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(71) Applicant: **EBARA CORPORATION**
Ota-ku,
Tokyo 144-8510 (JP)

(72) Inventor: **KASHIWAGI, Makoto**
Tokyo 144-8510 (JP)

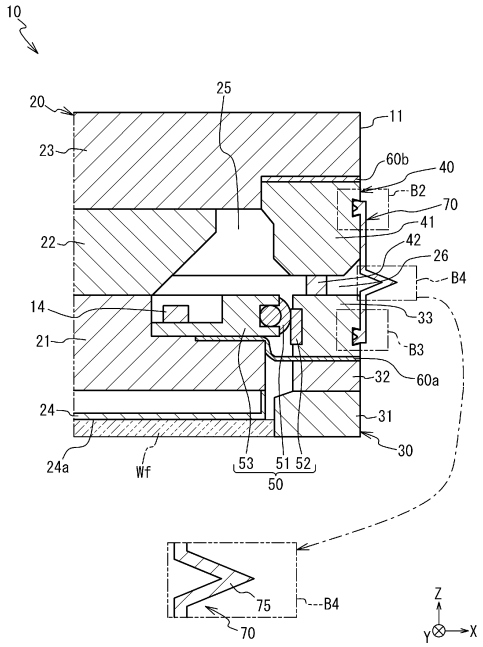
(74) Representative: **Schmidbauer, Andreas Konrad**
Wagner & Geyer Partnerschaft mbB
Patent- und Rechtsanwälte
Gewürzmühlstrasse 5
80538 München (DE)

(54) **TOP RING OF POLISHING APPARATUS AND POLISHING APPARATUS**

(57) Provided is a technique that allows suppressing disengagement of a fitting portion of a band from a groove during the use of a top ring.

In a top ring 10 of a polishing apparatus 100, at least one of an outer peripheral wall 11 of a retainer member 30 and an outer peripheral wall 11 of a pressing mechanism 40 is provided with a groove 15 in which fitting portions 71a, 71b of a band 70 are fitted. The groove is a dovetail groove configured to have a groove opening, a groove bottom opposed to the groove opening, a first groove side wall connecting the groove opening to the groove bottom, and a second groove side wall connecting the groove opening to the groove bottom and opposed to the first groove side wall, in cross-sectional view, and the dovetail groove is configured such that an interval between the first groove side wall and the second groove side wall widens as the interval approaches the groove bottom. The fitting portion is configured to be in contact with the first groove side wall and the second groove side wall in a state where the fitting portion of the band is fitted in the dovetail groove.

Fig. 4



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Description

TECHNICAL FIELD

[0001] The present invention relates to a top ring of a polishing apparatus and a polishing apparatus. This application claims priority from Japanese Patent Application No. 2021-118470 filed on July 19, 2021. The entire disclosure including the description, the claims, the drawings, and the abstract in Japanese Patent Application No. 2021-118470 is herein incorporated by reference.

BACKGROUND ART

[0002] As a polishing apparatus that polishes a substrate, there has been conventionally known a polishing apparatus including a top ring that holds a substrate and a polishing table that holds a polishing pad for polishing this substrate (for example, see PTL 1). The top ring of such a polishing apparatus includes a top ring main body having a substrate support surface that supports an upper surface of the substrate, a retainer member disposed so as to surround an outer periphery of the substrate support surface to hold an outer edge of the substrate, a pressing mechanism disposed above the retainer member and configured to press the retainer member downward, and a band disposed extending from an outer peripheral wall of the retainer member to an outer peripheral wall of the pressing mechanism. There is provided a groove on the outer peripheral wall of the retainer member and on the outer peripheral wall of the pressing mechanism, and fitting portions of the band (fitting portions disposed on both ends of the band in PTL 1) are fitted in these grooves.

CITATION LIST

PATENT LITERATURE

[0003] PTL 1: Japanese Unexamined Patent Application Publication No. 2020-19115

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004] The top ring of the conventional polishing apparatus as described above had a risk of disengagement of the band from the retainer member or the pressing mechanism during the use of the top ring.

[0005] The present invention has been made in view of the above-described circumstances, and one of the objects of the present invention is to provide a technique that allows suppressing disengagement of a band from a retainer member or a pressing mechanism during the use of a top ring.

SOLUTION TO PROBLEM

(Aspect 1)

[0006] To achieve the above-described object, a top ring of a polishing apparatus according to one aspect of the present invention includes a top ring main body, a retainer member, a pressing mechanism, and a band. The top ring main body has a substrate support surface supporting an upper surface of a substrate. The retainer member is disposed so as to surround an outer periphery of the substrate support surface to hold an outer edge of the substrate. The pressing mechanism is disposed above the retainer member and configured to press the retainer member downward. The band is disposed extending from an outer peripheral wall of the retainer member to an outer peripheral wall of the pressing mechanism, the band having at least one fitting portion. At least one of the outer peripheral wall of the retainer member and the outer peripheral wall of the pressing mechanism is provided with a groove in which the fitting portion of the band is fitted. The groove is a dovetail groove configured to have a groove opening, a groove bottom opposed to the groove opening, a first groove side wall connecting the groove opening to the groove bottom, and a second groove side wall connecting the groove opening to the groove bottom and opposed to the first groove side wall, in cross-sectional view, and the dovetail groove is configured such that an interval between the first groove side wall and the second groove side wall widens as the interval approaches the groove bottom. The fitting portion is configured to be in contact with the first groove side wall and the second groove side wall in a state where the fitting portion of the band is fitted in the dovetail groove.

[0007] With this aspect, since the groove in which the fitting portion of the band is fitted is the dovetail groove as described above, a degree of fitting between the fitting portion of the band and the groove can be strengthened in comparison to a case where the groove in which the fitting portion of the band is fitted is not the dovetail groove (for example, a case where an interval between the pair of groove side walls is a groove in a cross-sectionally constant rectangular shape). This allows suppressing disengagement of the fitting portion of the band from the groove during the use of the top ring. As a result, disengagement of the band from the retainer member or the pressing mechanism during the use of the top ring is suppressible.

(Aspect 2)

[0008] In the above-described aspect 1, the fitting portion of the band may have a first projecting portion in contact with the first groove side wall and a second projecting portion in contact with the second groove side wall. A V-shaped groove in a cross-sectionally V shape may be provided between the first projecting portion and

the second projecting portion.

(Aspect 3)

[0009] In the above-described aspect 1 or 2, a part of the band may be provided with an expansion and contraction portion expandable and contractable in a vertical direction.

[0010] With this aspect, since the expansion and contraction portion of the band is expandable and contractable in the vertical direction when the retainer member is displaced in the vertical direction, the disengagement of the fitting portion of the band from the groove is effectively suppressible.

(Aspect 4)

[0011] In any one aspect of the above-described aspects 1 to 3, the groove may be provided only on any one of the outer peripheral wall of the retainer member and the outer peripheral wall of the pressing mechanism.

(Aspect 5)

[0012] In any one aspect of the above-described aspects 1 to 3, the groove may be provided on both the outer peripheral wall of the retainer member and the outer peripheral wall of the pressing mechanism.

(Aspect 6)

[0013] In any one aspect of the above-described aspects 1 to 3, the groove may be provided only on the outer peripheral wall of the retainer member among the outer peripheral wall of the retainer member and the outer peripheral wall of the pressing mechanism. The top ring main body may have an upper side member disposed so as to cover an upper portion of the pressing mechanism. One end portion of both end portions of the band may be sandwiched between the upper side member and the pressing mechanism. The fitting portion of the band may be disposed on another end portion of the band.

[0014] With this aspect, since the fitting portion disposed on the other end portion of the band is fitted in the groove (the dovetail groove), the disengagement of this fitting portion from the groove is suppressible. Since the one end portion of the band is sandwiched between the upper side member and the pressing mechanism, disengagement of the one end portion of the band is also suppressible. With this aspect, for example, disengaging the fitting portion of the band from the groove during the maintenance of the top ring allows, for example, easily dividing the retainer member from the top ring. This allows improved maintainability of the top ring.

(Aspect 7)

[0015] In any one aspect of the above-described aspects 1 to 6, the groove opening may be provided with a depressed portion for a processing tool for processing the groove to pass through when the processing tool is inserted from the groove opening into the groove.

[0016] With this aspect, since the processing tool is easily insertable into the groove from the groove opening where the depressed portion is provided, the groove is easily processable.

(Aspect 8)

[0017] In any one aspect of the above-described aspects 1 to 7, the substrate may be a polygonal substrate.

(Aspect 9)

[0018] To achieve the above-described object, a top ring of a polishing apparatus according to one aspect of the present invention includes a top ring main body, a retainer member, a pressing mechanism, and a band. The top ring main body has a substrate support surface supporting an upper surface of a substrate. The retainer member is disposed so as to surround an outer periphery of the substrate support surface to hold an outer edge of the substrate. The pressing mechanism is disposed above the retainer member and configured to press the retainer member downward. The band is disposed extending from an outer peripheral wall of the retainer member to an outer peripheral wall of the pressing mechanism, the band having a fitting portion. The outer peripheral wall of the retainer member is provided with a groove in which the fitting portion of the band is fitted. The top ring main body has an upper side member disposed so as to cover an upper portion of the pressing mechanism. One end portion of both end portions of the band is sandwiched between the upper side member and the pressing mechanism. The fitting portion of the band is disposed on another end portion of the band.

[0019] With this aspect, since the one end portion of the band is sandwiched between the upper side member and the pressing mechanism, the disengagement of the one end portion of the band from the pressing mechanism during the use of the top ring is suppressible. That is, the disengagement of the band from the pressing mechanism during the use of the top ring is suppressible.

(Aspect 10)

[0020] To achieve the above-described object, a polishing apparatus according to one aspect of the present invention includes the top ring according to any one aspect of the above-described aspects 1 to 9 and a polishing table configured to hold a polishing pad for polishing the substrate held by the top ring.

[0021] With this aspect, the disengagement of the band from the retainer member or the pressing mechanism during the use of the top ring is suppressible.

BRIEF DESCRIPTION OF DRAWINGS

[0022]

Fig. 1A is a schematic diagram illustrating a main configuration of a polishing apparatus according to an embodiment.
Fig. 1B is a schematic plan view (a top view) of a polishing apparatus main body.
Fig. 2 is a schematic perspective view of a top ring according to the embodiment.
Fig. 3 is a schematic cross-sectional view of the top ring according to the embodiment.
Fig. 4 is a schematic enlarged cross-sectional view of the part B1 in Fig. 3.
Fig. 5A is schematic enlarged cross-sectional views of the part B2 and the part B3 in Fig. 4.
Fig. 5B is a schematic exploded view of a configuration of the part B2 in Fig. 4.
Fig. 6 is an enlarged cross-sectional view schematically illustrating an enlarged part of a top ring of a polishing apparatus according to a modification 1 of the embodiment.
Fig. 7A is a schematic diagram illustrating a state where a peripheral configuration of a groove of a pressing mechanism of a top ring according to a modification 2 of the embodiment is visually perceived from the front.
Fig. 7B is a schematic front view of a processing tool.
Fig. 8 is a schematic diagram illustrating a state where a part of an outer peripheral wall of the top ring according to the modification 2 of the embodiment is visually perceived from the -X-direction.

DESCRIPTION OF EMBODIMENTS

(Embodiment)

[0023] The following describes an embodiment of the present invention with reference to the drawings. Note that the drawings give schematic illustrations to facilitate understanding of features, and the dimensional proportion and the like of each component are not necessarily the same as actual ones. Further, in the drawings, orthogonal coordinates of X-Y-Z are illustrated as necessary. Of the orthogonal coordinates, the Z-direction corresponds to an upper side, and the -Z-direction corresponds to a lower side (a direction in which gravity acts).

[0024] Fig. 1A is a schematic diagram illustrating a main configuration of a polishing apparatus 100 according to the embodiment. Fig. 1B is a schematic plan view (top view) of a polishing apparatus main body 101. The polishing apparatus 100 according to the embodiment is a polishing apparatus that can perform chemical mechanical polishing (CMP). Specifically, the polishing apparatus 100 exemplified in Fig. 1A includes the polishing apparatus main body 101 and a control device 120.

[0025] The polishing apparatus main body 101 mainly includes a polishing table 102, a top ring 10, and a dresser 104. The polishing table 102 is configured to hold a polishing pad Pd and to rotate. Specifically, the polishing table 102 according to the embodiment is configured of a disc-shaped member, and the polishing pad Pd is attached to an upper surface of the disc-shaped member. An upper surface (a front surface) of the polishing pad Pd corresponds to a polishing surface. The polishing table 102 is connected to a table rotation shaft 103. This table rotation shaft 103 is rotatably driven by a driving mechanism (for example, a rotation motor), and thus, the polishing table 102 rotates. During polishing, a substrate Wf described later is pressed against the polishing pad Pd. This polishes the substrate Wf. The rotation operation of the polishing table 102 is controlled by the control device 120. Note that "R1" illustrated in Fig. 1B is one example of rotation directions of the polishing table 102.

[0026] The polishing pad Pd is not particularly limited to a specific type, and various kinds of polishing pads, such as a polishing pad of a hard foam type, a polishing pad of a nonwoven fabric type, and a polishing pad of a suede type, can be employed.

[0027] In the embodiment, as one example of the substrate Wf, a polygonal substrate with corner portions is employed. The number of the corner portions of this polygonal substrate is not particularly limited as long as it is three or more, and is four as one example in the embodiment. That is, the substrate Wf according to the embodiment is a quadrilateral substrate. The shape of the substrate Wf, however, is not limited to such a polygon, and may, for example, be a circular shape (including an ellipse) without a corner portion.

[0028] The top ring 10 is a member for holding the substrate Wf. The top ring 10 is configured to rotate while pressing a lower surface (that is, a surface to be polished) of the substrate Wf against the polishing pad Pd. Specifically, the top ring 10 is connected to a ring rotation shaft 105. This ring rotation shaft 105 is rotatably driven by a driving mechanism (for example, a rotation motor), and thus, the top ring 10 rotates. Note that "R2" illustrated in Fig. 1B is one example of rotation directions of the top ring 10.

[0029] The top ring 10 according to the embodiment is configured to swing with respect to the polishing pad Pd. Specifically, the ring rotation shaft 105 of the top ring 10 is connected to a substrate swing shaft 107 via a substrate swing arm 106. The substrate swing shaft 107 is swingably driven by a driving mechanism, thus, the substrate swing arm 106 swings in an arc about the substrate swing shaft 107 (that is, turns clockwise and counterclockwise), and as a result, the top ring 10 also swings in a similar way. The rotation operation and the swing operation of the top ring 10 are controlled by the control device 120. Note that "SW1" illustrated in Fig. 1B is one example of swinging directions of the top ring 10.

[0030] The dresser 104 is a member for dressing the polishing surface of the polishing pad Pd. The dresser 104 has a lower surface on which abrasive grains (for

example, diamonds) are disposed. The dresser 104 is connected to a dresser rotation shaft 108. This dresser rotation shaft 108 is rotatably driven by a driving mechanism (for example, a rotation motor), and thus, the dresser 104 rotates. Note that "R3" illustrated in Fig. 1B is one example of rotation directions of the dresser 104.

[0031] The dresser 104 according to the embodiment is configured to swing with respect to the polishing pad Pd. Specifically, the dresser rotation shaft 108 of the dresser 104 is connected to a dresser swing shaft 110 via a dresser swing arm 109. The dresser swing shaft 110 is swingably driven by a driving mechanism (for example, a swing motor), thus, the dresser swing arm 109 swings about the dresser swing shaft 110, and as a result, the dresser 104 also swings in a similar way. The rotation operation and the swing operation of this dresser 104 is controlled by the control device 120. Note that "SW2" illustrated in Fig. 1B is one example of swinging directions of the dresser 104.

[0032] The polishing apparatus 100 includes a slurry supply mechanism (not illustrated) for supplying slurry (polishing slurry) to the polishing surface of the polishing pad Pd. For the slurry, a solution containing abrasive grains of, for example, silicon oxide, aluminum oxide, and cerium oxide can be employed. It is only necessary that the specific type of this slurry is appropriately set according to the type of the substrate Wf. Note that the slurry may be supplied from an upper side of the polishing pad Pd, may be supplied from a lower side, or may be supplied from both the upper side and the lower side. The polishing apparatus 100 polishes the substrate Wf with each of the polishing table 102 and the top ring 10 rotating in the presence of the slurry.

[0033] The control device 120 integrally controls the operation of the polishing apparatus 100. Specifically, the control device 120 according to the embodiment includes a microcomputer. This microcomputer includes a central processing unit (CPU) 121 as a processor, a storage device 122 as a non-transitory storage medium, and the like. In the control device 120, the CPU 121 as the processor operates based on a command of a program stored in the storage device 122 to control the operation of the polishing apparatus 100.

[0034] Fig. 2 is a schematic perspective view of the top ring 10. The top ring 10 according to the embodiment has a rectangular parallelepiped shape as one example. The top ring 10 has an outer peripheral wall 11 having a plurality of corner portions 12 and connection walls 13 connecting the neighboring corner portions 12. In the embodiment, the number of the corner portions 12 is four. The number of the corner portions 12, however, is not limited to four, and may be three or may be five or more. Alternatively, the top ring 10 may have an external shape without the corner portions 12 (for example, a circular shape). Note that the corner portion 12 may be rounded (in this case, the corner portion 12 is rounded). The connection wall 13 according to the embodiment is configured of a flat surface as one example. Note that the outer peripheral wall 11 of the top ring 10 includes an outer peripheral wall of a retainer member 30 and an outer peripheral wall of a pressing mechanism 40, which will be described later, of the top ring 10.

[0035] Fig. 3 is a schematic cross-sectional view of the top ring 10, and specifically, schematically illustrates a cross section taken along the line A1-A1 in Fig. 2. Fig. 4 is a schematic enlarged cross-sectional view of the part B1 in Fig. 3. With reference to Fig. 3 and Fig. 4, the top ring 10 according to the embodiment includes a top ring main body 20, the retainer member 30, the pressing mechanism 40, a guide mechanism 50, a sealing member 60a, a sealing member 60b, and a band 70.

[0036] As illustrated in Fig. 3 and Fig. 4, the top ring main body 20 according to the embodiment includes a lower side member 21, an intermediate member 22 disposed above the lower side member 21, an upper side member 23 disposed above the intermediate member 22, and an elastic film 24 disposed below the lower side member 21. This elastic film 24 has a lower surface corresponding to a "substrate support surface 24a" that supports an upper surface of the substrate Wf. The upper side member 23, the intermediate member 22, and the lower side member 21 are fastened to one other with a bolt (not illustrated).

[0037] The elastic film 24 according to the embodiment is configured to expand like an airbag with the introduction of a gas. The top ring main body 20 having such an elastic film 24 allows pressing the substrate Wf against the polishing pad Pd with a uniform pressure while polishing the substrate Wf. Note that the configuration of this top ring main body 20 is not described in detail any further as it is similar to that of the top ring main body of the known polishing apparatus as described in PTL 1.

[0038] As illustrated in Fig. 4, the retainer member 30 is disposed to surround an outer periphery of the substrate support surface 24a. The retainer member 30 is configured to hold an outer edge of the substrate Wf. Specifically, the retainer member 30 according to the embodiment includes a first member 31, a second member 32 disposed above the first member 31, and a third member 33 disposed above the second member 32 as one example. The outer edge of the substrate Wf is held by an inner peripheral wall of the first member 31.

[0039] The pressing mechanism 40 is disposed above the retainer member 30. The pressing mechanism 40 is a mechanism for pressing the retainer member 30 downward. The pressing mechanism 40 is not particularly limited to a specific configuration as long as it has such a function, and the pressing mechanism 40 according to the embodiment includes a cylinder 41 and a piston 42 as one example.

[0040] The cylinder 41 is disposed so as to surround an outer periphery of the intermediate member 22 of the top ring main body 20. The piston 42 projects downward from the cylinder 41. The piston 42 is displaced in a vertical direction with respect to the cylinder 41. The piston 42 has a lower end abutting on an upper surface of the

third member 33 of the retainer member 30. The piston 42 is displaced downward, and thus, the retainer member 30 can be pressed downward. Note that the lower end of the piston 42 may be connected to the third member 33 of the retainer member 30 to have a configuration in which the retainer member 30 can be driven in the vertical direction in association with the vertical displacement of the piston 42.

[0041] The guide mechanism 50 is a mechanism for guiding the vertical displacement of the retainer member 30. The guide mechanism 50 is not particularly limited to a specific configuration as long as it has such a function, and the guide mechanism 50 according to the embodiment includes a guide roller 51, a guide pad 52, and a roller supporting member 53 as one example.

[0042] The guide roller 51 is rotatably supported by the roller supporting member 53. The roller supporting member 53 is connected to the lower side member 21 via a bolt 14. The guide pad 52 is disposed on an inner peripheral surface of the third member 33 of the retainer member 30. The guide pad 52 is guided in the vertical direction by the guide roller 51 during the displacement of the retainer member 30. This guides the displacement of the retainer member 30. Note that the configuration of this guide mechanism 50 is not described in detail any further as it is similar to that of a guide mechanism of the known polishing apparatus as described in PTL 1.

[0043] As illustrated in Fig. 4, the sealing member 60a is sandwiched between the second member 32 and the third member 33 of the retainer member 30 and is also sandwiched between the roller supporting member 53 and the lower side member 21 of the top ring main body 20. Note that the sealing member 60a may further be secured to the second member 32 and/or the third member 33 with a bolt (not illustrated). The sealing member 60a is disposed in order to inhibit the entry of the slurry into the guide roller 51 during the polishing of the substrate Wf.

[0044] In the embodiment, the top ring main body 20 is internally provided with a space 25. The upper side member 23 of the top ring main body 20 is disposed so as to cover an upper portion of the cylinder 41 of the pressing mechanism 40. The sealing member 60b is sandwiched between the upper side member 23 and the cylinder 41. Note that the sealing member 60b may further be secured to the cylinder 41 and/or the upper side member 23 with a bolt (not illustrated). The sealing member 60b is disposed in order to inhibit the entry of the slurry into the space 25 inside the top ring main body 20 from a clearance between the upper side member 23 and the cylinder 41. Note that the configurations of the sealing member 60a and the sealing member 60b are not described in detail any further as they are similar to that of a sealing member of the known polishing apparatus as described in PTL 1.

[0045] Subsequently, a peripheral configuration of the band 70 will be described. Fig. 5A is schematic enlarged cross-sectional views of the part B2 and the part B3 in Fig. 4. Fig. 5B is an exploded view schematically illustrating a state where the configuration of the part B2 in Fig. 4 is disassembled.

[0046] With reference to Fig. 4, Fig. 5A, and Fig. 5B, the band 70 is disposed extending from the outer peripheral wall 11 of the retainer member 30 to the outer peripheral wall 11 of the pressing mechanism 40. Specifically, the band 70 according to the embodiment is disposed extending from the outer peripheral wall 11 of the third member 33 of the retainer member 30 to the outer peripheral wall 11 of the cylinder 41 of the pressing mechanism 40. As illustrated in Fig. 2 and Fig. 3, the band 70 is disposed extending entirely in a circumferential direction of the outer peripheral walls 11. As illustrated in Fig. 4, the band 70 is disposed so as to cover a clearance 26 between the retainer member 30 and the pressing mechanism 40. The band 70 is mainly disposed in order to inhibit the entry of the slurry from the clearance 26 to the space 25 during the polishing of the substrate Wf. Note that the band 70 according to the embodiment has an external shape of a polygonal ring as a whole.

[0047] The band 70 has at least one "fitting portion" for being fitted in a groove 15 described later. Specifically, as illustrated in Fig. 5A and Fig. 5B, the band 70 according to the embodiment has a fitting portion 71a and a fitting portion 71b positioned above the fitting portion 71a. The fitting portion 71b according to the embodiment is disposed at one end portion (specifically, an upper end portion) of both end portions of the band 70. The fitting portion 71a according to the embodiment is disposed at the other end portion (specifically, a lower end portion) of both the end portions of the band 70.

[0048] At least the fitting portion of the band 70 according to the embodiment is configured of an elastic member, such as rubber. Specifically, the band 70 according to the embodiment has not only the fitting portion but also portions other than the fitting portion that are configured of the elastic member. That is, the band 70 according to the embodiment is entirely configured of the elastic member.

[0049] With reference to Fig. 5A and Fig. 5B, at least one of the outer peripheral wall 11 of the retainer member 30 and the outer peripheral wall 11 of the pressing mechanism 40 is provided with the groove 15 for the fitting portion of the band 70 to be fitted in. That is, the groove 15 may be provided only on the outer peripheral wall 11 of the retainer member 30, may be provided only on the outer peripheral wall 11 of the pressing mechanism 40, or may be provided on both the outer peripheral wall 11 of the retainer member 30 and the outer peripheral wall 11 of the pressing mechanism 40.

[0050] In the embodiment, the number of the fitting portions of the band 70 corresponds to the number of the grooves 15. The number of the fitting portions of the band 70 according to the embodiment is two, and therefore, the grooves 15 are also provided at two places. Specifically, the grooves 15 according to the embodiment are provided on both the outer peripheral wall 11 of the re-

tainer member 30 and the outer peripheral wall 11 of the pressing mechanism 40. The fitting portion 71b of the band 70 is fitted in the groove 15 provided on the outer peripheral wall 11 of the pressing mechanism 40 (specifically, the cylinder 41), and the fitting portion 71a of the band 70 is fitted in the groove 15 provided on the outer peripheral wall 11 of the retainer member 30 (specifically, the third member 33).

[0051] Note that, in the embodiment, the configuration of the groove 15 provided on the outer peripheral wall 11 of the retainer member 30 is similar to the configuration of the groove 15 provided on the outer peripheral wall 11 of the pressing mechanism 40. Therefore, the groove 15 will be described in detail with the groove 15 provided on the outer peripheral wall 11 of the pressing mechanism 40 as a specific example.

[0052] As illustrated in Fig. 5B, the groove 15 has a groove opening 15a, a groove bottom 15b opposed to the groove opening 15a, a pair of groove side walls (a first groove side wall 15c and a second groove side wall 15d) connecting the groove opening 15a to the groove bottom 15b. The first groove side wall 15c and the second groove side wall 15d are opposed to one another.

[0053] The first groove side wall 15c and the second groove side wall 15d are configured such that an interval d1 (that is, a "groove width") between the first groove side wall 15c and the second groove side wall 15d widens as the interval d1 approaches the groove bottom 15b. That is, the groove 15 according to the embodiment is a "dovetail groove."

[0054] In a state where the fitting portion (the fitting portion 71b and the fitting portion 71a) of the band 70 is fitted in the groove 15, this fitting portion is configured to be in contact with the first groove side wall 15c and the second groove side wall 15d.

[0055] As described above, according to the embodiment, since the groove 15 in which the fitting portion of the band 70 is fitted is the dovetail groove, a degree of fitting between the fitting portion of the band 70 and the groove 15 can be strengthened in comparison to a case where the groove in which the fitting portion of the band is fitted is not the dovetail groove (for example, a case where the interval between the pair of groove side walls is a groove in a cross-sectionally constant rectangular shape). This allows suppressing disengagement of the fitting portion of the band 70 from the groove 15 during the use of the top ring 10. As a result, disengagement of the band 70 from the retainer member 30 or the pressing mechanism 40 during the use of the top ring 10 is suppressible. Specifically, when the dovetail groove is provided in both the retainer member 30 and the pressing mechanism 40 as in the embodiment, it is possible to suppress the disengagement of the band 70 from the retainer member 30 and the pressing mechanism 40 during the use of the top ring 10.

[0056] As illustrated in Fig. 5B, each of the fitting portion 71b and the fitting portion 71a according to the embodiment has a first projecting portion 72 (in other words, a first "bump") in contact with the first groove side wall 15c and a second projecting portion 73 (in other words, a second "bump") in contact with the second groove side wall 15d. Between the first projecting portion 72 and the second projecting portion 73, a V-shaped groove 74 having a V-shaped cross section is provided. Specifically, this V-shaped groove 74 is configured such that an interval d2 (that is, a "groove width") of the V-shaped groove 74 widens toward distal ends of the first projecting portion 72 and the second projecting portion 73 in cross-sectional view.

[0057] A width d3 of the first projecting portion 72 and the second projecting portion 73 according to the embodiment is preliminarily set such that the first projecting portion 72 is in contact with the first groove side wall 15c and the second projecting portion 73 is in contact with the second groove side wall 15d. Furthermore, the maximum value of the width d3 of the first projecting portion 72 and the second projecting portion 73 according to the embodiment is a value larger than the minimum value of the interval d1 between the first groove side wall 15c and the second groove side wall 15d (that is, the size of the groove opening 15a).

[0058] With reference to the enlarged view of the part B4 in Fig. 4, a part of the band 70 according to the embodiment is provided with an expansion and contraction portion 75 expandable and contractable in the vertical direction.

[0059] This configuration allows this expansion and contraction portion 75 to expand and contract in the vertical direction when the retainer member 30 is displaced in the vertical direction, thereby allowing effective suppression of the disengagement of the fitting portion of the band 70 from the groove 15.

[0060] Note that, in the embodiment, although the dovetail groove is provided over the whole circumference of the outer peripheral wall 11 in the circumferential direction (that is, the dovetail groove is provided on the connection walls 13 and the corner portions 12), the configuration is not limited to this. For example, the dovetail groove may be provided only on the connection walls 13, without being provided on the corner portions 12, of the outer peripheral wall 11. In this case, the corner portion 12 may be provided with, for example, a groove in a cross-sectionally rectangular shape (a groove having a constant interval between the first groove side wall 15c and the second groove side wall 15d from the groove opening 15a to the groove bottom 15b) instead of the dovetail groove.

[0061] When the pressing mechanism 40 is compared with the retainer member 30, the pressing mechanism 40 tends to allow a liquid, such as a cleaning liquid (for example, a cleaning liquid for cleaning the top ring 10) and slurry for polishing, to easily enter from a part of the dovetail groove. Therefore, when only any one dovetail groove of the dovetail groove of the pressing mechanism 40 and the dovetail groove of the retainer member 30 is provided over the whole circumference of the outer pe-

ripheral wall 11, the configuration may have, for example, the dovetail groove of the pressing mechanism 40 provided over the whole circumference of the outer peripheral wall 11 and the dovetail groove of the retainer member 30 not provided over the whole circumference of the outer peripheral wall 11. In this case, the retainer member 30 may be provided with a groove in a cross-sectionally rectangular shape.

[0062] Subsequently, modifications of the embodiment described above will be described. Note that, in the following description, the same configurations as or corresponding configurations to those in the above-described embodiment have the same reference numerals, and their descriptions are appropriately omitted.

(Modification 1)

[0063] Fig. 6 is an enlarged cross-sectional view schematically illustrating an enlarged part of a top ring 10A of a polishing apparatus 100 according to a modification 1 of the embodiment. Specifically, Fig. 6 schematically illustrates an enlarged part which is the same part (the part B1) as in Fig. 4 described above. The top ring 10A according to the modification is different from the top ring 10 illustrated in Fig. 4 described above in that it includes a pressing mechanism 40A instead of the pressing mechanism 40 and that it includes a band 70A instead of the band 70.

[0064] The pressing mechanism 40A according to the modification is different from the pressing mechanism 40 exemplified in Fig. 4 in that it does not have a groove 15.

[0065] The band 70A according to the modification is different from the band 70 exemplified in Fig. 4 in that one end portion 76 of both end portions of the band 70A is sandwiched between an upper side member 23 and the pressing mechanism 40A. Specifically, the band 70A has a region from the one end portion 76 to the other end portion of the band 70A by a predetermined distance sandwiched between the upper side member 23 and an upper surface of a cylinder 41 of the pressing mechanism 40A. In other words, the one end portion 76 of the band 70A according to the modification is secured to the upper surface of the cylinder 41. Note that the band 70A may further be secured to the upper surface of the cylinder 41 with a bolt.

[0066] Note that the other end part of the band 70A according to the modification is configured of a fitting portion 71a described above, and this fitting portion 71a is fitted in a groove 15 (the dovetail groove) of a retainer member 30.

[0067] Also in the modification, the fitting portion 71a of the band 70A is fitted in the groove 15 (the dovetail groove), and thus, disengagement of the fitting portion 71a from the groove 15 is suppressible. As a result, disengagement of the band 70A from the retainer member 30 during the use of the top ring 10A is suppressible. The one end portion 76 of the band 70A is sandwiched between the upper side member 23 and the pressing mechanism 40A, and thus, disengagement of the one end portion 76 is also suppressible. As a result, disengagement of the band 70A from the pressing mechanism 40A during the use of the top ring 10A is suppressible.

[0068] According to the modification, for example, disengaging the fitting portion 71a of the band 70A from the groove 15 during the maintenance of the top ring 10A allows, for example, easily dividing the retainer member 30 from the top ring 10A. Specifically, the retainer member 30 and members disposed next to the retainer member 30 (specifically, a lower side member 21 and a guide mechanism 50) (hereinafter, these members are referred to as the "retainer member 30 and the like") can easily be disassembled from a top ring main body 20.

[0069] Specifically, in this case, the band 70A can easily be turned over such that the fitting portion 71a of the band 70A is disengaged from the groove 15 and this fitting portion 71a is put on, for example, the upper surface of the upper side member 23. This allows easily disassembling the retainer member 30 and the like since the band 70A does not hinder when the retainer member 30 and the like are disassembled. That is, the modification allows improved maintainability of the top ring 10A.

[0070] Note that, in the modification, the configuration of the groove 15 does not need to be the dovetail groove. Specifically, in this case, the groove 15 may be a "groove in a cross-sectionally rectangular shape." Also in this case, the one end portion 76 of the band 70A is sandwiched between the upper side member 23 and the pressing mechanism 40A, and thus, the disengagement of the one end portion 76 is suppressible. As a result, the disengagement of the band 70A from the pressing mechanism 40A during the use of the top ring 10A is suppressible.

(Modification 2)

[0071] Fig. 7A is a schematic diagram illustrating a state where a peripheral configuration of a groove 15 of a pressing mechanism 40 of a top ring 10B according to a modification 2 of the embodiment is visually perceived from the front. Fig. 7B is a schematic front view of a processing tool 200 for processing a dovetail groove. The processing tool 200 exemplified in Fig. 7B includes a rotation shaft 201 and a processing portion 202 (a portion that processes the dovetail groove) connected to an end portion of the rotation shaft 201. During processing with the processing tool 200, the rotation shaft 201 rotates, and thus, the processing portion 202 also rotates. The processing tool 200 according to the modification is a cutting tool as one example. Therefore, the processing portion 202 is configured of a cutting edge. The processing portion 202 has a shape similar to the shape of the groove side wall of the dovetail groove. Specifically, the processing portion 202 has a shape such that the processing portion 202 increases in diameter toward a distal end of the processing portion 202.

[0072] As illustrated in Fig. 7A, the top ring 10B ac-

cording to the modification is provided with a depressed portion 16 in a groove opening 15a of the groove 15 (the dovetail groove) of the pressing mechanism 40. This depressed portion 16 is a depressed portion for the processing tool 200, specifically, the processing portion 202 to pass through when it is inserted from the groove opening 15a. Specifically, the depressed portion 16 according to the modification is provided in order to allow the processing portion 202 to be inserted into the groove 15 from the groove opening 15a by increasing an opening size of a part of the groove opening 15a. The processing tool 200 according to the modification has the largest diameter of the processing portion 202 larger than the size of the groove opening 15a (the size of a part other than the depressed portion 16 in the groove opening 15a). In view of this, by providing such a depressed portion 16 in at least one place of the groove opening 15a, the size of the groove opening 15a is partly increased to allow the processing portion 202 of the processing tool 200 to be easily inserted into the groove 15.

[0073] Note that the depressed portion 16 is not particularly limited to a specific shape, and the depressed portion 16 according to the modification has an arc shape as one example. The depressed portion 16 according to the modification is disposed in a part of the groove opening 15a so as to be depressed downward in front view of the groove opening 15a as illustrated in Fig. 7A.

[0074] The top ring 10B according to the modification is also provided with a depressed portion 16 similar to that in Fig. 7A in a groove 15 of a retainer member 30 (see Fig. 8 described below).

[0075] Fig. 8 is a schematic diagram illustrating a state where a part of an outer peripheral wall 11 of the top ring 10B according to the modification is visually perceived from the -X-direction. Note that, in Fig. 8, a band 70 is not illustrated. The top ring 10B according to the modification has a positioning mark 17 disposed on each of the outer peripheral wall 11 of a top ring main body 20 and the outer peripheral wall 11 of the retainer member 30. Specifically, the positioning mark 17 is disposed on the outer peripheral wall 11 of an upper side member 23 of the top ring main body 20. The positioning mark 17 is also disposed on each of a first member 31 and a second member 32 of the retainer member 30. This positioning mark 17 is a mark to serve as an index for adjusting positions of constituting members when the constituting members of the top ring 10B are installed.

[0076] These positioning marks 17 and the depressed portion 16 of the groove opening 15a are arranged so as to align in the vertical direction. Thus, the depressed portion 16 according to the modification also has a function of the positioning mark.

[0077] According to the modification as described above, the depressed portion 16 is provided in the groove opening 15a, and thus, the processing tool 200 is easily insertable into the groove 15 from the groove opening 15a where the depressed portion 16 is provided.

[0078] This allows easy processing of the groove 15.

[0079] While the embodiment and the modifications of the present invention have been described above in detail, the present invention is not limited to such a specific embodiment or modifications, and is allowed to be variously modified and changed within the scope of the present invention described in the claims.

REFERENCE SIGNS LIST

[0080]

10...top ring
11...outer peripheral wall
15 ... groove (dovetail groove)
15a...groove opening
15b...groove bottom
15c...first groove side wall
15d...second groove side wall
20...top ring main body
23...upper side member
24a...substrate support surface
30...retainer member
40...pressing mechanism
70...band
71a, 71b...fitting portion
72...first projecting portion
73...second projecting portion
74...V-shaped groove
75...expansion and contraction portion
76...one end portion
100...polishing apparatus
102...polishing table
200...processing tool
Wf...substrate
Pd...polishing pad

Claims

1. A top ring of a polishing apparatus, comprising:

a top ring main body having a substrate support surface supporting an upper surface of a substrate;
a retainer member disposed so as to surround an outer periphery of the substrate support surface to hold an outer edge of the substrate;
a pressing mechanism disposed above the retainer member and configured to press the retainer member downward; and
a band disposed extending from an outer peripheral wall of the retainer member to an outer peripheral wall of the pressing mechanism, the band having at least one fitting portion, wherein at least one of the outer peripheral wall of the retainer member and the outer peripheral wall of the pressing mechanism is provided with a groove in which the fitting portion of the band is

fitted,
the groove is a dovetail groove configured to have a groove opening, a groove bottom opposed to the groove opening, a first groove side wall connecting the groove opening to the groove bottom, and a second groove side wall connecting the groove opening to the groove bottom and opposed to the first groove side wall, in cross-sectional view, and the dovetail groove is configured such that an interval between the first groove side wall and the second groove side wall widens as the interval approaches the groove bottom, and
the fitting portion is configured to be in contact with the first groove side wall and the second groove side wall in a state where the fitting portion of the band is fitted in the dovetail groove.

2. The top ring of the polishing apparatus according to claim 1, wherein

the fitting portion of the band has a first projecting portion in contact with the first groove side wall and a second projecting portion in contact with the second groove side wall, and
a V-shaped groove in a cross-sectionally V shape is provided between the first projecting portion and the second projecting portion.

3. The top ring of the polishing apparatus according to claim 1 or 2, wherein
a part of the band is provided with an expansion and contraction portion expandable and contractable in a vertical direction.

4. The top ring of the polishing apparatus according to any one of claims 1 to 3, wherein
the groove is provided only on any one of the outer peripheral wall of the retainer member and the outer peripheral wall of the pressing mechanism.

5. The top ring of the polishing apparatus according to any one of claims 1 to 3, wherein
the groove is provided on both the outer peripheral wall of the retainer member and the outer peripheral wall of the pressing mechanism.

6. The top ring of the polishing apparatus according to any one of claims 1 to 3, wherein

the groove is provided only on the outer peripheral wall of the retainer member among the outer peripheral wall of the retainer member and the outer peripheral wall of the pressing mechanism,
the top ring main body has an upper side member disposed so as to cover an upper portion of the pressing mechanism,
one end portion of both end portions of the band is sandwiched between the upper side member and the pressing mechanism, and
the fitting portion of the band is disposed on another end portion of the band.

7. The top ring of the polishing apparatus according to any one of claims 1 to 6, wherein
the groove opening is provided with a depressed portion for a processing tool for processing the groove to pass through when the processing tool is inserted from the groove opening into the groove.

8. The top ring of the polishing apparatus according to any one of claims 1 to 7, wherein
the substrate is a polygonal substrate.

9. A top ring of a polishing apparatus, comprising:

a top ring main body having a substrate support surface supporting an upper surface of a substrate;
a retainer member disposed so as to surround an outer periphery of the substrate support surface to hold an outer edge of the substrate;
a pressing mechanism disposed above the retainer member and configured to press the retainer member downward; and
a band disposed extending from an outer peripheral wall of the retainer member to an outer peripheral wall of the pressing mechanism, the band having a fitting portion, wherein
the outer peripheral wall of the retainer member is provided with a groove in which the fitting portion of the band is fitted,
the top ring main body has an upper side member disposed so as to cover an upper portion of the pressing mechanism,
one end portion of both end portions of the band is sandwiched between the upper side member and the pressing mechanism, and
the fitting portion of the band is disposed on another end portion of the band.

10. A polishing apparatus comprising:

the top ring according to any one of claims 1 to 9; and
a polishing table configured to hold a polishing pad for polishing the substrate held by the top ring.

Fig. 1A

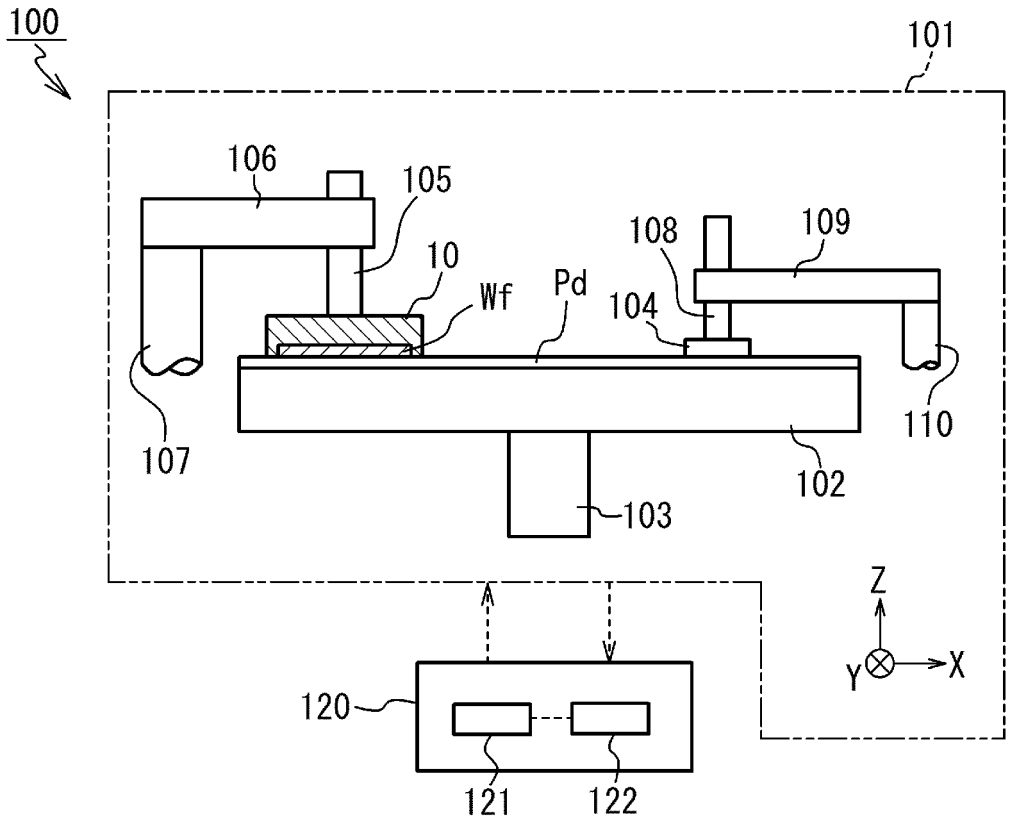
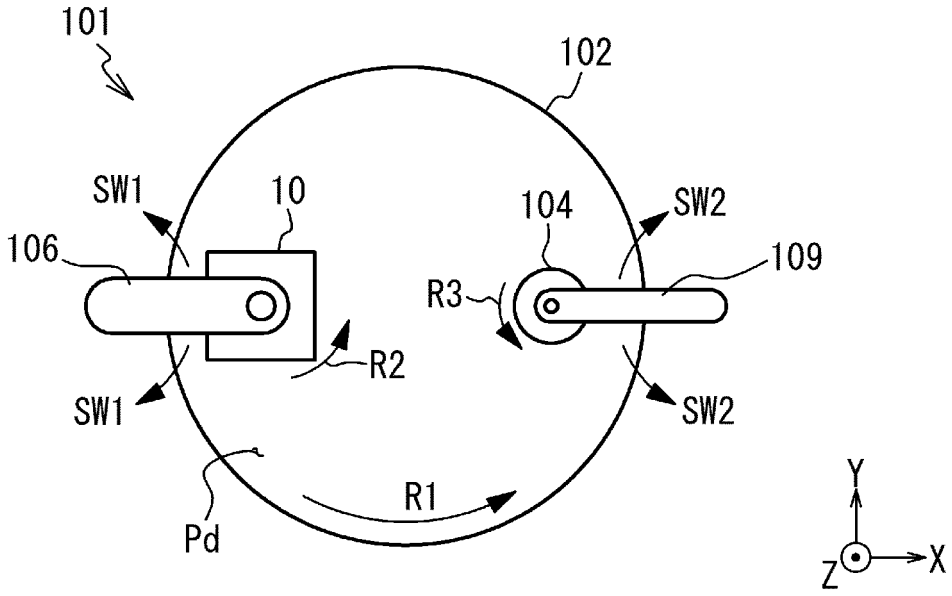

100
101
106
105
10
Wf
Pd
108
109
104
107
110
102
103
120
121
122
Z
Y
X

Fig. 1B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R2
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R1
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Fig. 2

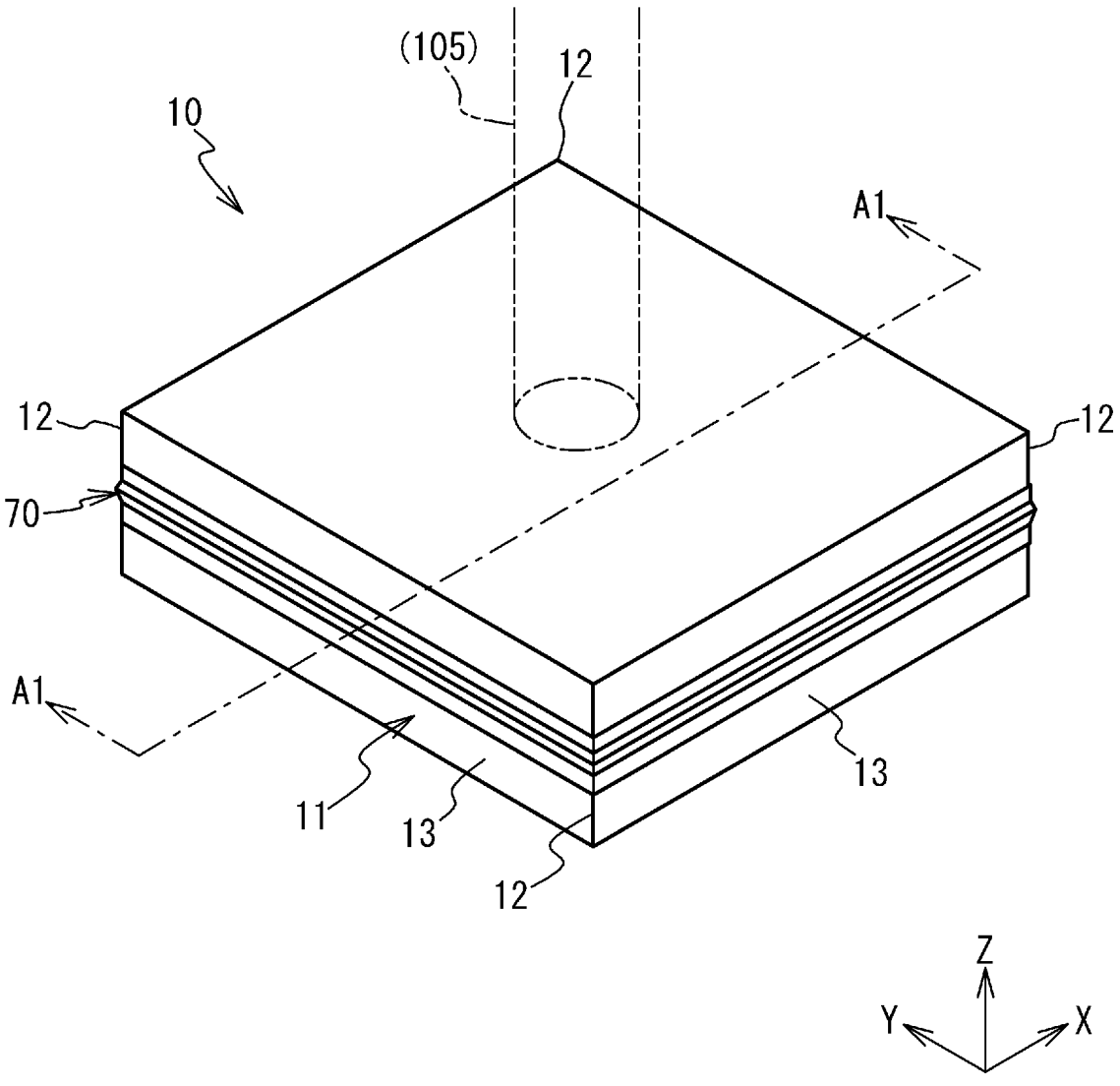
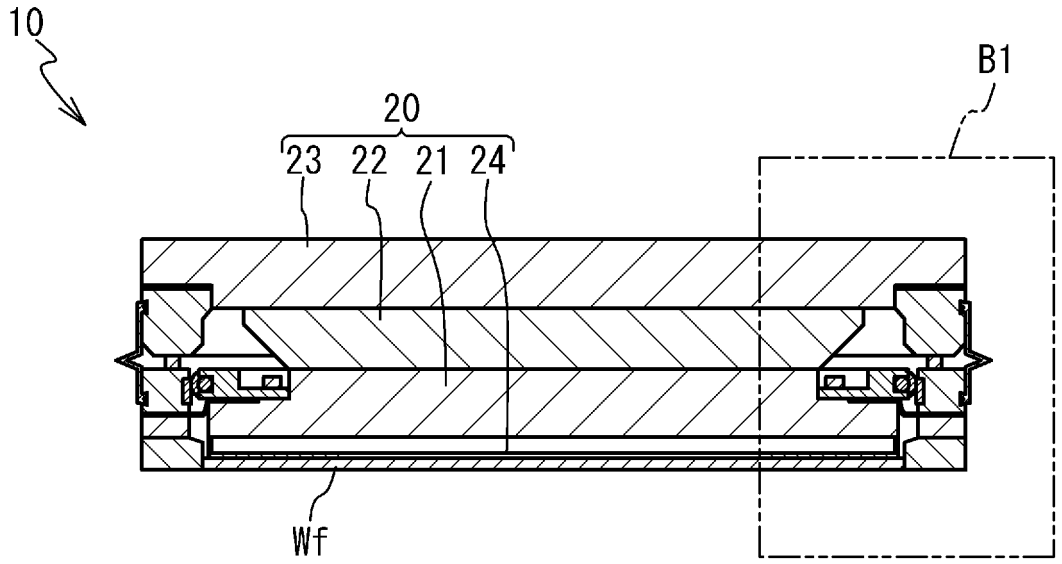


Fig. 3



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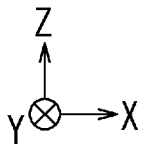
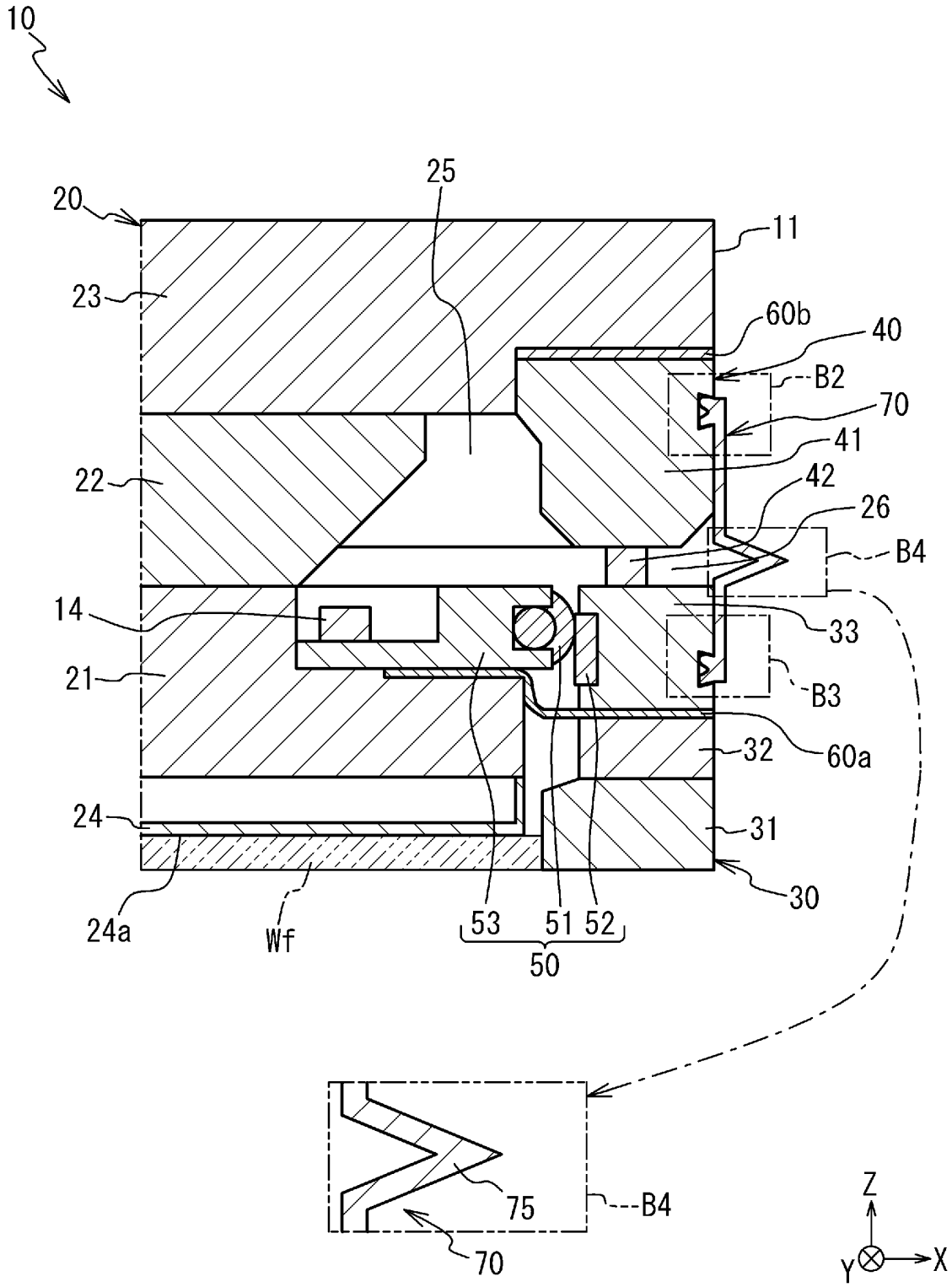


Fig. 4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60b
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B2
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42
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B4
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B3
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24a
Wf
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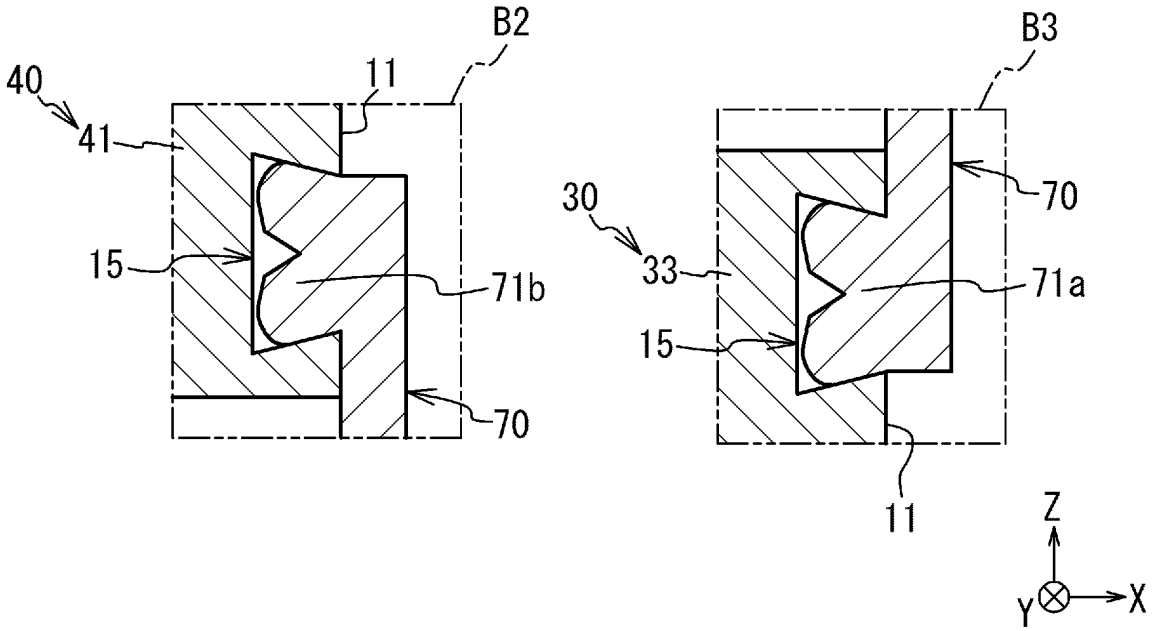
51
52
50
75
B4
70
Z
Y
X

Fig. 5A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B3
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71a
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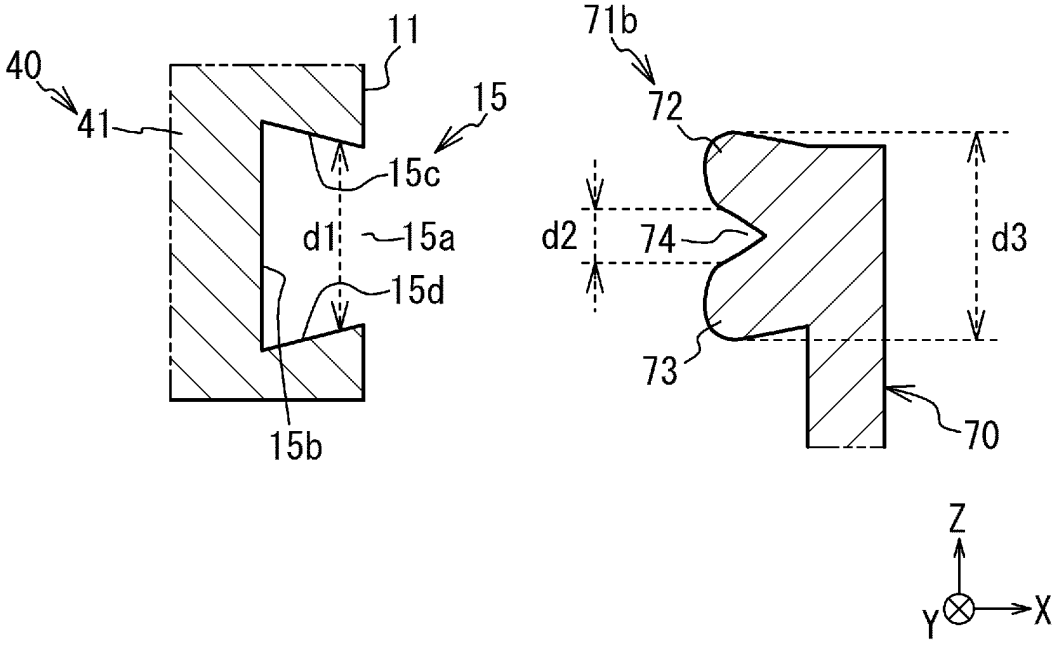
Z
Y
X

Fig. 5B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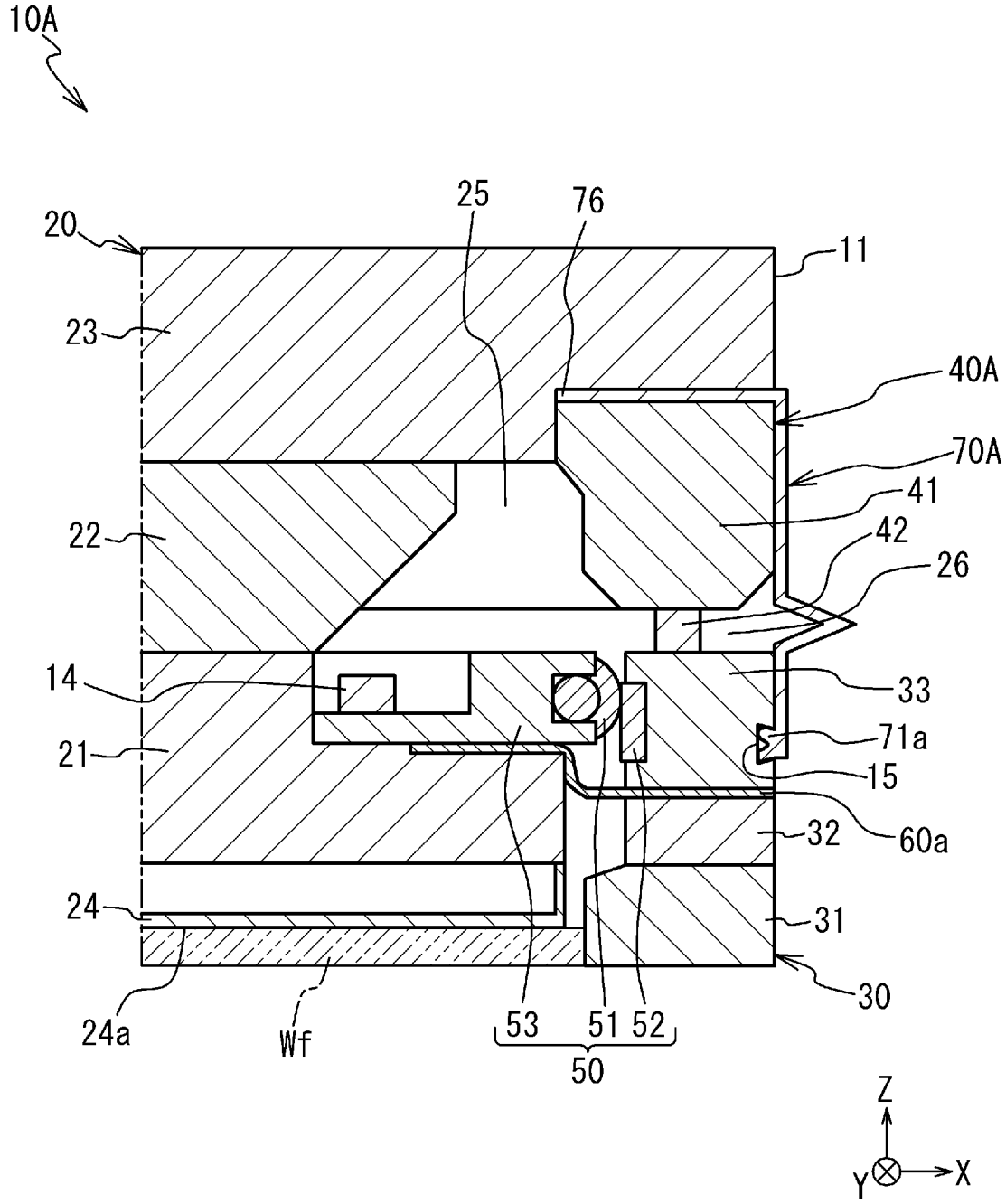
15d
15b
71b
72
d2
74
d3
73
70
Z
Y
X

Fig. 6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Y
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Fig. 7A

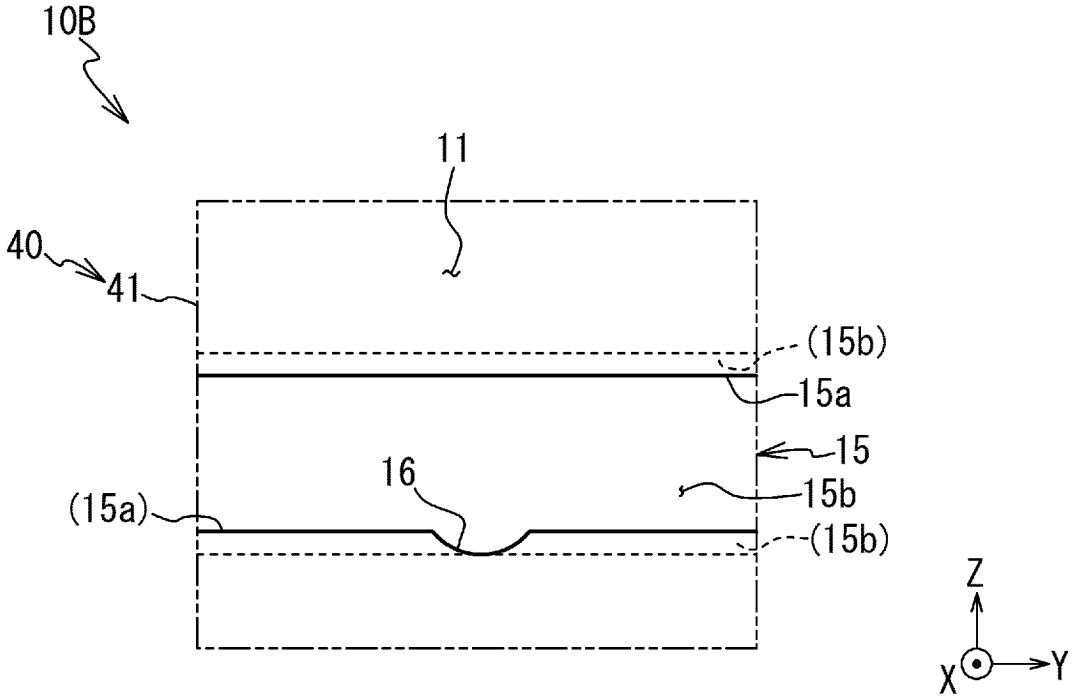


Fig. 7B

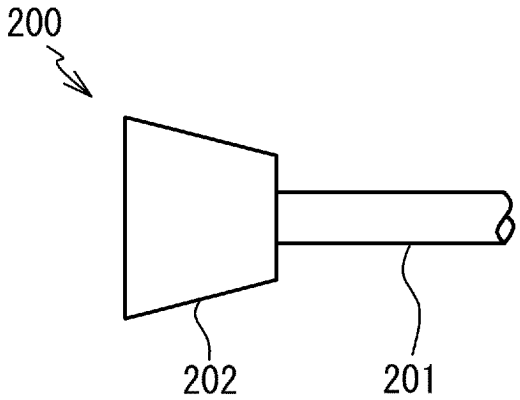
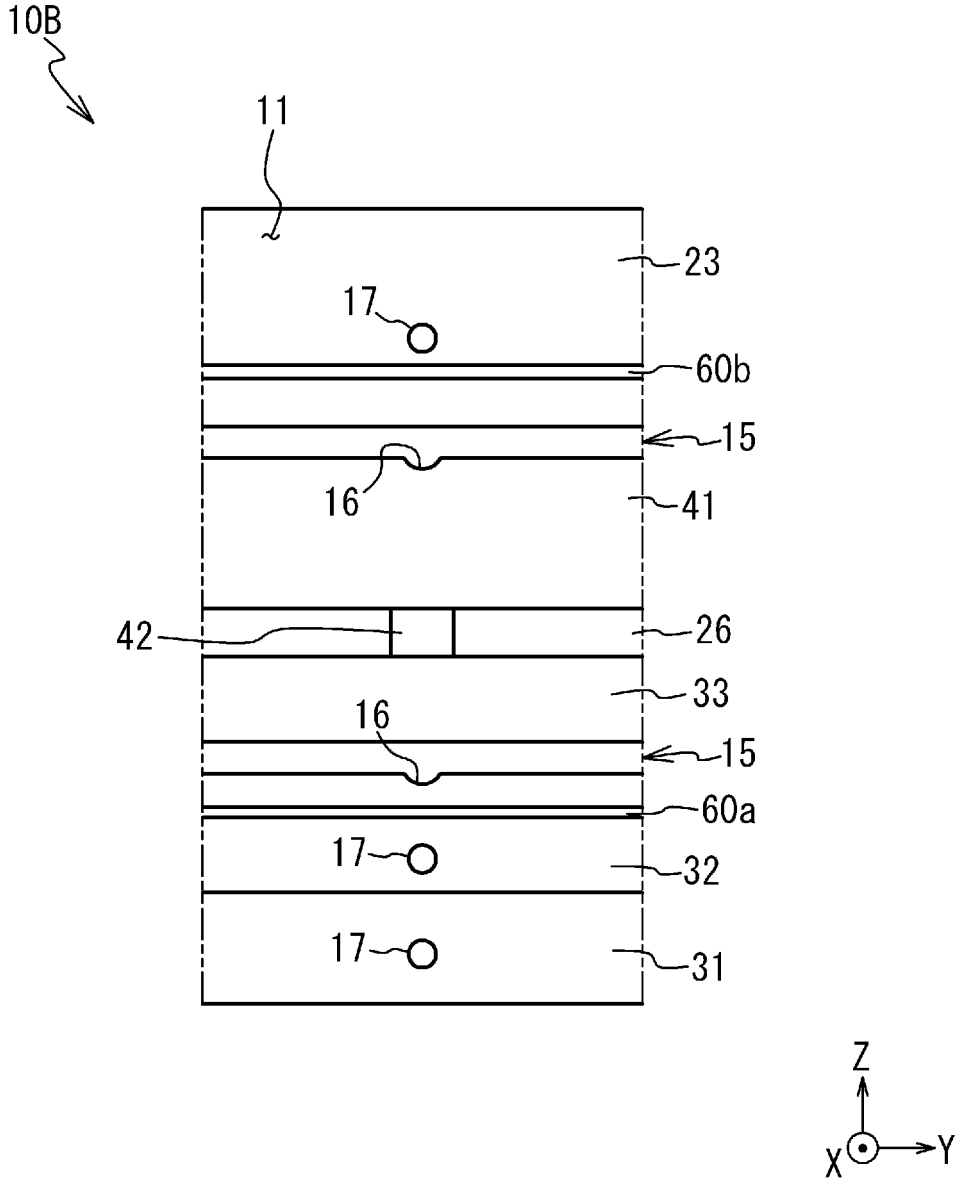


Fig. 8



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2022/026170

A. CLASSIFICATION OF SUBJECT MATTER

B24B 37/32(2012.01)i
FI: B24B37/32 A

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B24B37/32

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2022
Registered utility model specifications of Japan 1996-2022
Published registered utility model applications of Japan 1994-2022

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2020-19115 A (EBARA CORPORATION) 06 February 2020 (2020-02-06) paragraphs [0007]-[0075], fig. 1-16	1-10
Y	JP 2016-74088 A (EBARA CORPORATION) 12 May 2016 (2016-05-12) paragraph [0057], fig. 8, 15	1-8, 10
Y	JP 2002-113653 A (EBARA CORPORATION) 16 April 2002 (2002-04-16) paragraphs [0021]-[0022], fig. 1	6-10
Y	JP 2020-196053 A (TOKYO ELECTRON LTD) 10 December 2020 (2020-12-10) paragraphs [0058]-[0063], fig. 7-12	7-8, 10

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 August 2022	**16 August 2022**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2022/026170

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2020-19115 A	06 February 2020	US 2020/0039024 A1 paragraphs [0030]-[0102], fig. 1-16 CN 110788740 A KR 10-2020-0015390 A	
JP 2016-74088 A	12 May 2016	US 2013/0196573 A1 paragraph [0141], fig. 8, 16 KR 10-2013-0088804 A	
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Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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- JP 2020019115 A **[0003]**