

## SPECIFICATION

TITLE OF INVENTION: CUTTING APPARATUS AND METHOD FOR  
MANUFACTURING CUT ARTICLE

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Technical Field

**[0001]** The present invention relates to a technology of cutting apparatus and method for manufacturing cut article.

Related Art

10 **[0002]** Patent Literature 1 discloses a cutting apparatus including an end material processing apparatus for discharging end materials generated by cutting a package substrate. Specifically, the end material processing apparatus described in Patent Literature 1 is capable of sweeping the end materials downstream by spraying cleaning water from a cleaning nozzle onto the end materials that have fallen into a water case accommodating a chuck table.

15 Citation List

Patent Literature

**[0003]** Patent Literature 1: Japanese Patent Application Laid-Open Publication No. 2020-129580

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## SUMMARY OF INVENTION

Technical Problem

**[0004]** In the cutting device described in Patent Literature 1, there is a possibility that end materials that have fallen into the water case may accumulate. Since the accumulated end materials are heavy, it may not be possible to sweep the end materials away with cleaning water

from the cleaning nozzle. Moreover, if the liquid between the end materials that have fallen into the water case and the bottom surface of the water case dries, the end materials may adhere to the water case, making it impossible to sweep the end materials away with cleaning water from the cleaning nozzle.

5   **[0005]**   The present invention has been made in view of the above-described situation, and its objective is to provide a cutting apparatus and a method for manufacturing cut article that is capable of discharging end materials more reliably.

**[0006]**   The objective to be solved by the present invention is as described above, and to solve this problem, a cutting apparatus according to the present invention includes: a machining table  
10   which is movable along a linear moving direction; a cutting mechanism which cuts an object to be cut placed on the machining table; a receiving member which is formed along the moving direction below the machining table, and which has a groove portion capable of receiving end materials generated when the object to be cut is cut by the cutting mechanism; a mobile body which is movable along the moving direction; and a removing member which is provided on the  
15   mobile body, which is arranged to contact the groove portion, and which removes the end materials from the groove portion.

#### Solution to Problem

**[0007]**   Furthermore, the method for manufacturing cut article according to the present invention is a method for manufacturing cut article using the aforementioned cutting apparatus,  
20   and includes a step of placing the object to be cut on the machining table, and a step of cutting the object to be cut by relatively moving the cutting mechanism and the machining table.

#### Effects of Invention

**[0008]**   According to the present invention, it is possible to discharge end materials more reliably.

## BRIEF DESCRIPTION OF DRAWINGS

**[0009]** [FIG. 1] A schematic plan view showing the overall configuration of a cutting apparatus according to the first embodiment.

5 [FIG. 2] A plan view showing the configuration of a cutting module.

[FIG. 3] A cross-sectional view along the line S1-S1.

[FIG. 4] A plan view showing a lower portion of the cutting module.

[FIG. 5] A cross-sectional view along the line S2-S2.

[FIG. 6] (a) An enlarged plan view showing the first removing member. (b) An  
10 enlarged cross-sectional side view showing the first removing member.

[FIG. 7] A cross-sectional side view showing the first removing member moving forward.

[FIG. 8] (a) A cross-sectional side view showing the cutting apparatus according to the second embodiment. (b) A cross-sectional side view showing the cutting apparatus  
15 according to the third embodiment.

## DESCRIPTION OF EMBODIMENTS

**[0010]** In the following description, the directions indicated by the arrows U, D, L, R, F, and B shown in the drawings are defined as up direction, down direction, left direction, right direction, front direction, and rear direction, respectively. Moreover, the rotational direction around a  
20 rotation axis in the up-down direction is defined as the  $\theta$  direction for the purpose of explanation.

**[0011]** <Configuration of a cutting apparatus 100 according to the first embodiment>

First, the configuration of a cutting apparatus 100 according to the first embodiment will be described. In the embodiment, the configuration of the cutting apparatus 100 will be described in the case where a sealed substrate W, which is a substrate with semiconductor chips mounted thereon and encapsulated in resin, is used as the object to be cut for the cutting apparatus 100.

[0012] For the sealed substrate W, for example, BGA (Ball Grid Array) package substrates, CSP (Chip Size Package) package substrates, LED (Light Emitting Diode) package substrates, etc. are used. In addition to the sealed substrate W, a sealed lead frame, which is a lead frame with semiconductor chips mounted thereon and encapsulated in resin, may also be used as the object to be cut. Furthermore, a wiring substrate with single or multiple layers of wiring, without any electronic components or electronic devices mounted thereon, may also be used as the object to be cut.

[0013] The cutting apparatus 100 shown in FIG. 1 is a machining apparatus that singulates the sealed substrate W, which is the object to be cut, into multiple cut articles (products P) by cutting. The cutting apparatus 100 includes, as components, a substrate supplying module A, a cutting module B, and a storage module C. Each component is detachable and replaceable with respect to other components.

[0014] <Substrate Supplying Module A>

The substrate supplying module A mainly includes a substrate supplying mechanism 1 and a control portion CTL.

[0015] The sealed substrate W, which is the object to be cut, is discharged from the substrate supplying mechanism 1 and transferred to the cutting module B by a transfer mechanism (not shown). The sealed substrate W transferred to the cutting module B is placed on a cutting table 15, which will be described later.

**[0016]** The control portion CTL controls the operation of each part of the cutting apparatus 100. By controlling each part of the cutting apparatus 100 with the control portion CTL, it is possible to perform the feeding of the sealed substrate W, cutting of the sealed substrate W, inspection of the products P, discharging of the products P, etc. Moreover, the control portion CTL may also be provided in modules other than the substrate supplying module A. Moreover, it is possible to provide the control portion CTL in multiple parts. For example, it is possible to provide a control portion CTL in each module and control each part by coordinating the control portions CTL with each other.

**[0017]** <Cutting Module B>

The cutting module B shown in FIG. 1 mainly includes a mobile mechanism 13, a cutting table 15, a rotation mechanism 17, and a spindle portion 23.

**[0018]** In this embodiment, a twin-cut table type cutting apparatus 100 having two cutting tables 15 is exemplified. The cutting table 15 is movable in the front-rear direction by the mobile mechanism 13, and is also rotatable in the  $\theta$  direction by the rotation mechanism 17.

**[0019]** Furthermore, in this embodiment, a cutting apparatus 100 with a twin spindle configuration having two spindle portions 23 is exemplified. The two spindle portions 23 are independently movable in the left-right direction and the up-down direction.

**[0020]** In the cutting module B, while the sealed substrate W is held on the cutting table 15, by relatively moving the cutting table 15 and the two spindle portions 23, it is possible to cut and singulate the sealed substrate W. A blade 23a is mounted on the spindle portion 23. The blade 23a cuts the sealed substrate W held on the cutting table 15 by rotating in a plane including the front-rear direction and the up-down direction. At this time, it is also possible to cut the sealed substrate W while spraying cutting water from a cutting nozzle 23b (refer to FIG. 3), which will be described later, towards the blade 23a.

**[0021]** <Storage Module C>

The storage module C mainly includes an inspection table 2 and a tray 3.

**[0022]** An assembly consisting of multiple products P, which are singulated by cutting the sealed substrate W, is placed on the inspection table 2. The multiple products P are inspected by an inspection camera (not shown) and sorted into good products and defective products. The sorted good products are accommodated in the tray 3. The sorted defective products are accommodated in a separately prepared tray (not shown) and excluded from the products P. Moreover, it is not always necessary to perform inspection of the products P in the storage module C.

**[0023]** <Details of Cutting Module B>

Next, the specific configuration of the cutting module B will be described using FIGS. 2 to 6. In FIG. 4, the illustration of components installed in the upper portion of the cutting module B (second receiving member 14, cutting table 15, rear cover member 18, front cover member 19, upper cover member 20, etc., which will be described later) is appropriately omitted, and the lower portion of the cutting module B is illustrated. Moreover, since the apparatus configuration of the left and right cutting tables 15 is generally the same, the following detailed explanation will primarily focus on the apparatus configuration of the left cutting table 15.

**[0024]** The cutting module B mainly includes a first receiving member 11, an accommodating portion 12, a mobile mechanism 13, a second receiving member 14, a cutting table 15, a rotation mechanism 17, a rear cover member 18, a front cover member 19, an upper cover member 20, a first removing member 21, a cleaning nozzle 22, and a spindle portion 23.

**[0025]** The first receiving member 11 shown in FIGS. 2 to 5 is a member that receives end materials E generated when cutting the sealed substrate W. Moreover, the first receiving

member 11 is one form of implementation of the receiving member of the present invention. The first receiving member 11 is formed in a box-like shape that is open upward and rearward. The first receiving member 11 is capable of receiving end materials E that have fallen from the cutting table 15, and the second receiving member 14, etc., which will be described later. The first receiving member 11 mainly includes a protruding portion 11a, an opening portion 11b, an inclined groove portion 11c, and a side portion 11d.

**[0026]** The protruding portion 11a shown in FIGS. 3 to 5 is a part formed such that the bottom surface of the first receiving member 11 is raised upward. The protruding portion 11a is formed as a left-right pair to correspond to the cutting table 15. The protruding portion 11a is formed to extend in the front-rear direction.

**[0027]** The opening portion 11b shown in FIGS. 4 and 5 is a part formed to penetrate the bottom surface of the first receiving member 11 up and down. The opening portion 11b is formed on the upper surface of the protruding portion 11a. The opening portion 11b is formed to extend in the front-rear direction across both front and rear end portions of the protruding portion 11a.

**[0028]** The inclined groove portion 11c shown in FIGS. 3 to 5 is a part formed such that the bottom surface of the first receiving member 11 is inclined sloping downward and rearward. Moreover, the inclined groove portion 11c is one form of implementation of the groove portion of the present invention. The inclined groove portion 11c is formed on both left and right sides of the protruding portion 11a. Specifically, the inclined groove portion 11c is formed in a total of three locations: between the left and right protruding portions 11a, and between the left and right protruding portions 11a and the side portion 11d, which will be described later. The inclined groove portion 11c is formed to extend along the front-rear direction. The upper

surface of the inclined groove portion 11c is formed to incline downward as it extends toward the rear.

[0029] The side portion 11d is a part that forms the side surface of the first receiving member 11. The side portion 11d is formed to surround the protruding portion 11a, the opening portion 11b, and the inclined groove portion 11c from both left and right sides and front. The side portion 11d is formed to have an appropriate up-down width.

[0030] The accommodating portion 12 is a part that collects the end materials E discharged from the first receiving member 11. The accommodating portion 12 is formed in a box-like shape with an open top. The accommodating portion 12 is positioned at the rear end portion of the first receiving member 11. Moreover, in this embodiment, for convenience, in FIG. 3 and other drawings, a configuration where the accommodating portion 12 and the first receiving member 11 are integrally formed is illustrated. However, it is also possible to configure the first receiving member 11 and the accommodating portion 12 as separate components, allowing the accommodating portion 12 to be detachable and replaceable with respect to the first receiving member 11.

[0031] The mobile mechanism 13 is for moving the cutting table 15 back and forth. The mobile mechanism 13 mainly includes a mobile member 13a, a linkage portion 13b, a nut 13c, and a screw shaft 13d.

[0032] The mobile member 13a is a member that supports the cutting table 15 and is capable of moving back and forth. Moreover, the mobile member 13a is one form of implementation of the mobile body of the present invention. The mobile member 13a is formed, for example, in a cuboid shape. The mobile member 13a is positioned above the protruding portion 11a.

[0033] The linkage portion 13b is a part that connects the mobile member 13a and the nut 13c. The linkage portion 13b is formed in an elongated shape (for example, cylindrical shape)

extending up and down. The linkage portion 13b is positioned to extend from below to above the first receiving member 11 through the opening portion 11b. The upper end portion of the linkage portion 13b is fixed to the mobile member 13a.

[0034] The nut 13c and the screw shaft 13d constitute a ball screw mechanism. The screw shaft 13d is positioned below the opening portion 11b. The screw shaft 13d is arranged with its longitudinal direction oriented horizontally (in the front-rear direction). The screw shaft 13d may be rotated by a driving force from a driving source (not shown) such as a motor. The nut 13c is fitted onto the screw shaft 13d. Multiple balls (not shown) are interposed between the nut 13c and the screw shaft 13d. The lower end portion of the linkage portion 13b is fixed to the upper portion of the nut 13c. The rotation of the nut 13c around the screw shaft 13d is prevented.

[0035] In the mobile mechanism 13, when the screw shaft 13d rotates, the nut 13c fitted onto the screw shaft 13d moves linearly in a direction (either front direction or rear direction) corresponding to the rotational direction of the screw shaft 13d. As the nut 13c moves, the mobile member 13a, which is connected to the nut 13c via the linkage portion 13b, also moves linearly together with the nut 13c.

[0036] The second receiving member 14 shown in FIGS. 2 and 3 is a member that receives the end materials E generated when cutting the sealed substrate W. The second receiving member 14 is formed in a box-like shape open towards the upward and rearward directions. The second receiving member 14 is fixed to the upper portion of the mobile member 13a. The second receiving member 14 is capable of receiving the end materials E that have fallen from the cutting table 15.

[0037] The cutting table 15 is the part where the sealed substrate W, which is the object to be cut, is placed. Moreover, the cutting table 15 is one form of implementation of the machining

table of the present invention. The cutting table 15 is positioned above the first receiving member 11 and the second receiving member 14. The cutting table 15 is supported by the mobile member 13a via the rotation mechanism 17, which will be described later.

**[0038]** The rotation mechanism 17 is for rotating the cutting table 15 in the  $\theta$  direction. The rotation mechanism 17 is interposed between the mobile member 13a and the cutting table 15. The rotation mechanism 17 may be rotated the cutting table 15 by a driving force from a driving source (not shown) such as a motor.

**[0039]** The rear cover member 18 shown in FIGS. 3 and 5 covers the opening portion 11b from above at the rear of the mobile member 13a. The rear cover member 18 is positioned on the upper portion of the protruding portion 11a. The rear cover member 18 is formed in a bellows-like shape and is configured to be extendable and retractable back and forth. The front portion of the rear cover member 18 is connected to the mobile member 13a. As a result, the rear cover member 18 extends and retracts in the front-rear direction in response to the movement of the mobile member 13a in the front-rear direction.

**[0040]** The front cover member 19 shown in FIGS. 2, 3, and 5 covers the opening portion 11b from above at the front of the mobile member 13a. The front cover member 19 is positioned on the upper portion of the protruding portion 11a. The front cover member 19 is formed in a bellows-like shape and is configured to be extendable and retractable back and forth. The rear portion of the front cover member 19 is connected to the mobile member 13a. As a result, the front cover member 19 extends and retracts in the front-rear direction in response to the movement of the mobile member 13a in the front-rear direction.

**[0041]** The upper cover member 20 covers the rear cover member 18 from above. The upper cover member 20 mainly includes multiple plate-shaped members 20a and a linkage portion 20b.

**[0042]** The multiple plate-shaped members 20a are formed in a rectangular plate shape. The multiple plate-shaped members 20a are arranged to align in the front-rear direction above the upper cover member 20. The multiple plate-shaped members 20a are positioned such that at least a part of each overlaps in the up-down direction with respect to the adjacent plate-shaped members 20a in the front and rear. The adjacent plate-shaped members 20a are connected to each other in a manner that allows relative movement. The multiple plate-shaped members 20a are arranged to extend over both the front and rear end portions of the rear cover member 18. The rear end portion of the plate-shaped member 20a positioned at the rearmost is arranged to overlap with the accommodating portion 12 in the up-down direction.

**[0043]** The linkage portion 20b connects the plate-shaped members 20a and the second receiving member 14. The linkage portion 20b is fixed to the bottom surface of the rear end portion of the second receiving member 14. The linkage portion 20b is connected to the plate-shaped member 20a positioned at the foremost. As a result, the multiple plate-shaped members 20a extend and retract in the front-rear direction in response to the movement of the second receiving member 14 (mobile member 13a) in the front-rear direction.

**[0044]** The first removing member 21 shown in FIGS. 2 and 3 is for discharging the end materials E from the first receiving member 11 (inclined groove portion 11c) to the accommodating portion 12. Moreover, the first removing member 21 is one form of implementation of the removing member of the present invention. The first removing member 21 is provided on both left and right side surfaces of the mobile member 13a. Moreover, for convenience, the first removing member 21 is simplified in drawings other than FIG. 6, so the configuration of the first removing member 21 will be described using FIG. 6 below. The first removing member 21 mainly includes a support portion 21a, a mounting portion 21b, and a main body portion 21c.

**[0045]** The support portion 21a is a part that supports the mounting portion 21b and the main body portion 21c, which will be described later, in a swingable manner. The support portion 21a is fixed to both left and right side surfaces of the mobile member 13a respectively. The support portion 21a is provided to protrude from the mobile member 13a towards both left and right sides (at a position that overlaps with the inclined groove portion 11c in the up-down direction). A through hole 21d that penetrates the support portion 21a up and down is formed in the support portion 21a. The through hole 21d is only formed in a number corresponding to the mounting portion 21b to be described later (in this embodiment, two for one support portion 21a).

**[0046]** The mounting portion 21b is a member that is mounted on the mobile member 13a in a swingable manner. The mounting portion 21b is formed in an approximately cylindrical shape. The diameter of both upper and lower end portions of the mounting portion 21b is formed larger than the diameter of the upper and lower middle portion. The diameter of the upper and lower middle portion of the mounting portion 21b is formed smaller than the inner diameter of the through hole 21d of the support portion 21a. The diameter of both upper and lower end portions of the mounting portion 21b is formed larger than the inner diameter of the through hole 21d of the support portion 21a.

**[0047]** The upper and lower middle portion of the mounting portion 21b is inserted into the through hole 21d of the support portion 21a. Since the diameter of both upper and lower end portions of the mounting portion 21b is larger than the inner diameter of the through hole 21d, the mounting portion 21b does not fall off from the support portion 21a. In this state, there is a gap between the upper and lower middle portion of the mounting portion 21b and the through hole 21d, so the mounting portion 21b is supported to be swingable within a predetermined movable range with respect to the support portion 21a.

[0048] Moreover, FIG. 6 shows a simplified structure of the mounting portion 21b, but in reality, to insert the mounting portion 21b into the through hole 21d, the mounting portion 21b may be composed of multiple separable members (for example, a bolt and a nut, etc.).

[0049] The main body portion 21c is a member that is arranged to contact the inclined groove portion 11c. The main body portion 21c is formed in a rectangular plate shape with its longitudinal direction facing forward and rearward in a plan view. The front end portion of the main body portion 21c is fixed to the lower portion of the mounting portion 21b at a position lower than the support portion 21a. The rear portion of the main body portion 21c is arranged to extend downward and rearward from the mounting portion 21b. Since the mounting portion 21b is swingable, the main body portion 21c lowers by its own weight until its rear end portion contacts the upper surface of the inclined groove portion 11c.

[0050] It is desirable that at least the portion of the main body portion 21c that contacts the inclined groove portion 11c (tip portion 21e) is formed of an elastic body such as rubber. For example, it is possible to form the tip portion 21e of the main body portion 21c with an elastic body and form the other parts with a metal plate. Moreover, it is possible to form the entire main body portion 21c with an elastic body.

[0051] The main body portion 21c is mounted on the mobile member 13a in a swingable manner via the mounting portion 21b. Since the main body portion 21c swings downward due to its own weight, it may constantly contact the inclined groove portion 11c by following the inclined groove portion 11c even in the case where the first removing member 21 moves back and forth as described later.

[0052] Moreover, since the inclined groove portion 11c is inclined with respect to the moving direction (horizontal direction) of the mobile member 13a, an angle  $\alpha$  formed between the main body portion 21c of the first removing member 21 and the inclined groove portion 11c changes

according to the position of the mobile member 13a (first removing member 21). In this embodiment, regardless of the position of the mobile member 13a, the angle  $\alpha$  formed between the main body portion 21c and the inclined groove portion 11c is set to be 45 degrees or less.

[0053] In this manner, the first removing member 21 is provided on both left and right sides of the mobile member 13a, thereby being arranged to correspond to the three inclined groove portions 11c respectively.

[0054] The cleaning nozzle 22 shown in FIGS. 2 to 4 is for spraying cleaning water onto the inclined groove portion 11c. The cleaning nozzle 22 is positioned above the front portion of the inclined groove portion 11c, directed rearward. The cleaning nozzle 22 may spray cleaning water from its tip (rear end). The cleaning water sprayed from the cleaning nozzle 22 can sweep away the end materials E in the inclined groove portion 11c and wash away contaminants such as cutting chips, etc.

[0055] The spindle portion 23 shown in FIGS. 2 and 3 is for cutting the sealed substrate W, which is the object to be cut. Moreover, the spindle portion 23 is one form of implementation of the cutting mechanism of the present invention. The blade 23a that rotates in a plane including the front-rear direction and the up-down direction is mounted on the spindle portion 23. Moreover, near the spindle portion 23, a cutting nozzle 23b is provided for supplying cutting water when cutting the sealed substrate W. The cutting nozzle 23b may move integrally with the spindle portion 23.

[0056] <Discharge of end materials E>

The following describes how the end materials E that have fallen into the inclined groove portion 11c are discharged in the cutting apparatus 100 configured as described above, using FIGS. 3 and 7.

[0057] In the case of cutting the sealed substrate W, the mobile member 13a may be moved back and forth by rotating the screw shaft 13d of the mobile mechanism 13, and furthermore, the cutting table 15 may be moved in the front-rear direction. By combining the movement of the cutting table 15 in the front-rear direction by the mobile mechanism 13, the rotation of the cutting table 15 in the  $\theta$  direction by the rotation mechanism 17, and the movement of the spindle portion 23 in the left-right direction and up-down direction, the sealed substrate W placed on the cutting table 15 may be cut and singulated by the blade 23a.

[0058] The end materials E and cutting chips, etc., generated by cutting the sealed substrate W may fall from the cutting table 15 into the inclined groove portion 11c of the first receiving member 11. In response to this, when cutting the sealed substrate W, cleaning water is sprayed continuously or intermittently from the cleaning nozzle 22. This cleaning water can sweep away the end materials E and cutting chips, etc., that have fallen into the inclined groove portion 11c towards the accommodating portion 12.

[0059] Furthermore, in this embodiment, the first removing member 21 can more reliably discharging the end materials E, etc., that have fallen into the inclined groove portion 11c to the accommodating portion 12. Specifically, when the cutting table 15 moves back and forth while cutting the sealed substrate W, the first removing member 21 provided on the mobile member 13a also moves back and forth accordingly.

[0060] As shown in FIG. 3, in the case where the first removing member 21 moves rearward, the end materials E that have fallen behind the first removing member 21 are pushed from the front towards the accommodating portion 12 by the first removing member 21. As a result, even end materials E that cannot be completely washed away by the cleaning water from the cleaning nozzle 22 can be more reliably discharged to the accommodating portion 12 using the first removing member 21. Moreover, by providing a gap between the mounting portion 21b

and the through hole 21d of the support portion 21a, and by providing the tip portion 21e formed of an elastic body to the main body portion 21c, excessive load or resistance applied to the first removing member 21 can be suppressed when pushing out the end materials E.

5 [0061] Furthermore, as shown in FIG. 7, in the case where the first removing member 21 moves forward, if the first removing member 21 contacts the end materials E that have fallen in front of the first removing member 21, the first removing member 21 may swing upward and pass from the rear to the front above the end materials E. In this embodiment, the first removing member 21 is configured to be swingable in this manner. Moreover, the angle  $\alpha$  formed between the main body portion 21c and the inclined groove portion 11c is 45 degrees or less. As a result, the force pushing the end materials E backward is greater than the force pushing the end materials E back forward. Consequently, this can prevent the end materials E from being pushed back in a direction away from the accommodating portion 12 when the first removing member 21 moves forward.

15 [0062] The first embodiment of the present invention has been described above, but the present invention is not limited to the above-described embodiment, and appropriate modifications are possible within the scope of the technical idea of the invention described in the claims.

[0063] For example, the configuration (shape, arrangement, number, etc.) of each part of the cutting apparatus 100 described in this embodiment is not particularly limited and may be 20 arbitrarily changed.

[0064] Moreover, the configuration of the first removing member 21 shown in this embodiment is just an example, and the present invention is not limited thereto. For example, the configuration for swingably supporting the main body portion 21c is not limited to the configuration using the support portion 21a and the mounting portion 21b as in this embodiment

(refer to FIG. 6). As another example of the configuration, it is also possible to have a structure that swingably supports the main body portion 21c using a horizontally arranged swing axis.

[0065] Furthermore, in this embodiment, the tip portion 21e of the main body portion 21c is formed of an elastic body, but the material of the main body portion 21c is not particularly limited. Moreover, in this embodiment, the first removing member 21 is arranged such that the angle  $\alpha$  formed between the main body portion 21c and the inclined groove portion 11c is 45 degrees or less, but the posture of the first removing member 21 is not limited to this and may be arbitrarily changed.

[0066] Moreover, in this embodiment, an example where the first removing member 21 is provided on the mobile member 13a is shown, but the present invention is not limited thereto, and it is also possible to provide the first removing member 21 on other members that move integrally with the cutting table 15. For example, it is possible to provide the first removing member 21 on the second receiving member 14 or the linkage portion 13b.

[0067] Furthermore, in this embodiment, the first removing member 21 is configured to move integrally with the cutting table 15 via the mobile member 13a, but the present invention is not limited thereto, and it is also possible to configure the first removing member 21 and the cutting table 15 to move independently of each other. In this case, it is possible to provide a separate mobile mechanism for moving the first removing member 21, in addition to the mobile mechanism 13 that moves the cutting table 15.

[0068] <Second Embodiment>

The following describes the cutting apparatus 100 according to the second embodiment using FIG. 8(a). The cutting apparatus 100 according to the second embodiment differs from the cutting apparatus 100 of the first embodiment (refer to FIG. 3, etc.) in that it includes a

second removing member 24. Therefore, the following mainly describes the second removing member 24.

[0069] The second removing member 24 is for discharging the end materials E on the upper cover member 20 into the accommodating portion 12. The second removing member 24 is formed of an elastic body such as rubber. The second removing member 24 is formed in a plate shape. With the second removing member 24 sandwiched between the rear portion of the second receiving member 14 and a plate-shaped member 14a for fixing, the plate-shaped member 14a is fixed to the second receiving member 14 with fasteners such as bolts, whereby the second removing member 24 is fixed to the rear portion of the second receiving member 14. The second removing member 24 is arranged to extend downward and rearward from the second receiving member 14. The tip portion (rear end portion) of the second removing member 24 is arranged to contact the upper cover member 20.

[0070] In response to the cutting table 15 moving back and forth when cutting the sealed substrate W, the second removing member 24 provided on the second receiving member 14 also moves back and forth accordingly. In the case where the second removing member 24 moves rearward, the end materials E falling on the upper cover member 20 is pushed from the front toward the accommodating portion 12 by the second removing member 24, and is discharged from the upper cover member 20 into the accommodating portion 12. This can prevent the end materials E from falling through the gap between the plate-shaped members 20a onto the rear cover member 18, thereby preventing damage to the rear cover member 18.

[0071] Moreover, as shown by the imaginary line in FIG. 8(a), the position of the second removing member 24 is adjusted such that when the cutting table 15 moves to its rearmost position, the second removing member 24 is located further rearward than the rear end portion of

the upper cover member 20. This enables more reliable discharge of the end materials E into the accommodating portion 12.

**[0072]** <Third Embodiment>

5 The following describes the cutting apparatus 100 according to the third embodiment using FIG. 8(b). The cutting apparatus 100 according to the third embodiment differs from the cutting apparatus 100 of the second embodiment (refer to FIG. 8(a)) in that it includes a third removing member 25 instead of the second removing member 24. Therefore, the following mainly describes the third removing member 25.

**[0073]** The third removing member 25 is for discharging the end materials E on the upper  
10 cover member 20 into the accommodating portion 12. The third removing member 25 is composed of a brush having bundled bristles. For the material of the bristles of the third removing member 25, synthetic fibers may be used, for example. The third removing member 25 is provided on a bottom surface of the rear portion of the second receiving member 14. The tip portion (lower end portion) of the third removing member 25 is arranged to contact the upper  
15 cover member 20.

**[0074]** With the third removing member 25 configured in this manner, similar to the second removing member 24 of the second embodiment, it is possible to push out and discharge the end materials E falling on the upper cover member 20 toward the accommodating portion 12.

**[0075]** <Supplementary Note>

20 A cutting apparatus 100 of the first aspect of the present invention includes:  
a cutting table 15 (machining table) which is movable along a linear moving direction;  
a spindle portion 23 (cutting mechanism) which cuts the sealed substrate W (object to be cut) placed on the cutting table 15;

a first receiving member 11 (receiving member) which is formed along the moving direction below the cutting table 15, and which has an inclined groove portion 11c (groove portion) capable of receiving end materials E generated when the sealed substrate W is cut by the spindle portion 23;

- 5           a mobile member 13a (mobile body) which is movable along the moving direction; and
- a first removing member 21 (removing member) which is provided on the mobile member 13a, which is arranged to contact the inclined groove portion 11c, and which removes the end materials E from the inclined groove portion 11c.

          According to the cutting apparatus 100 of the first aspect of the present invention, the end materials E can be discharged more reliably. Specifically, the first removing member 21, which moves together with the mobile member 13a, can directly push out and discharge the end materials E that has fallen into the inclined groove portion 11c. As a result, the end materials E (the end materials E accumulated or adhered to the inclined groove portion 11c) that cannot be completely discharged by cleaning water can be more reliably discharged from the inclined groove portion 11c.

**[0076]** In the cutting apparatus 100 of the second aspect following the first aspect,

the mobile member 13a is integrally movable with the cutting table 15 along the moving direction.

          According to the cutting apparatus 100 of the second aspect of the present invention, the mechanism (mobile mechanism 13) for moving the cutting table 15 and the mechanism for moving the first removing member 21 may be used simultaneously.

**[0077]** The cutting apparatus 100 of the third aspect according to the first or second aspect includes:

an accommodating portion 12 which is arranged on one side of the first receiving member 11 in the moving direction and capable of accommodating the end materials E, in which the first removing member 21 includes:

a mounting portion 21b which is swingably mounted to the mobile member 13a; and

5 a main body portion 21c which is arranged to be inclined downward toward the accommodating portion 12 side from the mounting portion 21b, and which is in contact with the inclined groove portion 11c.

According to the cutting apparatus 100 of the third aspect of the present invention, it is possible to suppress excessive load from being applied to the first removing member 21 when  
10 extruding the end materials E. In addition, when the first removing member 21 moves in a direction away from the accommodating portion 12, the main body portion 21c can be swung to ride over the end materials E, thereby preventing the end materials E from being pushed back in a direction away from the accommodating portion 12.

**[0078]** In the cutting apparatus 100 of the fourth aspect according to the third aspect,  
15 the main body portion 21c is arranged to have an angle  $\alpha$  of 45 degrees or less with the inclined groove portion 11c.

According to the cutting apparatus 100 of the fourth aspect of the present invention, it is possible to make it easier to extrude the end materials E toward the accommodating portion 12.

**[0079]** In the cutting apparatus 100 of the fifth aspect according to the third or fourth aspect,  
20 the main body portion 21c has a part (tip portion 21e) in contact with the inclined groove portion 11c, the part being formed of an elastic body.

According to the cutting apparatus 100 of the fifth aspect of the present invention, it is possible to suppress excessive load from being applied to the first removing member 21 when

extruding the end materials E. In addition, it is possible to suppress the occurrence of damage (such as wear) to the inclined groove portion 11c that contacts the main body portion 21c.

**[0080]** In the cutting apparatus 100 of the sixth aspect according to the third to fifth aspects,

the inclined groove portion 11c is formed to be inclined downward toward the  
5 accommodating portion 12 side.

According to the cutting apparatus 100 of the sixth aspect of the present invention, it is possible to make it easier to discharge the end materials E toward the accommodating portion 12. In addition, since it is difficult for cleaning water and the like to remain in the inclined groove portion 11c, it is possible to suppress the end materials E from adhering to the inclined  
10 groove portion 11c.

**[0081]** The cutting apparatus 100 of the seventh aspect according to the first to sixth aspects includes:

a screw shaft 13d which is arranged below the mobile member 13a and which extends along the moving direction;

15 a nut 13c which is movable along the screw shaft 13d in response to rotation of the screw shaft 13d; and

a linkage portion 13b which connects the nut 13c and the mobile member 13a.

According to the cutting apparatus 100 of the seventh aspect of the present invention, it is possible to move the mobile member 13a with a simple configuration.

20 **[0082]** A method for manufacturing cut article according to the eighth aspect of the present invention is a method for manufacturing cut article using the cutting apparatus 100 according to any one of the first to seventh aspects, the method including:

a step of placing the sealed substrate W on the cutting table 15; and

a step of cutting the sealed substrate W by relatively moving the spindle portion 23 and the cutting table 15.

According to the method for manufacturing cut article of the eighth aspect of the present invention, it is possible to discharge the end materials E more reliably.

## 5 Reference Signs List

[0083] 11 First receiving member

11c Inclined groove portion

12 Accommodating portion

13a Mobile member

10 13b Linkage portion

13c Nut

13d Screw shaft

15 Cutting table

21 First removing member

15 21b Mounting portion

21c Main body portion

21e Tip portion

23 Spindle portion

100 Cutting apparatus

20

WHAT IS CLAIMED IS:

[Claim 1] A cutting apparatus, comprising:

a machining table which is movable along a linear moving direction;

a cutting mechanism which cuts an object to be cut placed on the machining table;

5 a receiving member which is formed along the moving direction below the machining table, and which has a groove portion capable of receiving end materials generated when the object to be cut is cut by the cutting mechanism;

a mobile body which is movable along the moving direction; and

10 a removing member which is provided on the mobile body, which is arranged to contact the groove portion, and which removes the end materials from the groove portion.

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

wherein the mobile body is integrally movable with the machining table along the moving direction

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[Claim 3] The cutting apparatus according to claim 1 or claim 2, further comprising:

an accommodating portion which is arranged on one side of the receiving member in the moving direction and capable of accommodating the end materials,

wherein the removing member comprises:

20 a mounting portion which is swingably mounted on the mobile body; and

a main body portion which is arranged to be inclined downward toward the accommodating portion side from the mounting portion and which is in contact with the groove portion.

[Claim 4] The cutting apparatus according to claim 3,

wherein the main body portion is arranged to have an angle of 45 degrees or less with the groove portion.

5 [Claim 5] The cutting apparatus according to claim 3 or claim 4,

wherein the main body portion has a part in contact with the groove portion, the part being formed of an elastic body.

[Claim 6] The cutting apparatus according to any one of claims 3 to 5,

10 wherein the groove portion is formed to be inclined downward toward the accommodating portion side.

[Claim 7] The cutting apparatus according to any one of claims 1 to 6, comprising:

15 a screw shaft which is arranged below the mobile body and which extends along the moving direction;

a nut which is movable along the screw shaft in response to rotation of the screw shaft; and

a linkage portion which connects the nut and the mobile body.

20 [Claim 8] A method for manufacturing cut article using the cutting apparatus according to any one of claims 1 to 7, the method comprising:

a step of placing the object to be cut on the machining table; and

a step of cutting the object to be cut by relatively moving the cutting mechanism and the machining table.