for detecting a position in the X-axis direction of the chuck table 30; a Y-axis direction position detecting unit, not illustrated, for detecting a position in the Y-axis direction of the cutting units 40;

and a Z-axis direction position detecting unit, not illustrated, for detecting a position in the Z-axis direction of the cutting units 40. The X-axis direction position detecting unit and the Y-axis direction position detecting unit can be formed by a linear scale parallel with the X-axis direction or the Y-axis direction and a read head that is provided so as to be movable in the X-axis direction or the Y-axis direction by the X-axis moving unit 70 or the Y-axis moving unit 80 and reads a graduation of the linear scale. The X-axis direction position detecting unit and the Y-axis direction position detecting unit output, to the control unit 100, information indicating the graduation of the linear scale which graduation is read by the read head as information indicating the position in the X-axis direction of the chuck table 30 or the position in the Y-axis direction of the cutting units 40. The Z-axis direction position detecting unit detects the position in the Z-axis direction of the cutting units 40 by the number of pulses of a pulse motor 92 that rotates a ball screw 91 about an axis. The Z-axis direction position detecting unit outputs information indicating the detected position in the Z-axis direction of the cutting units 40 to the control unit 100.

The cleaning unit 60 cleans the workpiece 200 in which the work 210 has been cut. The cleaning unit 60 includes: a chuck table 61 that sucks and holds the work 210 and rotates about an axis parallel with the Z-axis direction; and a cleaning water nozzle not illustrated, which supplies cleaning water to the work 210 sucked and held on the chuck table 30. In addition, in the embodiment, the chuck table 61 of the cleaning unit 60 is provided so as to be raisable and lowerable in the Z-axis direction by an air cylinder not illustrated or the like. The conveying unit conveys the workpiece 200 in which the work 210 has been cut by the cutting units 40 from the chuck table 30 to the chuck table 61 of the cleaning unit 60.

The control unit 100 makes the processing apparatus 1 perform processing operation on the work 210 of the workpiece 200 by controlling each of the above-described units of the processing apparatus 1. Specifically, the control unit 100 makes the guide rails 21 of the temporary placement unit 20 support the workpiece 200 before cutting processing which workpiece has been conveyed from the cassette 7 by the carrying-in/out unit 10, and thereafter makes the temporary placement unit 20 mount the work 210 of the workpiece 200 supported by the

guide rails 21 onto the holding surface 31 of the chuck table 30. After sucking and holding the work 210 on the chuck table 30, the control unit 100 makes the X-axis moving unit 70 move the chuck table 30, and makes the camera unit 50 image the work 210 on the chuck table 30. The control unit 100 carries out alignment that aligns the work 210 and the cutting blade 41 with each other, and makes the cutting blades 41 of the cutting units 40 cut into planned dividing lines 202 while moving the chuck table 30 and the cutting blades 41 relative to each other along the planned dividing lines 202.

After making the cutting blades 41 cut into all of the planned dividing lines 202, the control unit 100 releases the sucking and holding of the chuck table 30, and makes the conveying unit convey the workpiece 200 on the chuck table 30 to the cleaning unit 60. The control unit 100 makes the cleaning unit 60 clean the workpiece 200, makes the guide rails 21 of the temporary placement unit 20 support the workpiece 200 on the chuck table 61 of the cleaning unit 60, and thereafter makes the carrying-in/out unit 10 carry the workpiece 200 into the cassette 7.

The control unit 100 is a computer including an arithmetic processing apparatus having a microprocessor

such as a central processing unit (CPU), a storage apparatus having a memory such as a read only memory (ROM) or a random access memory (RAM), and an input-output interface apparatus. The arithmetic processing apparatus of the control unit 100 performs arithmetic processing according to a computer program stored in the storage apparatus, and outputs a control signal for controlling the processing apparatus 1 to each of the above-described units of the processing apparatus 1 via the input-output interface apparatus.

In addition, the control unit 100 is connected with a display unit not illustrated, which displays a state of processing operation, the image imaged by the camera unit 50, and the like and an input unit used when an operator registers processing content information and the like. The display unit is formed by a liquid crystal display apparatus or the like. The input unit is formed by a touch panel provided in the display screen of the display unit, an external input apparatus such as a keyboard, or the like.

The present specification will next describe a configuration of the temporary placement unit 20, particularly the guide rails 21. As illustrated in FIG. 2, FIG. 3, and FIG. 4, the guide rails 21 each include a

side wall member 211, a bottom member 212 as a bottom portion, and a rotating apparatus 213 (illustrated in FIG. 1). The side wall member 211 is attached to the coupling members 22, and includes a top wall portion 214 flat along a horizontal direction and a side wall portion 215 continuous with an edge of the top wall portion 214 on a far side of the guide rail 21 which side is far from the other guide rail 21. The side wall portion 215 is formed so as to be flat along the vertical direction.

The bottom member 212 is formed in the shape of a band plate extending in the Y-axis direction. As illustrated in FIG. 3 and FIG. 4, the bottom member 212 is provided to a lower end of the side wall portion 215 so as to be rotatable over a closed state in which an upper surface 217 is parallel with the horizontal direction and an opened state in which the upper surface 217 is parallel with the vertical direction. Incidentally, the rotational center of the bottom member 212 is parallel with the Y-axis direction. In addition, the rotational center of the bottom member 212 is disposed at an edge on a far side of the guide rail 21 which side is far from the other the guide rail 21 in the closed state in which the upper surface is parallel with the horizontal direction. The bottom member 212 in the closed

state supports the annular frame 206 of the workpiece 200 on the upper surface 217. The bottom member 212 in the opened state does not support the annular frame 206 of the workpiece 200.

The rotating apparatus 213 is a rotary cylinder that is attached to the side wall portion 215 and whose output shaft rotating about an axis is attached to the bottom member 212. The rotating apparatus 213 rotates the bottom member 212 over the closed state and the opened state. Thus, the bottom members 212 of the pair of guide rails 21 open and close in a double-door manner when the bottom members 212 rotate.

In addition, in the embodiment, the temporary placement unit 20 includes an abutting unit 25 and a movement assistance unit 26. The abutting unit 25 is provided to each of the guide rails 21. In the embodiment, the abutting unit 25 is disposed above the chuck table 30 located in the carrying-in-and-out region. The abutting unit 25 presses the workpiece 200 from the outside of the pair of guide rails 21 toward the center of the pair of guide rails 21 along the X-axis direction as the bottom member 212 rotates to open from the closed state to the opened state, that is, so as to be interlocked with the rotation of the bottom member 212. The abutting unit 25

thereby positions the workpiece 200 at a predetermined position in the X-axis direction. In the embodiment, the abutting unit 25 presses the annular frame 206 of the workpiece 200 from the outside of the pair of guide rails 21 toward the center of the pair of guide rails 21 along the X-axis direction as the bottom member 212 rotates to open from the closed state to the opened state, that is, so as to be interlocked with the rotation of the bottom member 212.

As illustrated in FIG. 2, FIG. 3, and FIG. 5, the abutting unit 25 is disposed within a notch portion 216 formed by notching a part of the side wall portion 215 of the side wall member 211 of each guide rail 21. The abutting unit 25 includes a pair of link members 251, a pair of abutting blocks 252, a pair of biasing units 253, and an action unit 27.

Each link member 251 is formed in a doglegged planar shape, and a central portion in a longitudinal direction of the link member 251 is located most inward in the pair of guide rails 21. Each link member 251 is attached to the top wall portion 214 of the side wall member 211 so as to be rotatable about the central portion. The rotational center of the link member 251 is parallel with the Z-axis direction. In addition, the pair

of link members 251 is arranged at an interval in the Y-axis direction.

The abutting blocks 252 are set so as to be movable from the outer circumference of the workpiece 200 supported by the guide rails 21 toward the center of the workpiece 200. The abutting blocks 252 are formed in a columnar shape parallel with the Z-axis direction, and are attached to one end portions of the pair of link members 251 which end portions are adjacent to each other. The abutting blocks 252 are attached to the one end portions of the link members 251 provided so as to be rotatable about the central portions. The abutting blocks 252 are thereby set so as to be movable from the outer circumference of the workpiece 200 supported by the guide rails 21 toward the center of the workpiece 200.

The biasing units 253 position the abutting blocks 252 at a retracted position illustrated in FIG. 5 and the like at which retracted position the abutting blocks 252 are supported by the guide rails 21 in the X-axis direction and are retracted to the outside of the workpiece 200. In the embodiment, the biasing units 253 are provided to other end portions of the pair of link members 251 which other end portions are on sides far from each other, and bias the link members 251 in a

direction in which the abutting blocks 252 go toward the outside of the workpiece 200 supported by the guide rails 21. When the abutting blocks 252 are positioned at the retracted position, the biasing units 253 abut against the inner surface of the notch portion 216, so that displacement of the abutting blocks 252 to the outside of the workpiece 200 from the retracted position is regulated.

The action unit 27 is fixed to the bottom member 212 of the guide rail 21. The action unit 27 is retracted from the abutting blocks 252 in the closed state in which the bottom member 212 is closed. The action unit 27 presses the abutting blocks 252 toward the workpiece 200 with a force exceeding a biasing force of the biasing units 253 in the opened state in which the bottom member 212 is opened. The action unit 27 is fixed to an undersurface of the bottom member 212, and is disposed in a center in the Y-axis direction of the notch portion 216.

The action unit 27 includes an outward protruding portion 271 protruding more to the outside of the pair of guide rails 21 than the bottom member 212 when the bottom member 212 is positioned in the closed state and an upward extending portion 272 extending upward from an end of the outward protruding portion 271.

The upward extending portion 272 includes cam surfaces 273 in a central portion in the Y-axis direction. The cam surfaces 273 are provided from an upper end of the upward extending portion 272 to both ends in the Y-axis direction of a recessed notch 274 and inclined in directions of approaching each other toward a lower side when the bottom member 212 is positioned in the closed state. When the bottom member 212 is in the closed state, the cam surfaces 273 are separated from the abutting blocks 252. In addition, when the bottom member 212 is rotated from the closed state toward the opened state, the cam surfaces 273 abut against the abutting blocks 252 and move the abutting unit 25 to the inside of the pair of guide rails 21 by pressing the abutting unit 25 to the inside of the pair of guide rails 21 against a biasing force of the biasing units 253. The cam surfaces 273 thereby make the abutting blocks 252 abut against the annular frame 206 of the workpiece 200 supported by the guide rails 21.

The movement assistance unit 26 assists in the movement of the workpiece 200 by the abutting blocks 252 of the abutting unit 25 by jetting a gas from the bottom member 212 of the guide rail 21. The movement assistance unit 26 includes: a plurality of jetting holes 261

arranged in the bottom member 212; and an air supply source 262 (illustrated in FIG. 1) that supplies a pressurized gas to the plurality of jetting holes 261. When the work 210 supported by the annular frame 206 of the workpiece 200 supported by at least the bottom member 212 of the guide rail 21 is mounted on the holding surface 31 of the chuck table 30, the movement assistance unit 26 jets, from the jetting holes 261, a pressurized gas from the air supply source 262, and thus facilitates the movement of the annular frame 206 with respect to the guide rail 21 by the pressurized gas.

Operation of the temporary placement unit 20 will next be described with reference to drawings. FIG. 6 is a front view as viewed from a cassette side, the front view schematically illustrating a state in which the guide rails of the temporary placement unit of the processing apparatus illustrated in FIG. 1 support a workpiece carried out from the cassette by the carrying-in/out unit. FIG. 7 is a perspective view illustrating principal parts of the temporary placement unit illustrated in FIG. 6. FIG. 8 is another perspective view illustrating principal parts of the temporary placement unit illustrated in FIG. 6. FIG. 9 is a front view of the temporary placement unit illustrated in FIG. 6 as viewed from the cassette side.

FIG. 10 is a front view as viewed from the cassette side, the front view schematically illustrating a state in which the workpiece supported by the guide rails illustrated in FIG. 6 is mounted on the holding surface of the chuck table. FIG. 11 is a perspective view illustrating principal parts, in which perspective view the bottom portion of the temporary placement unit illustrated in FIG. 7 is rotated toward the opened state. FIG. 12 is another perspective view illustrating principal parts of the temporary placement unit illustrated in FIG. 11. FIG. 13 is a front view of the temporary placement unit illustrated in FIG. 11 as viewed from the cassette side. FIG. 14 is a perspective view illustrating principal parts, in which perspective view the bottom portion of the temporary placement unit illustrated in FIG. 7 is positioned in the opened state. FIG. 15 is another perspective view illustrating principal parts of the temporary placement unit illustrated in FIG. 14. FIG. 16 is a front view of the temporary placement unit illustrated in FIG. 14 as viewed from the cassette side. FIG. 17 is a sectional view taken along a line XVII-XVII in FIG. 14. FIG. 18 is a front view as viewed from the cassette side, the front view schematically illustrating a state in which the bottom

portion of the guide rail illustrated in FIG. 7 is positioned in the opened state. FIG. 19 is a front view as viewed from the cassette side, the front view schematically illustrating a state in which the guide rails illustrated in FIG. 18 are raised.

The temporary placement unit 20 operates as follows under control of the control unit 100. Before the workpiece 200 carried out from the cassette 7 by the carrying-in/out unit 10 is temporarily placed on the temporary placement unit 20, the bottom members 212 are positioned in the closed state, as illustrated in FIG. 6, FIG. 7, FIG. 8, and FIG. 9. The temporary placement unit 20 is stopped at a position raised by the raising and lowering portion 23, and the annular frame 206 of the workpiece 200 carried out from the cassette 7 by the carrying-in/out unit 10 is temporarily placed on the bottom member 212. At this time, the bottom member 212 is positioned in the closed state, and the abutting blocks 252 are positioned at the retracted position. In addition, the processing apparatus 1 positions the chuck table 30 directly below the work 210 of the workpiece 200 carried out from the cassette 7 by the carrying-in/out unit 10 and supported by the guide rails 21.

The temporary placement unit 20 lowers the guide

rails 21 toward the chuck table 30 positioned directly below the workpiece 200 by the raising and lowering portion 23, and stops the guide rail 21 at the lowered position. As illustrated in FIG. 10, the temporary placement unit 20 thus mounts the work 210 supported by the annular frame 206 of the workpiece 200 supported on the bottom member 212 of the guide rail 21 onto the holding surface 31 of the chuck table 30 with the tape 205. The temporary placement unit 20 jets the pressurized gas of the air supply source 262 from the jetting holes 261 by the movement assistance unit 26, and rotates the bottom member 212 from the closed state toward the opened state by the rotating apparatus 213, as illustrated in FIG. 11, FIG. 12, and FIG. 13.

Then, in the temporary placement unit 20, the upward extending portion 272 of the action unit 27 approaches the abutting blocks 252, and the cam surfaces 273 provided to the upward extending portion 272 abut against the abutting blocks 252. The temporary placement unit 20 further rotates the bottom member 212 toward the opened state. The cam surfaces 273 thus press the abutting blocks 252 to the inside of the pair of guide rails 21 against a biasing force of the biasing units 253. The temporary placement unit 20 positions the bottom

member 212 in the opened state, and thereby opens the bottom member 212, as illustrated in FIG. 14, FIG. 15, FIG. 16, FIG. 17, and FIG. 18.

Then, in the temporary placement unit 20, the abutting blocks 252 provided to each of the guide rails 21 press the annular frame 206 of the workpiece 200 to the inside of the pair of guide rails 21. The temporary placement unit 20 mounts the workpiece 200 onto the chuck table 30 while positioning the workpiece 200 at a predetermined position in the X-axis direction with respect to the chuck table 30, and stops jetting the pressurized gas from the jetting holes 261 of the movement assistance unit 26. Therefore, the annular frame 206 is positioned by the gas jetted from the jetting holes 261 of the movement assistance unit 26 without scraping the guide rail 21. Then, the processing apparatus 1 sucks and holds the work 210 on the holding surface 31 of the chuck table 30 with the tape 205. Thus, the workpiece 200 is pressed from the outside by the abutting blocks 252 until immediately before being sucked and held from the chuck table 30.

As illustrated in FIG. 19, the temporary placement unit 20 rises by the raising and lowering portion 23, and retracts from the chuck table 30. Then, the processing

apparatus 1 cuts the work 210 by the cutting units 40. When the processing apparatus 1 completes cutting the work 210, the processing apparatus 1 positions the chuck table 30 holding the workpiece 200 directly below a position between the pair of guide rails 21 as illustrated in FIG. 19, and stops the sucking and holding of the holding surface 31. The processing apparatus 1 supports the workpiece 200 on the chuck table 30 by the pair of guide rails 21 by performing an operation reverse to the operation of mounting the workpiece 200 supported by the guide rails 21 onto the chuck table 30.

Specifically, the processing apparatus 1 lowers, by the raising and lowering portion 23, the guide rails 21 whose bottom members 212 are positioned in the opened state toward the chuck table 30 on which the workpiece 200 is mounted, and stops the guide rails 21 at the lowered position. The processing apparatus 1 jets the pressurized gas of the air supply source 262 from the jetting holes 261 by the movement assistance unit 26 of the temporary placement unit 20, and rotates the bottom members 212 from the opened state toward the closed state by the rotating apparatuses 213. The processing apparatus 1 supports the annular frame 206 of the workpiece 200 on the bottom members 212 when the bottom members 212 are

positioned in the closed state. The processing apparatus 1 raises the guide rails 21 by the raising and lowering portion 23. The processing apparatus 1 thus removes the workpiece 200 from the chuck table 30.

The processing apparatus 1 mounts the workpiece 200 supported by the guide rails 21 onto the chuck table 61 of the cleaning unit 60 by performing an operation similar to the operation of mounting the workpiece 200 onto the chuck table 30. The processing apparatus 1 sucks and holds the workpiece 200 on the chuck table 61, and cleans the workpiece 200 by the cleaning unit 60. The cleaning unit 60 lowers the chuck table 61 during the cleaning, and raises the chuck table 61 before and after the cleaning.

When the processing apparatus 1 completes the cleaning by the cleaning unit 60, the processing apparatus 1 removes the workpiece 200 from the chuck table 61 by performing an operation similar to the operation of removing the workpiece 200 from the chuck table 30, and supports the workpiece 200 by the pair of guide rails 21. The processing apparatus 1 carries the workpiece 200 supported by the guide rails 21 into the cassette 7 by the carrying-in/out unit 10. As described above, the temporary placement unit 20 temporarily places

the workpiece 200 on the guide rails 21, and positions the workpiece 200 at a predetermined position in the X-axis direction with respect to the chuck tables 30 and 61.

The processing apparatus 1 according to the foregoing embodiment realizes the positioning in the X-axis direction of the workpiece 200 supported by the pair of guide rails 21, that is, the centering of the workpiece 200, by the abutting unit 25 pressing the workpiece 200 from the outside and the gas jetted from the bottom members 212 of the guide rails 21. In addition, in the processing apparatus 1, the action unit 27 is fixed to the bottom members 212, and when the bottom members 212 are rotated from the closed state to the opened state, the action unit 27 presses the annular frame 206 of the workpiece 200 toward the inside of the pair of guide rails 21 from the retracted position of the abutting unit 25. As a result, the processing apparatus 1 can position the workpiece 200 by the abutting unit 25 using the rotating apparatus 213 that rotates the bottom member 212, and thus makes it possible to position the workpiece 200 at a desired position in the X-axis direction without the annular frame 206 of the workpiece 200 scraping the guide rail 21 while obviating a need for a new driving source. Hence, the processing apparatus 1

produces an effect of being able to achieve a reduction in cost and a reduction in weight.

In addition, the processing apparatus 1 mounts the workpiece 200 on the chuck table 30, and the workpiece 200 is pressed from the outside by the abutting blocks 252 until immediately before being sucked and held from the chuck table. There is thus another effect of being able to minimize positional displacement of the workpiece 200 in the X-axis direction.

It is to be noted that the present invention is not limited to the foregoing embodiment. That is, the present invention can be modified and carried out in various manners without departing from the gist of the present invention. In the foregoing embodiment, a cutting apparatus is illustrated as the processing apparatus 1. However, in the present invention, the processing apparatus 1 is not limited to a cutting apparatus, and may be various kinds of processing apparatuses performing various kinds of processing on the work 210 of the workpiece 200, such as a laser processing apparatus performing laser processing on the work 210 of the workpiece 200.

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 processing apparatus comprising:

a cassette mounting unit on which a cassette housing a plurality of workpieces is mounted;

carrying in/out means for carrying out a workpiece from the cassette mounted on the cassette mounting unit and carrying the workpiece into the cassette;

a temporary placement unit in which the workpiece carried out by the carrying in/out means is temporarily placed;

a chuck table configured to hold the workpiece transferred from the temporary placement unit;

a processing unit configured to process the workpiece held by the chuck table; and

a processing feed unit configured to processing-feed the chuck table in an X-axis direction, wherein

the cassette mounting unit and the temporary placement unit are disposed so as to be substantially aligned with each other in a Y-axis direction orthogonal to the X-axis direction,

the carrying in/out means includes

a holding unit configured to hold the workpiece housed in the cassette and a moving unit configured to move the holding unit in the Y-axis

direction,

the temporary placement unit includes

a pair of guide rails having a bottom portion and a side wall portion extending in the Y-axis direction and supporting the workpiece, the bottom portion opening and closing in a double-door manner,

a raising and lowering unit configured to raise and lower the guide rails, and

an abutting unit configured to position the workpiece at a predetermined position in the X-axis direction by pressing the workpiece from an outside to a center so as to be interlocked with rotation of the bottom portions of the guide rails, and

the guide rails are lowered toward the chuck table positioned directly below the workpiece supported by the guide rails, and the workpiece is mounted onto the chuck table by opening the bottom portions of the guide rails while the workpiece is positioned at the predetermined position in the X-axis direction.

2. The processing apparatus according to claim 1, wherein

the workpiece is a frame unit having the workpiece fixed in an opening of an annular frame by a tape, and with a diameter smaller than an interval between the pair

of guide rails, the chuck table fixes the frame unit.

3. The processing apparatus according to claim 1, wherein

the abutting unit includes

an abutting block set so as to be movable from a periphery of the workpiece supported by the guide rails toward a center of the workpiece,

a biasing unit configured to position the abutting block at a retracted position at which the abutting block is retracted to an outside of the workpiece in the X-axis direction, and

an action unit fixed to the bottom portions of the guide rails, the action unit retracting from the abutting block when the bottom portions are closed, and pressing the abutting block toward the workpiece with a force exceeding a biasing force of the biasing unit when the bottom portions are opened.

4. The processing apparatus according to claim 1, wherein

the temporary placement unit further includes a movement assistance unit configured to assist movement of the workpiece by the abutting unit by jetting a gas from the bottom portions of the guide rails.