DESCRIPTION

TITLE OF INVENTION:

Cutting Apparatus and Method of Manufacturing Product

TECHNICAL FIELD

[0001] The present disclosure relates to a cutting apparatus and a method of manufacturing a product.

BACKGROUND ART

[0002] For example, PTL 1 discloses an apparatus that manufactures a plurality of products from which contamination such as chips has been removed by a cleaning apparatus cleaning, by injecting cleaning water, a plurality of cut articles obtained by cutting of an object to be cut by a cutting apparatus and the cleaning apparatus drying, by injecting air, the plurality of cut articles.

CITATION LIST

PATENT LITERATURE

[0003] PTL 1: Japanese Patent Laying-Open No. 2020-68294

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004] Since opposing surfaces of a plurality of cut articles can sufficiently be cleaned and dried also in the apparatus described in PTL 1, a plurality of products from which contamination has been removed can be manufactured. It has recently been desired, however, to manufacture a plurality of products from which contamination had been removed while an amount of cleaning fluid used for cleaning of the opposing surfaces of the plurality of cut articles and an amount of air used for drying are reduced.

SOLUTION TO PROBLEM

[0005] According to an embodiment disclosed herein, a cutting apparatus can be provided, the cutting apparatus including a machining table where an object to be cut can be set, a cutting mechanism capable of cutting the object to be cut set on the machining table into a plurality of cut articles, a first cleaning and drying mechanism

including a rotatable first spinner table that can chuck first surfaces of the plurality of cut articles, the first cleaning and drying mechanism being capable of cleaning and drying second surfaces opposite to the first surfaces of the plurality of cut articles, a second cleaning and drying mechanism including a rotatable second spinner table that can chuck second surfaces of the plurality of cut articles, the second cleaning and drying mechanism being capable of cleaning and drying the first surfaces of the plurality of cut articles, a first conveyance mechanism capable of receiving the plurality of cut articles from the machining table and capable of passing the plurality of cut articles to the first spinner table, a second conveyance mechanism capable of receiving the plurality of cut articles from the first spinner table, and a third conveyance mechanism capable of receiving the plurality of cut articles from the second conveyance mechanism and capable of passing the plurality of cut articles to the second spinner table.

[0006] According to an embodiment disclosed herein, a method of manufacturing a product can be provided, the method including setting an object to be cut on a machining table, making a plurality of cut articles by cutting the object to be cut on the machining table, receiving, by a first conveyance mechanism, the plurality of cut articles from the machining table and passing, by the first conveyance mechanism, the plurality of cut articles to a first spinner table, rotating, by the first spinner table, while the first spinner table chucks first surfaces of the plurality of cut articles, cleaning and thereafter drying second surfaces opposite to the first surfaces of the plurality of cut articles during the rotating by the first spinner table, receiving, by a second conveyance mechanism, the plurality of cut articles from the first spinner table after the second surfaces of the plurality of cut articles are dried, inverting the second conveyance mechanism while the second conveyance mechanism holds the second surfaces of the plurality of cut articles, receiving, by a third conveyance mechanism, the plurality of cut articles from the second conveyance mechanism after the inverting the second conveyance mechanism and passing, by the third conveyance mechanism, the plurality of cut articles to a second spinner table, rotating, by the second spinner table, while the

second spinner table chucks the second surfaces of the plurality of cut articles, and obtaining a plurality of products by cleaning and thereafter drying the first surfaces of the plurality of cut articles during the rotating by the second spinner table.

ADVANTAGEOUS EFFECTS OF INVENTION

[0007] According to the embodiment disclosed herein, the cutting apparatus and the method of manufacturing a product that allow manufacturing of a plurality of products from which contamination has been removed while an amount of cleaning fluid used for cleaning of opposing surfaces of a plurality of cut articles and an amount of air used for drying are reduced can be provided.

BRIEF DESCRIPTION OF DRAWINGS

[0008] Fig. 1 is a diagram showing a schematic configuration of an exemplary cutting apparatus in an embodiment.

Fig. 2 is a schematic perspective view of an exemplary first cleaning and drying mechanism or an exemplary second cleaning and drying mechanism shown in Fig. 1.

Fig. 3 is a schematic cross-sectional view of an exemplary first, second spinner table shown in Fig. 2.

Fig. 4 is a schematic partial plan view of an exemplary first, second chucking member of the first, second spinner table shown in Fig. 3.

Fig. 5 is a schematic cross-sectional view illustrating a part of a step in an exemplary method of manufacturing a product in the embodiment.

Fig. 6 is a schematic partial cross-sectional view illustrating a part of the step in the exemplary method of manufacturing a product in the embodiment.

Fig. 7 is a schematic partial cross-sectional view illustrating a part of the step in the exemplary method of manufacturing a product in the embodiment.

Fig. 8 is a schematic cross-sectional view illustrating a part of the step in the exemplary method of manufacturing a product in the embodiment.

Fig. 9 is a schematic cross-sectional view illustrating a part of the step in the exemplary method of manufacturing a product in the embodiment.

Fig. 10 is a schematic cross-sectional view illustrating a part of the step in the

exemplary method of manufacturing a product in the embodiment.

Fig. 11 is a schematic cross-sectional view illustrating a part of the step in the exemplary method of manufacturing a product in the embodiment.

Fig. 12 is a schematic cross-sectional view illustrating a part of the step in the exemplary method of manufacturing a product in the embodiment.

Fig. 13 is a schematic cross-sectional view illustrating a part of the step in the exemplary method of manufacturing a product in the embodiment.

Fig. 14 is a schematic cross-sectional view illustrating a part of the step in the exemplary method of manufacturing a product in the embodiment.

DESCRIPTION OF EMBODIMENTS

[0009] An embodiment will be described below. In the drawings referred to in description of the embodiment, the same or corresponding elements have the same reference characters allotted.

[0010] <Cutting Apparatus>

Fig. 1 shows a schematic configuration of an exemplary cutting apparatus in an embodiment. A cutting apparatus 100 in the embodiment shown in Fig. 1 includes a magazine module A, a cutting engine module B, a cleaning and drying module C, and an off-load module D. In cutting apparatus 100 in the embodiment, magazine module A and cutting engine module B are adjacent to each other, cutting engine module B and cleaning and drying module C are adjacent to each other, and cleaning and drying module C and off-load module D are adjacent to each other.

[0011] <Magazine Module A>

Magazine module A includes a magazine 101 in which, for example, a plurality of objects to be cut (not shown) can be accommodated in a vertical direction and a pusher (not shown) capable of pushing an object to be cut from magazine 101 to a strip rail 102 of cutting engine module B. For example, a package substrate or the like including a support member and sealing resin with which at least a part of the support member is sealed can be adopted as the object to be cut. The support member is, for example, a member that supports a semiconductor chip, a thin film, or the like, includes

a lead frame, a substrate, an interposer, a substrate made of a semiconductor (an Si wafer or the like), a substrate made of metal, a substrate made of glass, a substrate made of ceramic, a substrate made of resin, or a circuit board, and may be provided or not provided with wiring. The sealing resin is resin with which at least one surface of a semiconductor chip, a thin film, or the like supported on the support member is sealed. Though an example where a semiconductor package substrate is adopted as the object to be cut is described in the present embodiment, the object to be cut is not limited to the semiconductor package substrate.

[0012] <Cutting Engine Module B>

Cutting engine module B includes strip rail 102 capable of receiving the object to be cut from magazine module A, a conveyance mechanism 103 such as a strip loader capable of conveying the object to be cut on strip rail 102 to a machining table 105, machining table 105 on which the object to be cut can be carried, and a cutting mechanism 109 capable of cutting the object to be cut fixed to machining table 105 into a plurality of cut articles (not shown). Though a configuration in which cutting apparatus 100 includes two machining tables 105 and two cutting mechanisms 109 is described in the present embodiment. cutting apparatus 100 may include a single machining table 105 and a single cutting mechanism 109 or may include three or more machining tables 105 and three or more cutting mechanisms 109. Furthermore, cutting engine module B includes a cleaning fluid injection nozzle 108 capable of cleaning upper surfaces of a plurality of cut articles cut by cutting mechanism 109 by injecting a cleaning fluid, an air injection nozzle 104 capable of drying the upper surfaces of the plurality of cleaned cut articles by injecting air, and a first conveyance mechanism 106 such as a package unloader capable of receiving the plurality of dried cut articles from machining table 105 and passing the plurality of cut articles to a first spinner table 111. Conveyance mechanism 103 can make reciprocating movement between strip rail 102 and machining table 105 over an axis of movement 129 along an X axis. Machining table 105 can make reciprocating movement over an axis of movement 130 along a Y axis. Cutting mechanism 109 can make reciprocating

movement over an axis of movement 131 along the X axis. First conveyance mechanism 106 can make reciprocating movement between machining table 105 and first spinner table 111 over an axis of movement 132 along the X axis. As will be described later, since upper surfaces of a plurality of cut articles are cleaned and dried by a first cleaning and drying mechanism 110 in cleaning and drying module C, cleaning fluid injection nozzle 108 and air injection nozzle 104 do not have to be provided.

[0013] <Cleaning and Drying Module C>

Cleaning and drying module C includes first cleaning and drying mechanism 110 including first spinner table 111, a second cleaning and drying mechanism 133 including a second spinner table 114, a second conveyance mechanism 112 capable of receiving a plurality of cut articles from first spinner table 111, a third conveyance mechanism 115 capable of receiving the plurality of cut articles from second conveyance mechanism 112 and passing the plurality of cut articles to second spinner table 114, a first inspection mechanism 117 capable of inspecting from below, lower surfaces of a plurality of products obtained by cleaning and drying of the plurality of cut articles by second cleaning and drying mechanism 133, a second inspection mechanism 120 capable of inspecting from above, upper surfaces of the plurality of products, a fourth conveyance mechanism 118 capable of conveying the plurality of products to first inspection mechanism 117, a fifth conveyance mechanism 121 capable of conveying the plurality of products to second inspection mechanism 120, and an air injection nozzle 116 capable of drying the lower surfaces of the plurality of products by injecting air thereto, the plurality of products being obtained by cleaning and drying of the plurality of cut articles by second cleaning and drying mechanism 133. The "cut article" herein means a semifinished product before cleaning and drying by second cleaning and drying mechanism 133 after cutting mechanism 109 cuts the object to be cut fixed to machining table 105. The "product" means a final product obtained by cleaning and drying of the cut article by second cleaning and drying mechanism 133.

[0014] First spinner table 111 can chuck lower surfaces of the plurality of cut articles

and can rotate. First cleaning and drying mechanism 110 can clean and dry upper surfaces of the plurality of cut articles. Second spinner table 114 can chuck the lower surfaces of the plurality of cut articles and can rotate. Second cleaning and drying mechanism 133 can clean and dry the upper surfaces of the plurality of cut articles. Second conveyance mechanism 112 includes an inversion mechanism 113 and can be inverted such that the upper surfaces and the lower surfaces of the plurality of cut articles are interchanged.

[0015] Second conveyance mechanism 112 can make reciprocating movement between first spinner table 111 and second spinner table 114 over an axis of movement 134 along the Y axis. Furthermore, second conveyance mechanism 112 can make reciprocating movement over a not-shown axis of movement along a Z axis that vertically extends, that is, can make vertical movement. Third conveyance mechanism 115 can make reciprocating movement over the not-shown axis of movement along the Z axis that vertically extends, that is, can make vertical movement. Fourth conveyance mechanism 118 can make reciprocating movement between second spinner table 114 and a first area 119 over an axis of movement 135 along the X axis. Furthermore, fourth conveyance mechanism 118 can make reciprocating movement over the not-shown axis of movement along the Z axis that vertically extends, that is, can make vertical movement. Fifth conveyance mechanism 121 can make reciprocating movement between first area 119 and a second area 122 over an axis of movement 136 along the Y axis. First inspection mechanism 117 is located on axis of movement 135 of fourth conveyance mechanism 118. First inspection mechanism 117 is movable in a Y-axis direction. Second inspection mechanism 120 is located on axis of movement 136 of fifth conveyance mechanism 121. Second inspection mechanism 120 is movable in an X-axis direction. Fourth conveyance mechanism 118 is capable of receiving a plurality of products from third conveyance mechanism 115 above second spinner table 114 and capable of passing in first area 119, the plurality of products to fifth conveyance mechanism 121. Fifth conveyance mechanism 121 is capable of receiving in first area 119, the plurality of products from

fourth conveyance mechanism 118 and passing in second area 122, the plurality of products to a sixth conveyance mechanism 138.

[0016] In cutting apparatus 100 in the embodiment, axis of movement 132 of first conveyance mechanism 106 is orthogonal to axis of movement 134 of second conveyance mechanism 112. Axis of movement 134 of second conveyance mechanism 112 is orthogonal to the axis of movement of third conveyance mechanism 115 that extends in a Z-axis direction and orthogonal to axis of movement 135 of fourth conveyance mechanism 118. Axis of movement 135 of fourth conveyance mechanism 118 is orthogonal to the axis of movement of third conveyance mechanism 115 that extends in the Z-axis direction and orthogonal to axis of movement 136 of fifth conveyance mechanism 121. Axis of movement 136 of fifth conveyance mechanism 121 is orthogonal to an axis of movement 137 of sixth conveyance mechanism 138. Axis of movement 132 of first conveyance mechanism 106, axis of movement 135 of fourth conveyance mechanism 118, and axis of movement 137 of sixth conveyance mechanism 138 are in parallel to one another. Axis of movement 134 of second conveyance mechanism 112 and axis of movement 136 of fifth conveyance mechanism 121 are in parallel to each other. Therefore, in cleaning and drying module C of cutting apparatus 100 in the embodiment, first cleaning and drying mechanism 110, second cleaning and drying mechanism 133, first inspection mechanism 117, first area 119, second inspection mechanism 120, and second area 122 are arranged in a "bracket" shape, however, limitation to this configuration is not intended. For example, first cleaning and drying mechanism 110, second cleaning and drying mechanism 133, first inspection mechanism 117, first area 119, second inspection mechanism 120, and second area 122 may linearly be arranged (that is, axis of movement 132 of first conveyance mechanism 106, axis of movement 134 of second conveyance mechanism 112, axis of movement 135 of fourth conveyance mechanism 118, and axis of movement 136 of fifth conveyance mechanism 121 being in parallel to one another). In an example where first cleaning and drying mechanism 110, second cleaning and drying mechanism 133, first inspection mechanism 117, first area 119,

second inspection mechanism 120, and second area 122 are arranged in the "bracket" shape as in cutting apparatus 100 in the embodiment, a length of the entire cutting apparatus 100 can be shorter.

[0017] <Off-Load Module D>

Off-load module D includes sixth conveyance mechanism 138 such as a loader capable of receiving in second area 122, a plurality of products from fifth conveyance mechanism 121 and passing the plurality of products to an index table 123, index table 123 being capable of receiving the plurality of products from sixth conveyance mechanism 138, a conveyance mechanism 124 such as a pick-and-place apparatus capable of receiving at least one of the plurality of products from index table 123, a first tray 125 such as a conforming product tray capable of receiving the plurality of products from conveyance mechanism 124, a second tray 126 such as a defective product tray, and a third tray 128 such as an empty tray to be supplied to first tray 125 or second tray 126.

[0018] <Configuration of First Cleaning and Drying Mechanism and Second Cleaning and Drying Mechanism>

Fig. 2 shows a schematic perspective view of exemplary first, second cleaning and drying mechanism 110, 133 shown in Fig. 1. As shown in Fig. 2, first, second cleaning and drying mechanism 110, 133 includes a cleaning fluid scattering prevention cover 203 that surrounds a peripheral edge of first, second spinner table 111, 114, a cleaning fluid injection nozzle 202 capable of injecting a cleaning fluid to upper surfaces of the plurality of cut articles on first, second spinner table 111, 114, and an air injection nozzle 201 capable of injecting air to the upper surfaces of the plurality of cut articles on first, second spinner table 111, 114.

[0019] <Configuration of First Spinner Table and Second Spinner Table>

Fig. 3 shows a schematic cross-sectional view of exemplary first, second spinner table 111, 114 shown in Fig. 2. As shown in Fig. 3, first, second spinner table 111, 114 includes a first, second chucking member 303, 403 that can hold by chucking the lower surfaces of the plurality of cut articles and a first, second support member

309, 409 capable of supporting first, second chucking member 303, 403. First, second chucking member 303, 403 is provided with first, second through holes 307, 407 for suctioning the plurality of cut articles. First chucking member 303 and second chucking member 403 are different from each other in that they chuck surfaces opposite to each other of the plurality of cut articles as will be described later.

[0020] First, second chucking member 303, 403 can be composed, for example, of rubber. As first, second chucking member 303, 403 is composed of rubber, force of chucking the plurality of cut articles by first, second spinner table 111, 114 can be improved.

[0021] Fig. 4 shows a schematic partial plan view of exemplary first, second chucking member 303, 403 of first, second spinner table 111, 114 shown in Fig. 3. As shown in Fig. 4, first, second chucking member 303, 403 includes a plurality of combinations of first, second through hole 307, 407 having a circular or rectangular two-dimensional shape and a first, second frame-shaped portion 305, 405 having a rectangular two-dimensional shape, the first, second frame-shaped portion surrounding a peripheral edge of first, second through hole 307, 407. The combinations of first, second through hole 307, 407 and first, second frame-shaped portion 305, 405 are aligned one by one in each of a longitudinal direction and a lateral direction (the X-axis direction and the Y-axis direction) to form first, second chucking member 303, 403. One first, second through hole 307, 407 is provided in correspondence with each of the plurality of cut articles. According to such a configuration, as will be described later, first, second spinner table 111, 114 can chuck the lower surfaces of the plurality of cut articles so as to come in contact with peripheral edge regions of the lower surfaces of the plurality of cut articles without coming in contact with regions inside the peripheral edge regions of the lower surfaces of the plurality of cut articles. Furthermore, first, second through hole 307, 407 is configured to have a small diameter in a lower portion and a large diameter in an upper portion. In the present embodiment (Fig. 4), the combination of first, second through hole 307, 407 and first, second frame-shaped portion 305, 405 is in a rectangular shape in the upper portion and in a circular shape in

the lower portion. According to such a configuration, each of the plurality of cut articles can be held by first, second spinner table 111, 114 with greater suction force.

[0022] As shown in Fig. 3, an upper surface of first, second support member 309, 409 is provided with a recess 310, 410 with which first, second through hole 307, 407 communicates, and recess 310, 410 is connected to a through hole 320, 420 provided at the center of a lower surface of first, second support member 309, 409. Through hole 320, 420 is connected to a not-shown vacuum pump through a suction channel.

[0023] Chucking portions of machining table 105, conveyance mechanism 103, first conveyance mechanism 106, second conveyance mechanism 112, third conveyance mechanism 115, fourth conveyance mechanism 118, fifth conveyance mechanism 121, and sixth conveyance mechanism 138 which are other mechanisms that chuck the plurality of cut articles in cutting apparatus 100 in the present embodiment are configured substantially similarly to first, second spinner table 111, 114.

[0024] <Method of Manufacturing Product>

An exemplary method of manufacturing a product in the embodiment with cutting apparatus 100 in the embodiment shown in Fig. 1 will be described below. Initially, a pusher (not shown) pushes an object to be cut placed in magazine 101 of magazine module A shown in Fig. 1 to strip rail 102 in cutting engine module B. Conveyance mechanism 103 then receives the object to be cut from strip rail 102, conveys the object to be cut to machining table 105, and passes the object to be cut to machining table 105. Thereafter, machining table 105 chucks the object to be cut.

[0025] Fig. 5 shows a schematic cross-sectional view showing an exemplary state in which machining table 105 chucks a lower surface 701 of an object to be cut 700. As shown in Fig. 5, machining table 105 includes a machining table chucking member 703 that can chuck lower surface 701 of object to be cut 700 by suctioning lower surface 701 through a through hole 707 and a machining table support member 709 capable of supporting machining table chucking member 703. In the present embodiment, object to be cut 700 is held on machining table 105 with a terminal 311 facing up. Terminal 311 is shown for facilitating description and it does not necessarily have to be provided

in object to be cut 700.

[0026] Machining table 105 to which object to be cut 700 is chucked then moves over axis of movement 130 shown in Fig. 1 along the Y axis to a position adjacent to cutting mechanism 109. Cutting mechanism 109 then moves over axis of movement 131 along the X axis to above object to be cut 700 on machining table 105. Cutting mechanism 109 then cuts object to be cut 700 chucked to machining table 105 to make a plurality of cut articles.

[0027] Machining table 105 to which the plurality of cut articles 300 are chucked then moves over axis of movement 130 shown in Fig. 1 along the Y axis and moves to below cleaning fluid injection nozzle 108 as shown in a schematic partial cross-sectional view in Fig. 6. Cleaning fluid injection nozzle 108 then injects a cleaning fluid to upper surfaces (second surfaces 302 including terminal 311 in Fig. 6) of the plurality of cut articles 300 to clean the upper surfaces of the plurality of cut articles 300. Thereafter, cleaning fluid injection nozzle 108 stops injecting the cleaning fluid. Air injection nozzle 104 shown in a schematic partial cross-sectional view in Fig. 7 then injects air to the upper surfaces (second surfaces 302 in Fig. 7) of the plurality of cut articles 300 to dry the upper surfaces of the plurality of cleaned cut articles 300. Thereafter, air injection nozzle 104 stops injecting air. Machining table 105 to which the plurality of cut articles 300 are chucked then moves over axis of movement 130 shown in Fig. 1 along the Y axis to the original position (the position on axis of movement 132 of first conveyance mechanism 106 shown in Fig. 1).

[0028] First conveyance mechanism 106 then moves over axis of movement 132 shown in Fig. 1 along the X axis and moves to above the plurality of cut articles 300 chucked to machining table 105. As shown in a schematic cross-sectional view in Fig. 8, first conveyance mechanism 106 then moves downward and collectively receives the plurality of cut articles 300 from machining table 105. At this time, machining table 105 promotes cancellation of chucking of the plurality of cut articles 300 thereby, by opening a suction channel to the atmosphere or breaking the vacuum for passing the plurality of cut articles 300 to first conveyance mechanism 106. First

conveyance mechanism 106, on the other hand, chucks the upper surfaces (second surfaces 302 in Fig. 8) of the plurality of cut articles 300 by suction through the suction channel for receiving the plurality of cut articles 300 from machining table 105. While first conveyance mechanism 106 chucks the upper surfaces of the plurality of cut articles 300, it then moves upward. Since the description about passing and reception of the plurality of cut articles 300 and products 3000 (see Figs. 11 to 14) which will be described later is the same as above, the description will not be provided hereafter.

[0029] First conveyance mechanism 106 then moves over axis of movement 132 shown in Fig. 1 along the X axis toward first spinner table 111 while it chucks the upper surfaces of the plurality of cut articles 300.

[0030] First conveyance mechanism 106 that has moved to above first spinner table 111 then collectively passes the plurality of cut articles 300 to first spinner table 111. Fig. 9 shows a schematic cross-sectional view of an exemplary state in which the plurality of cut articles 300 are placed on first spinner table 111. First spinner table 111 at this time chucks the lower surfaces (first surfaces 301 in Fig. 9) of the plurality of cut articles 300 to first chucking member 303.

[0031] At this time, first chucking member 303 of first spinner table 111 preferably chucks first surfaces 301 of the plurality of cut articles 300 so as to come in contact with peripheral edge regions 301b of first surfaces 301 of the plurality of cut articles 300 without coming in contact with inner regions 301a of surfaces to be chucked (first surfaces 301 in Fig. 9) of the plurality of cut articles 300. In this case, attachment of contamination to inner regions 3001a, 3002a (see Figs. 11 to 14) of products 3000 which will be described later can further be suppressed. The "peripheral edge regions" herein mean regions at peripheral edges of surfaces to be chucked of the plurality of cut articles or the plurality of products and the "inner regions" mean regions at an inner side of the "peripheral edge regions" of the plurality of cut articles or the plurality of products. First conveyance mechanism 106 collectively passes the plurality of cut articles 300 to first spinner table 111 and thereafter moves over axis of movement 132 shown in Fig. 1 along the X axis to the original position (the position

above machining table 105 on axis of movement 132 of first conveyance mechanism 106 shown in Fig. 1).

[0032] First cleaning and drying mechanism 110 then cleans and thereafter dries the upper surfaces (second surfaces 302 in Fig. 9) of the plurality of cut articles 300. First cleaning and drying mechanism 110 can clean and dry the upper surfaces of the plurality of cut articles 300, for example, as below.

[0033] Initially, the plurality of cut articles 300 are placed on first spinner table 111 shown in Fig. 2. Cleaning fluid scattering prevention cover 203 then moves upward in a direction shown with an arrow 204 in Fig. 2 such that an upper end thereof is located above the upper surfaces of the plurality of cut articles 300. Scattering of the cleaning fluid during cleaning and drying of the upper surfaces of the plurality of cut articles 300 by first cleaning and drying mechanism 110 to the outside of first cleaning and drying mechanism 110 can thus be suppressed.

[0034] Cleaning fluid injection nozzle 202 then revolves toward the inside of cleaning fluid scattering prevention cover 203 in a direction shown with an arrow 205 to be located above the upper surfaces of the plurality of cut articles 300 and first spinner table 111 starts rotating. At this time, a rotation speed that allows force of chucking of the lower surfaces of the plurality of cut articles 300 by first chucking member 303 of first spinner table 111 to be greater than centrifugal force applied to the plurality of cut articles 300 chucked to first spinner table 111 is desirable.

[0035] Then, while first spinner table 111 is rotating, cleaning fluid injection nozzle 202 injects the cleaning fluid to clean the upper surfaces of the plurality of cut articles 300. At this time, cleaning fluid injection nozzle 202 can inject the cleaning fluid while it swings as appropriate in the direction shown with arrow 205. Capability of cleaning the upper surfaces of the plurality of cut articles 300 can thus be improved. A two-fluid nozzle can be employed as cleaning fluid injection nozzle 202. In this case as well, capability of cleaning the upper surfaces of the plurality of cut articles 300 can be improved. Injection of the cleaning fluid from cleaning fluid injection nozzle 202 is thereafter stopped. Thereafter, cleaning fluid injection nozzle 202 retracts from

above the upper surfaces of the plurality of cut articles 300 along arrow 205 in Fig. 2.

[0036] While first spinner table 111 keeps rotating, air injection nozzle 201 then revolves toward the inside of cleaning fluid scattering prevention cover 203 in a direction shown with an arrow 206 to be located above the upper surfaces of the plurality of cut articles 300 and injects air to dry the upper surfaces of the plurality of cut articles 300. At this time, air injection nozzle 201 can inject air while it swings as appropriate in the direction shown with arrow 206. Drying of the upper surfaces of the plurality of cut articles 300 can thus be promoted. A temperature of air injected from air injection nozzle 201 is preferably a temperature at which deterioration of quality by heating of the plurality of cut articles 300 is suppressed and drying of the upper surfaces of the plurality of cut articles 300 is promoted. Thereafter, injection of air from air injection nozzle 201 is stopped. First spinner table 111 then stops rotating. Drying of the upper surfaces of the plurality of cut articles 300 can be promoted by rotating first spinner table 111 also after air injection nozzle 201 stops injecting air. Thereafter, air injection nozzle 201 retracts from above the upper surfaces of the plurality of cut articles 300 along arrow 206 in Fig. 2.

[0037] Cleaning fluid scattering prevention cover 203 then moves downward in a downward direction of arrow 204 such that the upper end thereof is located below the upper surfaces of the plurality of cut articles 300. Second conveyance mechanism 112 which will be described later thus more readily receives the plurality of cut articles 300 from first spinner table 111.

[0038] Cleaning fluid injection nozzle 202 and air injection nozzle 201 may be movable upward and downward while it is attached to cleaning fluid scattering prevention cover 203 movable upward and downward as described above, or may be configured as being movable upward and downward independently of cleaning fluid scattering prevention cover 203 without being attached to cleaning fluid scattering prevention cover 203.

[0039] As shown in the schematic cross-sectional view in Fig. 8, second conveyance mechanism 112 then moves to above first spinner table 111 and thereafter moves

downward to collectively receive the plurality of cut articles 300 from first spinner table 111. At this time, first spinner table 111 stops suctioning whereas second conveyance mechanism 112 chucks the upper surfaces (second surfaces 302 in Fig. 8) of the plurality of cut articles 300 by suction through the suction channel for receiving the plurality of cut articles 300 from first spinner table 111. In collectively passing the plurality of cut articles 300 or the plurality of products 3000, passing is done by stopping suctioning by the conveyance mechanism at a side of passing and starting suction at a side of reception, unless otherwise specified.

[0040] Second conveyance mechanism 112 that chucks second surfaces 302 of the plurality of cut articles 300 then moves over axis of movement 134 shown in Fig. 1 along the Y axis toward second spinner table 114. In the middle of conveyance of the plurality of cut articles 300 by this second conveyance mechanism 112, inversion mechanism 113 shown in Fig. 1 inverts second conveyance mechanism 112 such that the upper surfaces and lower surfaces of the plurality of cut articles 300 are interchanged while second conveyance mechanism 112 chucks the plurality of cut articles 300 as shown in a schematic cross-sectional view in Fig. 10. First surfaces 301 of the plurality of cut articles 300 are thus located as the upper surfaces and second surfaces 302 of the plurality of cut articles 300 are located as the lower surfaces. Thereafter, second conveyance mechanism 112 moves over axis of movement 134 shown in Fig. 1 along the Y axis to above second spinner table 114 while it chucks the lower surfaces (second surfaces 302 in Fig. 10) of the plurality of cut articles 300.

[0041] As shown in a schematic cross-sectional view in Fig. 11, third conveyance mechanism 115 that has been located further above second spinner table 114 then moves downward toward second conveyance mechanism 112. As shown in a schematic cross-sectional view in Fig. 12, third conveyance mechanism 115 then collectively receives the plurality of cut articles 300 from second conveyance mechanism 112. At this time, third conveyance mechanism 115 chucks the upper surfaces (first surfaces 301 in Fig. 12) of the plurality of cut articles 300. Second conveyance mechanism 112 passes the plurality of cut articles 300 to third conveyance

mechanism 115, thereafter moves over axis of movement 134 shown in Fig. 1 along the Y axis to the original position (the position between first spinner table 111 and second spinner table 114 shown in Fig. 1), is inverted by inversion mechanism 113, and stands by until next time the plurality of cut articles 300 are passed thereto.

[0042] Third conveyance mechanism 115 located above second spinner table 114 then collectively passes the plurality of cut articles 300 to second spinner table 114. Fig. 10 shows the schematic cross-sectional view of an exemplary state in which the plurality of cut articles 300 are placed on second spinner table 114. Second spinner table 114 chucks the surfaces (second surfaces 302 in Fig. 10) to be chucked of the plurality of cut articles 300. At this time, second spinner table 114 preferably chucks second surfaces 302 of the plurality of cut articles 300 such that second chucking member 403 thereof comes in contact with peripheral edge regions 302b of second surfaces 302 of the plurality of cut articles 300 without coming in contact with inner regions 302a of second surfaces 302 of the plurality of cut articles 300. Third conveyance mechanism 115 passes the plurality of cut articles 300 to second spinner table 114 and thereafter moves over the axis of movement along the Z axis to the original position (the position above second spinner table 114).

[0043] Second cleaning and drying mechanism 133 then cleans and thereafter dries the upper surfaces (first surfaces 301 in Fig. 10) of the plurality of cut articles 300 so that the plurality of products 3000 are obtained. Second cleaning and drying mechanism 133 can clean and dry the upper surfaces of the plurality of cut articles 300 similarly to first cleaning and drying mechanism 110.

[0044] <Subsequent Steps>

After second cleaning and drying mechanism 133 finishes cleaning and drying the upper surfaces of the plurality of cut articles 300, steps below are performed. Initially, fourth conveyance mechanism 118 moves over axis of movement 135 shown in Fig. 1 along the X axis to move to above second spinner table 114. As shown in the schematic cross-sectional view in Fig. 12, fourth conveyance mechanism 118 then collectively receives the plurality of products 3000 from second spinner table 114. At

this time, fourth conveyance mechanism 118 chucks the upper surfaces (first surfaces 3001 in Fig. 12) of the plurality of products 3000.

[0045] Fourth conveyance mechanism 118 then moves over axis of movement 135 shown in Fig. 1 along the X axis toward first area 119 while it chucks the upper surfaces of the plurality of products 3000. At this time, when fourth conveyance mechanism 118 passes over air injection nozzle 116, air injection nozzle 116 injects air to the lower surfaces (second surfaces 3002 in Fig. 12) of the plurality of products 3000. The cleaning fluid remaining on second surfaces 3002 of the plurality of products 3000, if any, can thus completely be removed and the cleaning fluid can be prevented from being brought to subsequent steps.

[0046] As shown in a schematic partial cross-sectional view in Fig. 13, fourth conveyance mechanism 118 is then arranged above first inspection mechanism 117 while it chucks the upper surfaces (first surfaces 3001 in Fig. 13) of the plurality of products 3000. First inspection mechanism 117 inspects from below, the lower surfaces (second surfaces 3002 in Fig. 13) of the plurality of products 3000 chucked to fourth conveyance mechanism 118.

[0047] After first inspection mechanism 117 finishes inspection, the plurality of products 3000 are conveyed to first area 119 by fourth conveyance mechanism 118. In first area 119, as shown in the schematic cross-sectional view in Fig. 11, fourth conveyance mechanism 118 collectively passes the plurality of products 3000 to fifth conveyance mechanism 121. At this time, fifth conveyance mechanism 121 chucks the lower surfaces (second surfaces 3002 in Fig. 11) of the plurality of products 3000.

[0048] Fifth conveyance mechanism 121 then moves over axis of movement 136 shown in Fig. 1 along the Y axis toward second area 122. At this time, fifth conveyance mechanism 121 is arranged below second inspection mechanism 120 as shown in a schematic partial cross-sectional view in Fig. 14. Second inspection mechanism 120 inspects from above, the upper surfaces (first surfaces 3001 in Fig. 14) of the plurality of products 3000 chucked to fifth conveyance mechanism 121.

[0049] After second inspection mechanism 120 finishes inspection, fifth conveyance

mechanism 121 conveys the plurality of products 3000 to second area 122. In second area 122, as shown in the schematic cross-sectional view in Fig. 12, fifth conveyance mechanism 121 collectively passes the plurality of products 3000 to sixth conveyance mechanism 138. At this time, sixth conveyance mechanism 138 chucks the upper surfaces (first surfaces 3001 in Fig. 12) of the plurality of products 3000.

[0050] Thereafter, sixth conveyance mechanism 138 collectively passes the plurality of products 3000 to index table 123 in off-load module D shown in Fig. 1, over axis of movement 137 shown in Fig. 1 along the X axis. At least one of the plurality of products 3000 collectively passed to index table 123 is picked up by conveyance mechanism 124. A plurality of products 3000 picked up by conveyance mechanism 124 are passed to first tray 125 such as the conforming product tray and second tray 126 such as the defective product tray and accommodated therein. A process from pick-up by this conveyance mechanism 124 to accommodation in any tray 125 and/or 126 is repeated until there are no longer the plurality of products 3000 passed to index table 123.

[0051] <Functions and Effects>

In cutting apparatus 100 in the present embodiment, the upper surfaces (second surfaces 302 in Fig. 9) of the plurality of cut articles 300 are cleaned and dried while first spinner table 111 of first cleaning and drying mechanism 110 rotates as it chucks the lower surfaces (first surfaces 301 in Fig. 9) of the plurality of cut articles 300, and thereafter the upper surfaces (first surfaces 301 in Fig. 10) of the plurality of cut articles 300 are cleaned and thereafter dried while second spinner table 114 of second cleaning and drying mechanism 133 rotates as it chucks the lower surfaces (second surfaces 302 in Fig. 10) of the plurality of cut articles 300, so that the plurality of products 3000 can be manufactured. The opposing surfaces of the plurality of cut articles 300 can thus be cleaned while the amount of cleaning fluid used in cleaning of the plurality of cut articles 300 and the amount of air used in drying are reduced. It could be confirmed in experiments that, in cutting apparatus 100 in the present embodiment, the amount of necessary cleaning fluid and the amount of air used in drying could be reduced to

approximately 1/3 as compared with those in cleaning and drying with a conventional cutting apparatus (a cutting apparatus including air injection nozzle 104 and cleaning fluid injection nozzle 108 of cutting apparatus 100 in the present embodiment for cleaning and drying of the opposing surfaces of the plurality of cut articles where a table to which the plurality of cut articles were fixed was not rotated in cleaning and drying). This may be because of cleaning and drying using centrifugal force of cutting apparatus 100 in the present embodiment.

[0052] In addition, attachment of contamination to inner regions 3001a and 3002a of the plurality of products 3000 obtained by cleaning and drying without contact of inner regions 301a, 302a of first, second surfaces 301, 302 of the plurality of cut articles 300 with such a member as machining table 105, first, second spinner table 111, 114, first to third conveyance mechanisms 106, 112, and 115, and the like can further be suppressed. In this case, attachment again of contamination to the plurality of cut articles 300 from machining table 105, first, second spinner table 111, 114, first to third conveyance mechanisms 106, 112, and 115, and the like can also be suppressed. Furthermore, since products can be manufactured without using a brush in the present embodiment, attachment again of contamination attached to the brush to the plurality of products 3000 can be suppressed.

[0053] <Additional Aspects>

(Disclosed Embodiment 1)

Disclosed Embodiment 1 is directed to a cutting apparatus including a machining table where an object to be cut can be set, a cutting mechanism capable of cutting the object to be cut set on the machining table into a plurality of cut articles, a first cleaning and drying mechanism including a rotatable first spinner table that can chuck first surfaces of the plurality of cut articles, the first cleaning and drying mechanism being capable of cleaning and drying second surfaces opposite to the first surfaces of the plurality of cut articles, a second cleaning and drying mechanism including a rotatable second spinner table that can chuck the second surfaces of the plurality of cut articles, the second cleaning and drying mechanism being capable of

cleaning and drying the first surfaces of the plurality of cut articles, a first conveyance mechanism capable of receiving the plurality of cut articles from the machining table and capable of passing the plurality of cut articles to the first spinner table, a second conveyance mechanism capable of receiving the plurality of cut articles from the first spinner table, and a third conveyance mechanism capable of receiving the plurality of cut articles from the second conveyance mechanism and capable of passing the plurality of cut articles to the second spinner table. According to Disclosed Embodiment 1, a plurality of products from which contamination has been removed can be manufactured while an amount of cleaning fluid used for cleaning of opposing surfaces of the plurality of cut articles and an amount of air used for drying are reduced.

[0054] (Disclosed Embodiment 2)

Disclosed Embodiment 2 is directed to the cutting apparatus described in Disclosed Embodiment 1, in which the first spinner table or the second spinner table is configured to come in contact with peripheral edge regions of surfaces to be chucked of the plurality of cut articles without coming in contact with regions inside the peripheral edge regions of the surfaces to be chucked of the plurality of cut articles in chucking the plurality of cut articles. According to Disclosed Embodiment 2, even when one surfaces or opposing surfaces of the plurality of cut articles are provided with asperities, the plurality of cut articles can appropriately be held by the first spinner table or the second spinner table.

[0055] (Disclosed Embodiment 3)

Disclosed Embodiment 3 is directed to the cutting apparatus described in Disclosed Embodiment 1 or 2, in which the second conveyance mechanism can be inverted. According to Disclosed Embodiment 3, the opposing surfaces of the plurality of cut articles can readily be cleaned and dried.

[0056] (Disclosed Embodiment 4)

Disclosed Embodiment 4 is directed to the cutting apparatus described in any one of Disclosed Embodiments 1 to 3, in which an axis of movement of the second conveyance mechanism and an axis of movement of the third conveyance mechanism

are orthogonal to each other. According to Disclosed Embodiment 4, the length of the entire cutting apparatus can be shorter.

[0057] (Disclosed Embodiment 5)

Disclosed Embodiment 5 is directed to the cutting apparatus described in any one of Disclosed Embodiments 1 to 4, in which an axis of movement of the first conveyance mechanism and an axis of movement of the second conveyance mechanism are orthogonal to each other. According to Disclosed Embodiment 5, the length of the entire cutting apparatus can be shorter.

[0058] (Disclosed Embodiment 6)

Disclosed Embodiment 6 is directed to the cutting apparatus described in any one of Disclosed Embodiments 1 to 5, the cutting apparatus further including a first inspection mechanism capable of inspecting second surfaces of a plurality of products obtained by cleaning and drying of the plurality of cut articles by the second cleaning and drying mechanism and a second inspection mechanism capable of inspecting first surfaces opposite to the second surfaces of the plurality of products. According to Disclosed Embodiment 6, the opposing surfaces of the plurality of products can be inspected.

[0059] (Disclosed Embodiment 7)

Disclosed Embodiment 7 is directed to the cutting apparatus described in Disclosed Embodiment 6, the cutting apparatus further including a fourth conveyance mechanism capable of conveying the plurality of products to the first inspection mechanism. According to Disclosed Embodiment 7, the plurality of products can be conveyed to the first inspection mechanism.

[0060] (Disclosed Embodiment 8)

Disclosed Embodiment 8 is directed to the cutting apparatus described in Disclosed Embodiment 7, in which an axis of movement of the fourth conveyance mechanism is orthogonal to an axis of movement of the second conveyance mechanism and in parallel to an axis of movement of the first conveyance mechanism. According to Disclosed Embodiment 8, the length of the entire cutting apparatus can be shorter.

[0061] (Disclosed Embodiment 9)

Disclosed Embodiment 9 is directed to the cutting apparatus described in Disclosed Embodiment 7 or 8, the cutting apparatus further including a fifth conveyance mechanism capable of conveying the plurality of products to the second inspection mechanism. According to Disclosed Embodiment 9, the plurality of products can be conveyed to the second inspection mechanism.

[0062] (Disclosed Embodiment 10)

Disclosed Embodiment 10 is directed to the cutting apparatus described in Disclosed Embodiment 9, in which an axis of movement of the fifth conveyance mechanism is orthogonal to an axis of movement of the fourth conveyance mechanism and in parallel to an axis of movement of the second conveyance mechanism. According to Disclosed Embodiment 10, the length of the entire cutting apparatus can be shorter.

[0063] (Disclosed Embodiment 11)

Disclosed Embodiment 11 is directed to a method of manufacturing a product including setting an object to be cut on a machining table, making a plurality of cut articles by cutting the object to be cut on the machining table, receiving, by a first conveyance mechanism, the plurality of cut articles from the machining table and passing, by the first conveyance mechanism, the plurality of cut articles to a first spinner table, rotating, by the first spinner table, while the first spinner table chucks first surfaces of the plurality of cut articles, cleaning and thereafter drying second surfaces opposite to the first surfaces of the plurality of cut articles during the rotating by the first spinner table, receiving, by a second conveyance mechanism, the plurality of cut articles from the first spinner table after the second surfaces of the plurality of cut articles are dried, inverting the second conveyance mechanism while the second conveyance mechanism holds the second surfaces of the plurality of cut articles, receiving, by a third conveyance mechanism, the plurality of cut articles from the second conveyance mechanism after the inverting the second conveyance mechanism and passing, by the third conveyance mechanism, the plurality of cut articles to a

second spinner table, rotating, by the second spinner table, while the second spinner table chucks the second surfaces of the plurality of cut articles, and obtaining a plurality of products by cleaning and thereafter drying the first surfaces of the plurality of cut articles during the rotating by the second spinner table. According to Disclosed Embodiment 11, a plurality of products from which contamination has been removed can be manufactured while an amount of cleaning fluid used for cleaning of opposing surfaces of the plurality of cut articles and an amount of air used for drying are reduced.

[0064] It should be understood that the embodiment and experimental examples disclosed herein are illustrative and non-restrictive in every respect. The scope of the present invention is defined by the terms of the claims rather than the description above and is intended to include any modifications within the scope and meaning equivalent to the terms of the claims.

INDUSTRIAL APPLICABILITY

[0065] The cutting apparatus in the present embodiment can suitably be used, for example, as a cutting apparatus in a post process in manufacturing a semiconductor, such as cutting of a package semiconductor substrate.

REFERENCE SIGNS LIST

[0066] 101 magazine; 102 strip rail; 103 conveyance mechanism; 104 air injection nozzle; 105 machining table; 106 first conveyance mechanism; 108 cleaning fluid injection nozzle; 109 cutting mechanism; 110 first cleaning and drying mechanism; 111 first spinner table; 112 second conveyance mechanism; 113 inversion mechanism; 114 second spinner table; 115 third conveyance mechanism; 116 air injection nozzle; 117 first inspection mechanism; 118 fourth conveyance mechanism; 119 first area; 120 second inspection mechanism; 121 fifth conveyance mechanism; 122 second area; 123 index table; 124 conveyance mechanism; 125 first tray; 126 second tray; 128 third tray; 129, 130, 131, 132, 134, 135, 136, 137 axis of movement; 133 second cleaning and drying mechanism; 138 sixth conveyance mechanism; 201 air injection nozzle; 202 cleaning fluid injection nozzle; 203 cleaning fluid scattering prevention cover; 204, 205, 206 arrow; 300 a plurality of cut articles; 301 first surface; 301a, 302a inner

region; 301b, 302b peripheral edge region; 302 second surface; 303 first chucking member; 305 first frame-shaped portion; 307 first through hole; 309 first support member; 310 recess; 311 terminal; 320 through hole; 403 second chucking member; 405 second frame-shaped portion; 407 second through hole; 409 second support member; 410 recess; 420 through hole; 700 object to be cut; 701 lower surface; 703 machining table chucking member; 707 through hole; 709 machining table support member; 3000 a plurality of products; 3001 first surface; 3001a, 3002a inner region; 3002 second surface.

CLAIMS

[Claim 1] A cutting apparatus comprising:

a machining table where an object to be cut can be set;

a cutting mechanism capable of cutting the object to be cut set on the machining table into a plurality of cut articles;

a first cleaning and drying mechanism including a rotatable first spinner table that can chuck first surfaces of the plurality of cut articles, the first cleaning and drying mechanism being capable of cleaning and drying second surfaces opposite to the first surfaces of the plurality of cut articles;

a second cleaning and drying mechanism including a rotatable second spinner table that can chuck the second surfaces of the plurality of cut articles, the second cleaning and drying mechanism being capable of cleaning and drying the first surfaces of the plurality of cut articles;

a first conveyance mechanism capable of receiving the plurality of cut articles from the machining table and capable of passing the plurality of cut articles to the first spinner table;

a second conveyance mechanism capable of receiving the plurality of cut articles from the first spinner table; and

a third conveyance mechanism capable of receiving the plurality of cut articles from the second conveyance mechanism and capable of passing the plurality of cut articles to the second spinner table.

[Claim 2] The cutting apparatus according to claim 1, wherein

the first spinner table or the second spinner table is configured to come in contact with peripheral edge regions of surfaces to be chucked of the plurality of cut articles without coming in contact with regions inside the peripheral edge regions of the surfaces to be chucked of the plurality of cut articles in chucking the plurality of cut articles.

[Claim 3] The cutting apparatus according to claim 1 or 2, wherein the second conveyance mechanism can be inverted.

[Claim 4] The cutting apparatus according to any one of claims 1 to 3, wherein

an axis of movement of the second conveyance mechanism and an axis of movement of the third conveyance mechanism are orthogonal to each other.

[Claim 5] The cutting apparatus according to any one of claims 1 to 4, wherein

an axis of movement of the first conveyance mechanism and an axis of movement of the second conveyance mechanism are orthogonal to each other.

[Claim 6] The cutting apparatus according to any one of claims 1 to 5, further comprising:

a first inspection mechanism capable of inspecting second surfaces of a plurality of products obtained by cleaning and drying of the plurality of cut articles by the second cleaning and drying mechanism; and

a second inspection mechanism capable of inspecting first surfaces opposite to the second surfaces of the plurality of products.

[Claim 7] The cutting apparatus according to claim 6, further comprising a fourth conveyance mechanism capable of conveying the plurality of products to the first inspection mechanism.

[Claim 8] The cutting apparatus according to claim 7, wherein

an axis of movement of the fourth conveyance mechanism is orthogonal to an axis of movement of the second conveyance mechanism and in parallel to an axis of

movement of the first conveyance mechanism.

[Claim 9] The cutting apparatus according to claim 7 or 8, further comprising a fifth conveyance mechanism capable of conveying the plurality of products to the second inspection mechanism.

[Claim 10] The cutting apparatus according to claim 9, wherein

an axis of movement of the fifth conveyance mechanism is orthogonal to an axis of movement of the fourth conveyance mechanism and in parallel to an axis of movement of the second conveyance mechanism.

[Claim 11] A method of manufacturing a product comprising:

setting an object to be cut on a machining table;

making a plurality of cut articles by cutting the object to be cut on the machining table;

receiving, by a first conveyance mechanism, the plurality of cut articles from the machining table and passing, by the first conveyance mechanism, the plurality of cut articles to a first spinner table;

rotating the first spinner table chucking first surfaces of the plurality of cut articles;

cleaning and thereafter drying second surfaces opposite to the first surfaces of the plurality of cut articles during the rotating of the first spinner table;

receiving, by a second conveyance mechanism, the plurality of cut articles from the first spinner table after the second surfaces of the plurality of cut articles are dried;

inverting the second conveyance mechanism while the second conveyance mechanism holds the second surfaces of the plurality of cut articles;

receiving, by a third conveyance mechanism, the plurality of cut articles from the second conveyance mechanism after the inverting the second conveyance mechanism and passing, by the third conveyance mechanism, the plurality of cut

articles to a second spinner table;

rotating the second spinner table chucking the second surfaces of the plurality of cut articles; and

obtaining a plurality of products by cleaning and thereafter drying the first surfaces of the plurality of cut articles during the rotating of the second spinner table.