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(54) **CLEANING APPARATUS, ADJUSTMENT JIG, AND ADJUSTMENT METHOD**

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(57) **ABSTRACT**

A cleaning apparatus includes: first and second dischargers configured to discharge a brush cleaning liquid so that the brush cleaning liquid lands linearly on contact surfaces of first and second brushes, in a state in which the first and second brushes configured to clean a substrate are located at a retracted position spaced apart from the substrate; and a support configured to support the first and second discharger, so that the brush cleaning liquid discharged from the first discharger and the brush cleaning liquid discharged from the second discharger do not interfere with each other until the brush cleaning liquid lands on the contact surfaces of the first and second brushes.

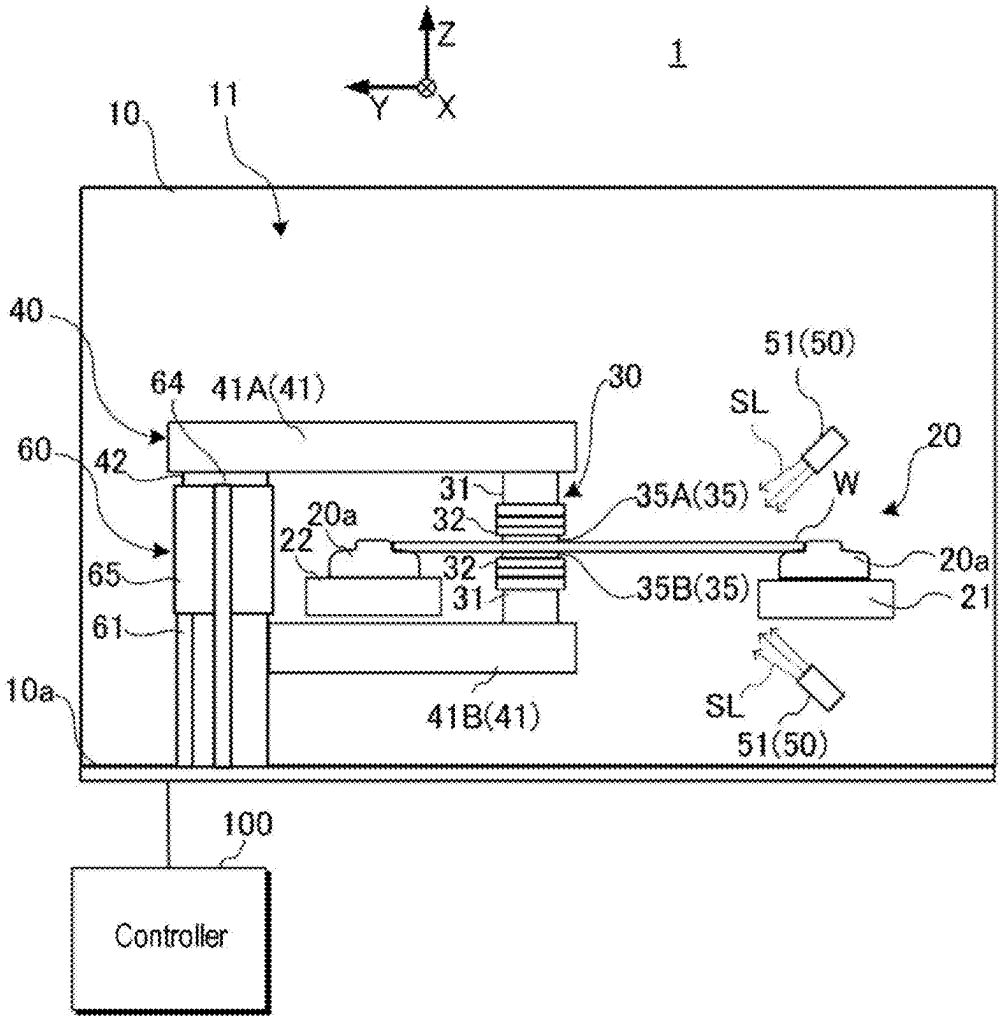
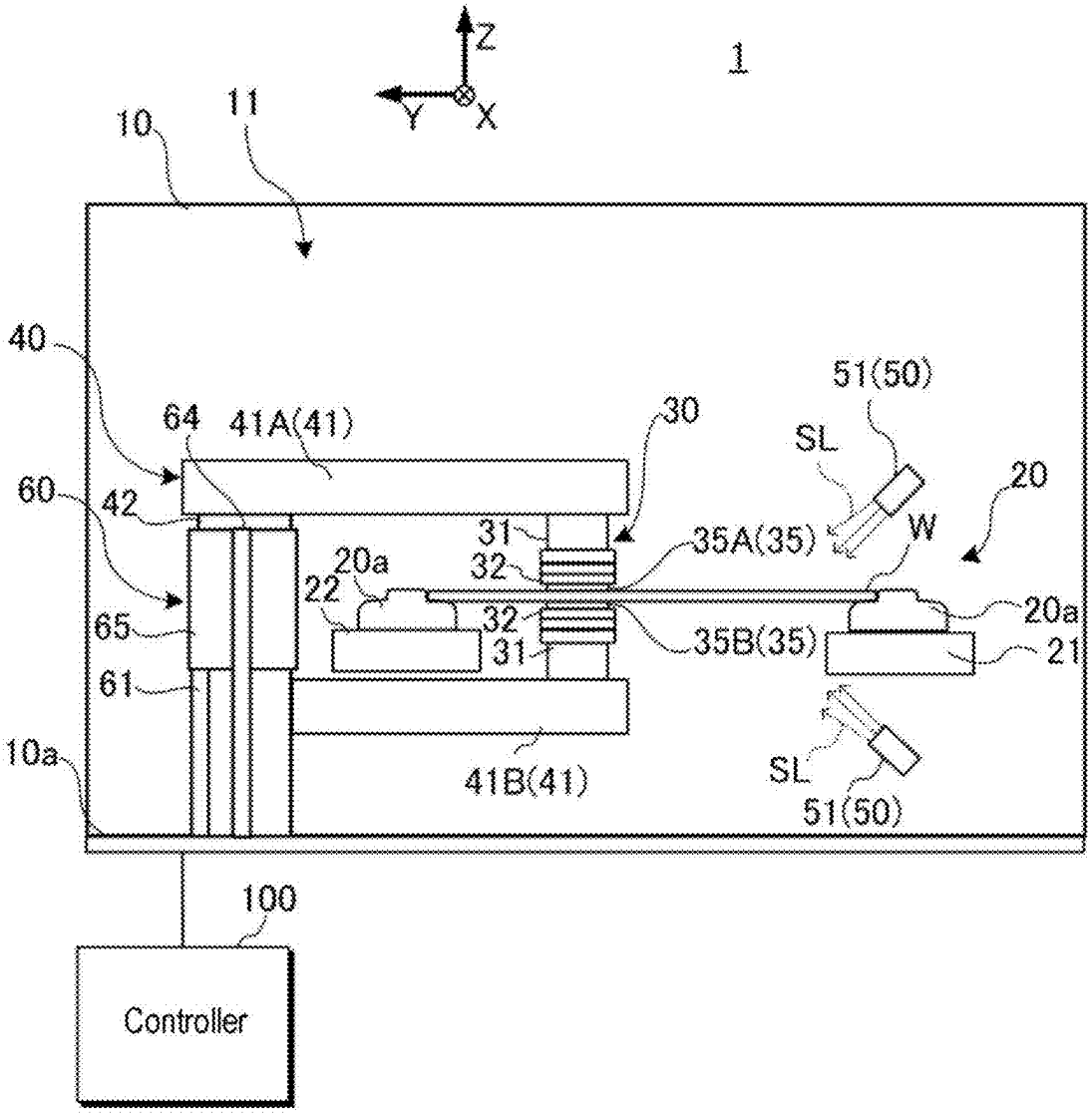


FIG. 1


Z
Y
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1
10
11
40
64
41A(41)
30
51(50)
SL
20
60
42
31
35A(35)
W
20a
22
32
20a
65
32
35B(35)
21
31
61
10a
41B(41)
SL
51(50)
100
Controller

FIG. 2

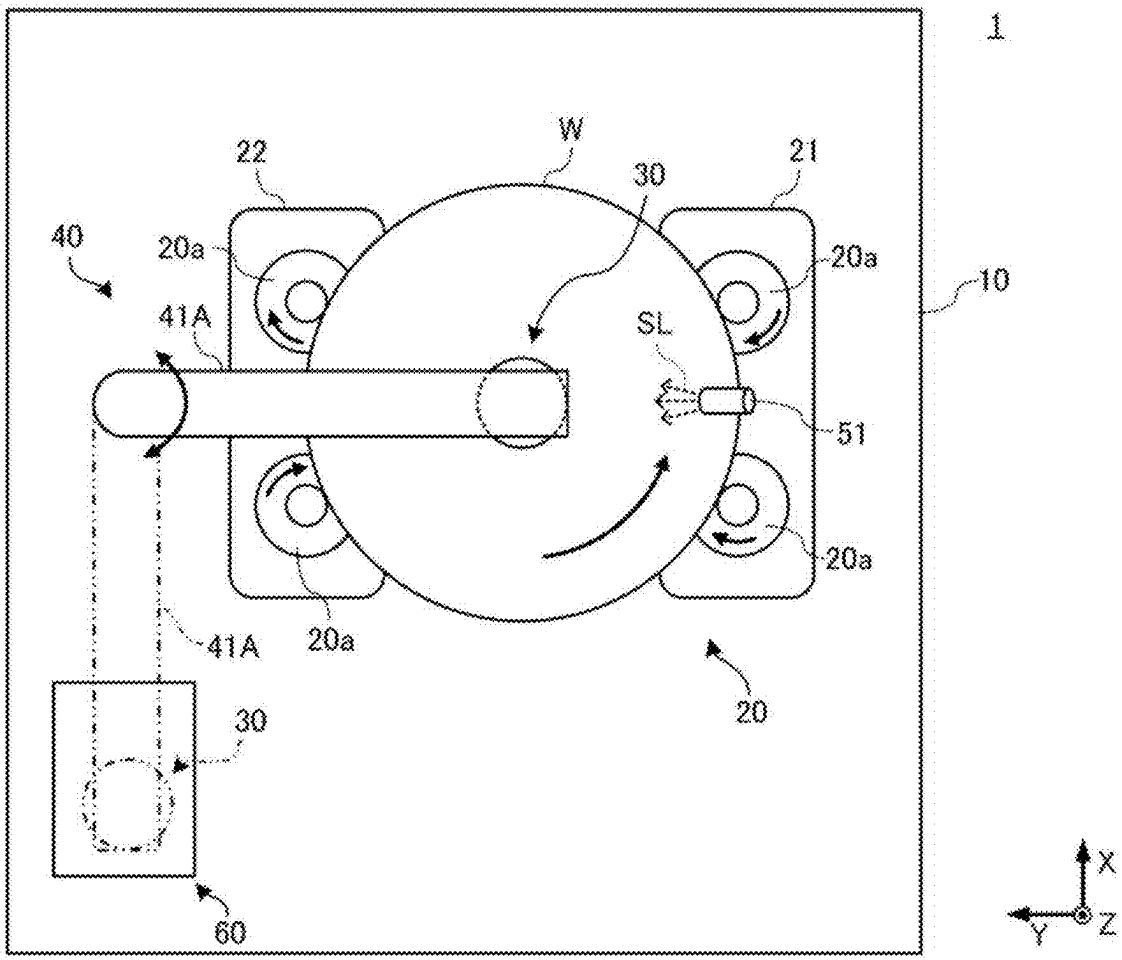


FIG. 3

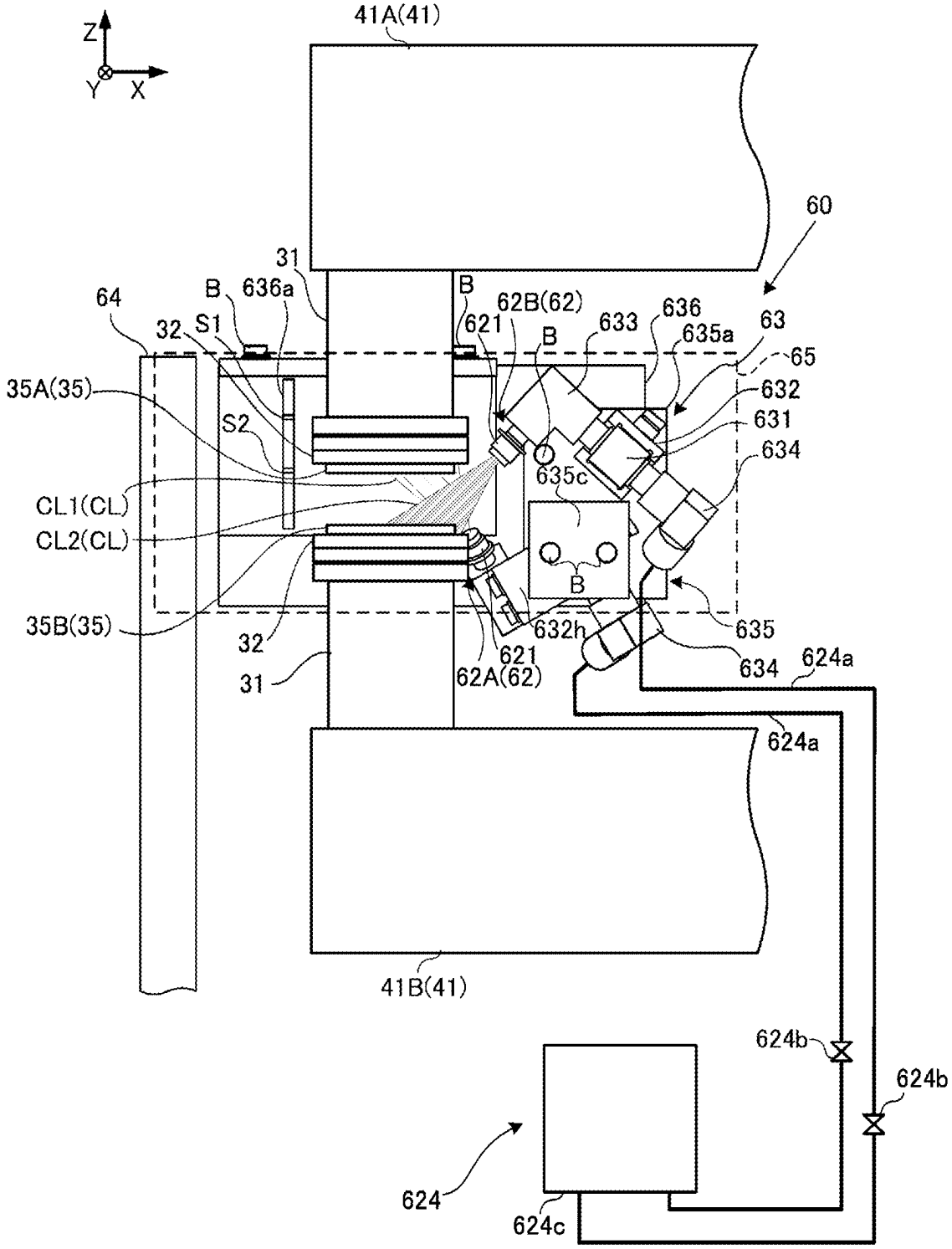
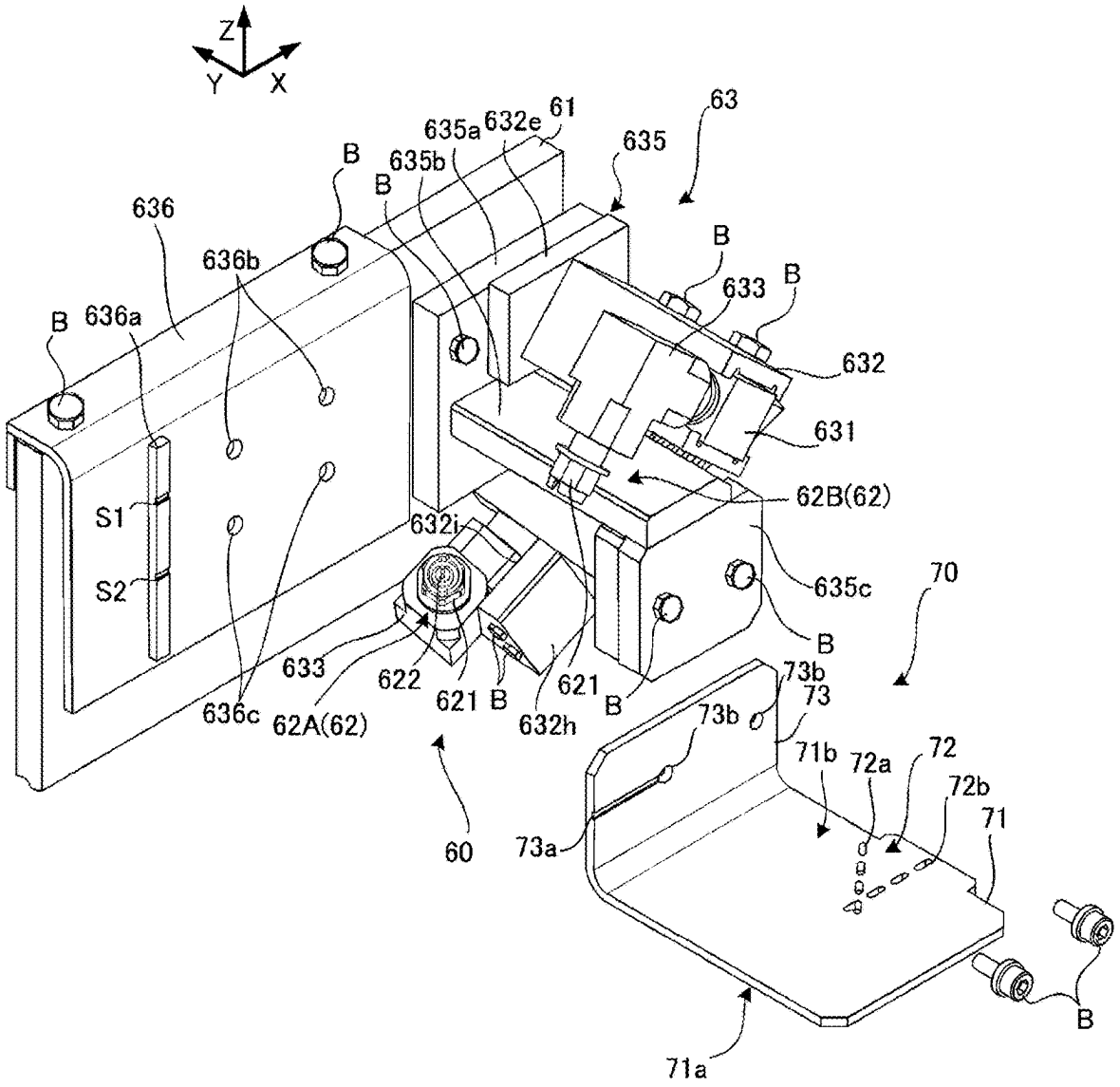

Z
Y
X
41A(41)
60
31
B
636a
64
32
S1
621
62B(62)
633
636
635a
63
65
632
631
634
35A(35)
S2
635c
CL1(CL)
CL2(CL)
B
635
632h
35B(35)
32
621
62A(62)
634
624a
31
624a
41B(41)
624b
624b
624
624c

FIG. 4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Y
X
63
61
635
635a
632e
635b
B
636
636b
636a
633
632
631
62B(62)
S1
S2
632i
635c
70
633
622
621
621
632h
636c
62A(62)
60
73b
73
71b
72a
72
72b
71
73a
71a

FIG. 5A

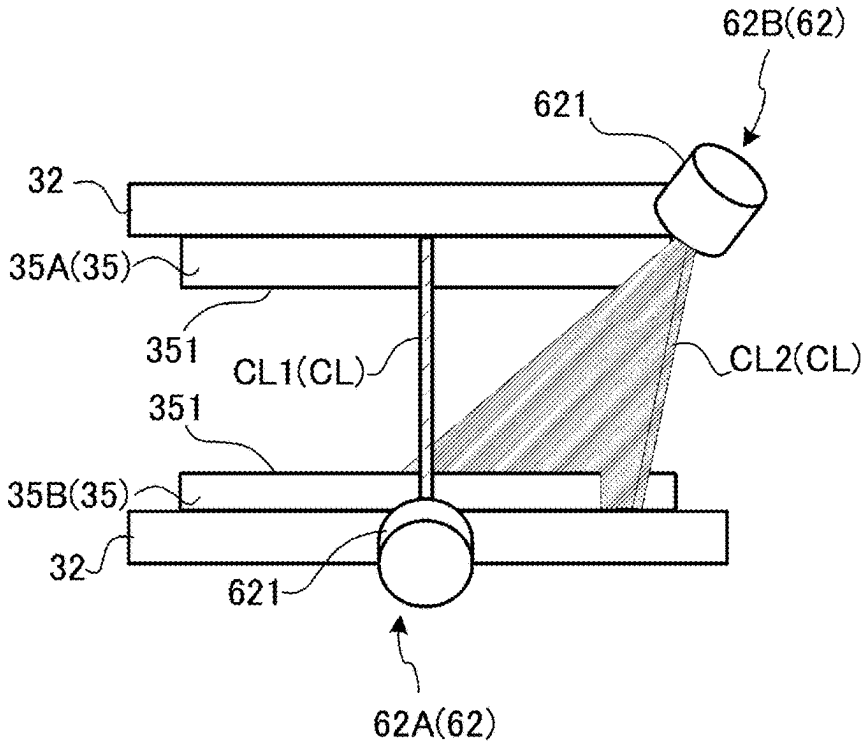
62B(62)
621
32
35A(35)
351
CL1(CL)
CL2(CL)
351
35B(35)
32
621
62A(62)

FIG. 5B

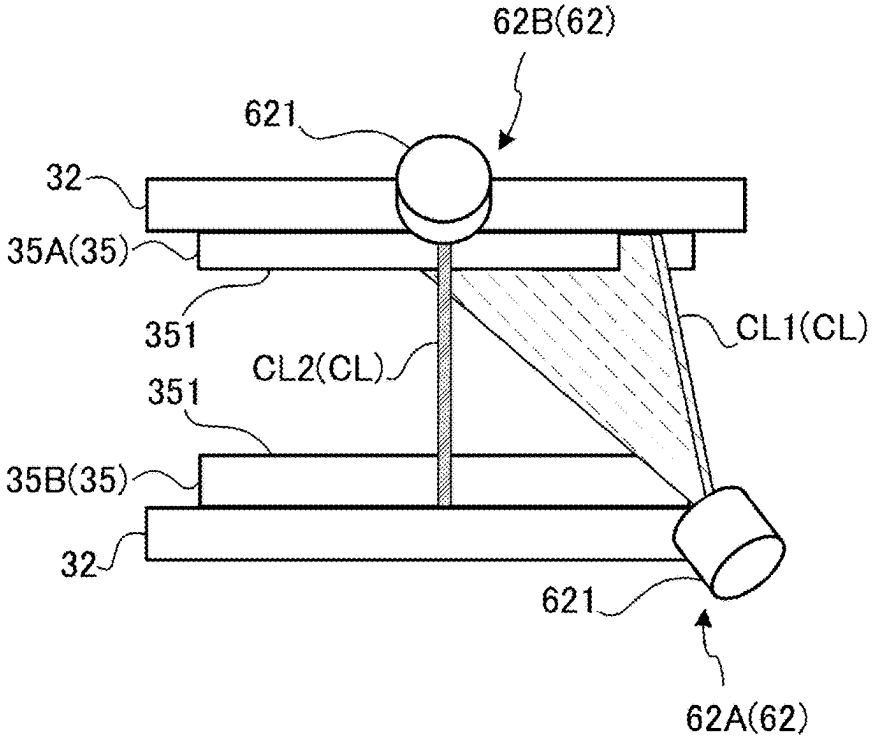
62B(62)
621
32
35A(35)
351
CL2(CL)
CL1(CL)
351
35B(35)
32
621
62A(62)

FIG. 6A

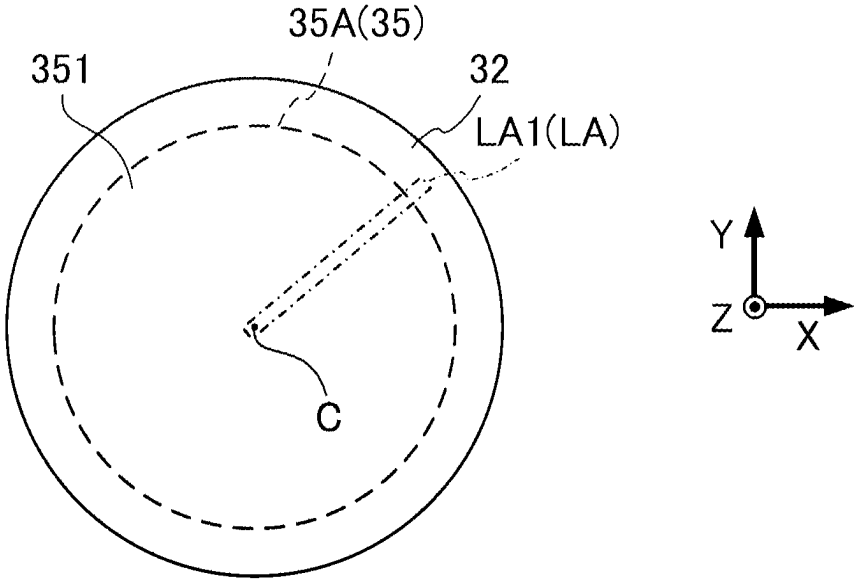

FIG. 6B

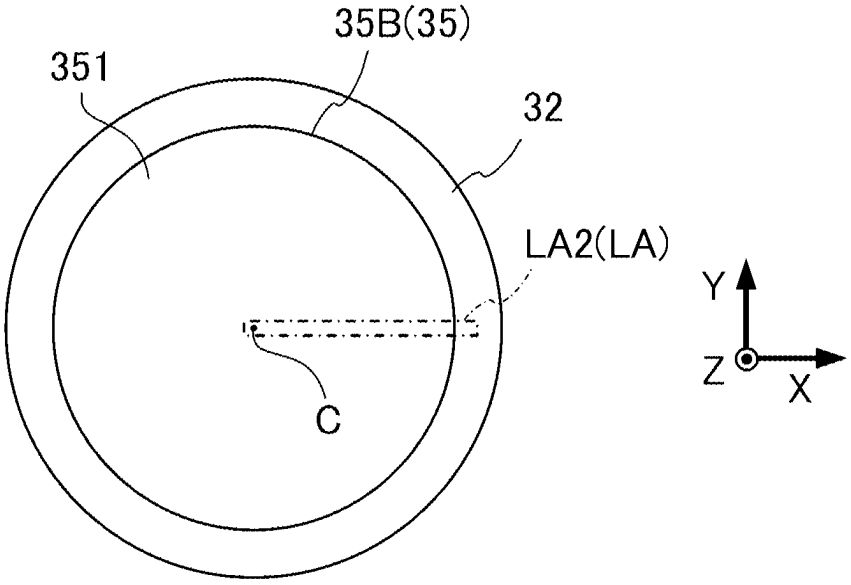

FIG. 7

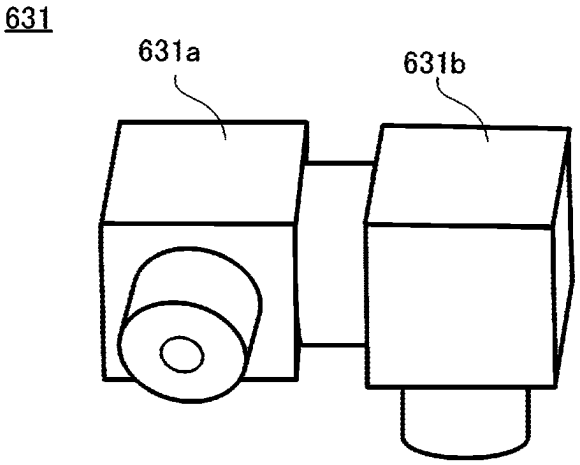

FIG. 8A

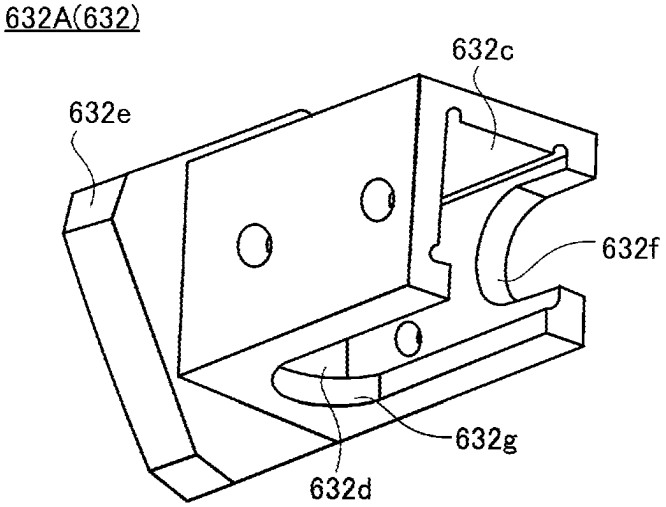
632A(632)
632c
632e
632f
632g
632d

FIG. 8B

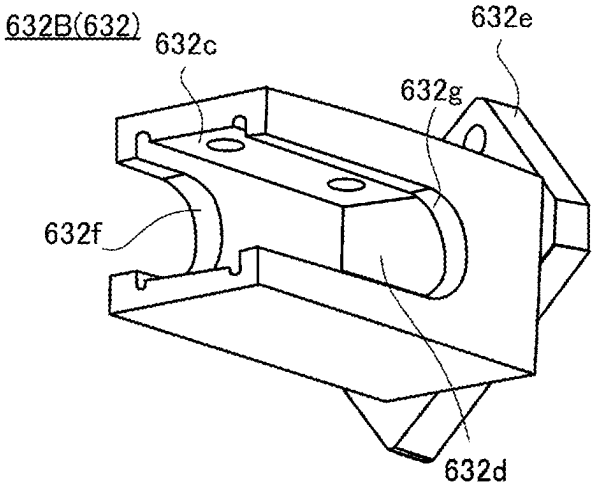
632B(632)
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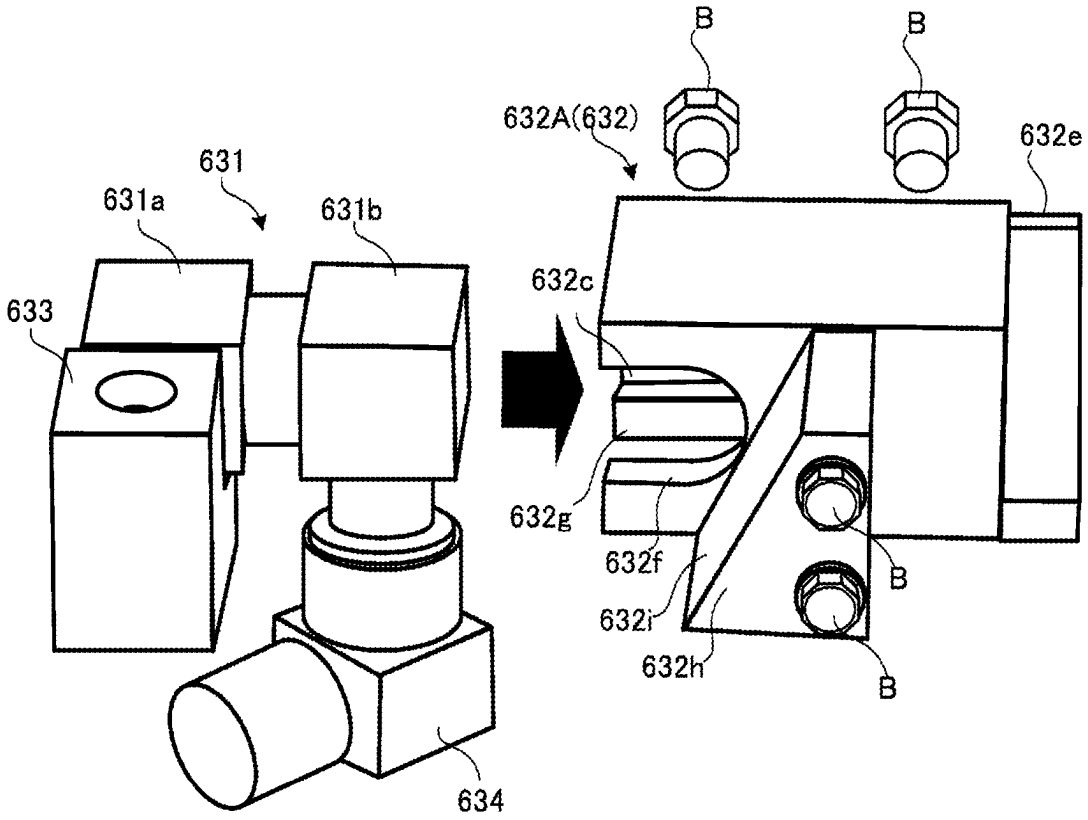
FIG. 9


B
B
632A(632)
632e
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631a
631b
633
632c
632g
632f
632i
632h
B
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634

FIG. 10

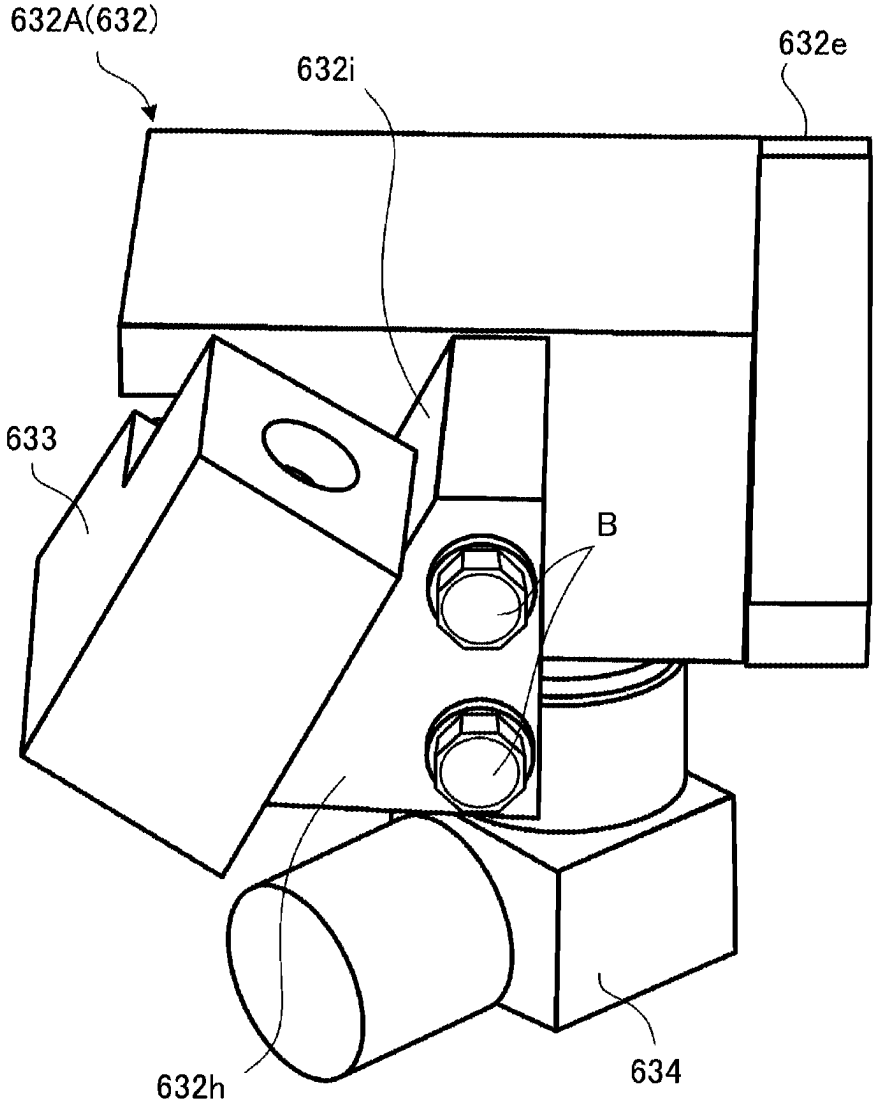
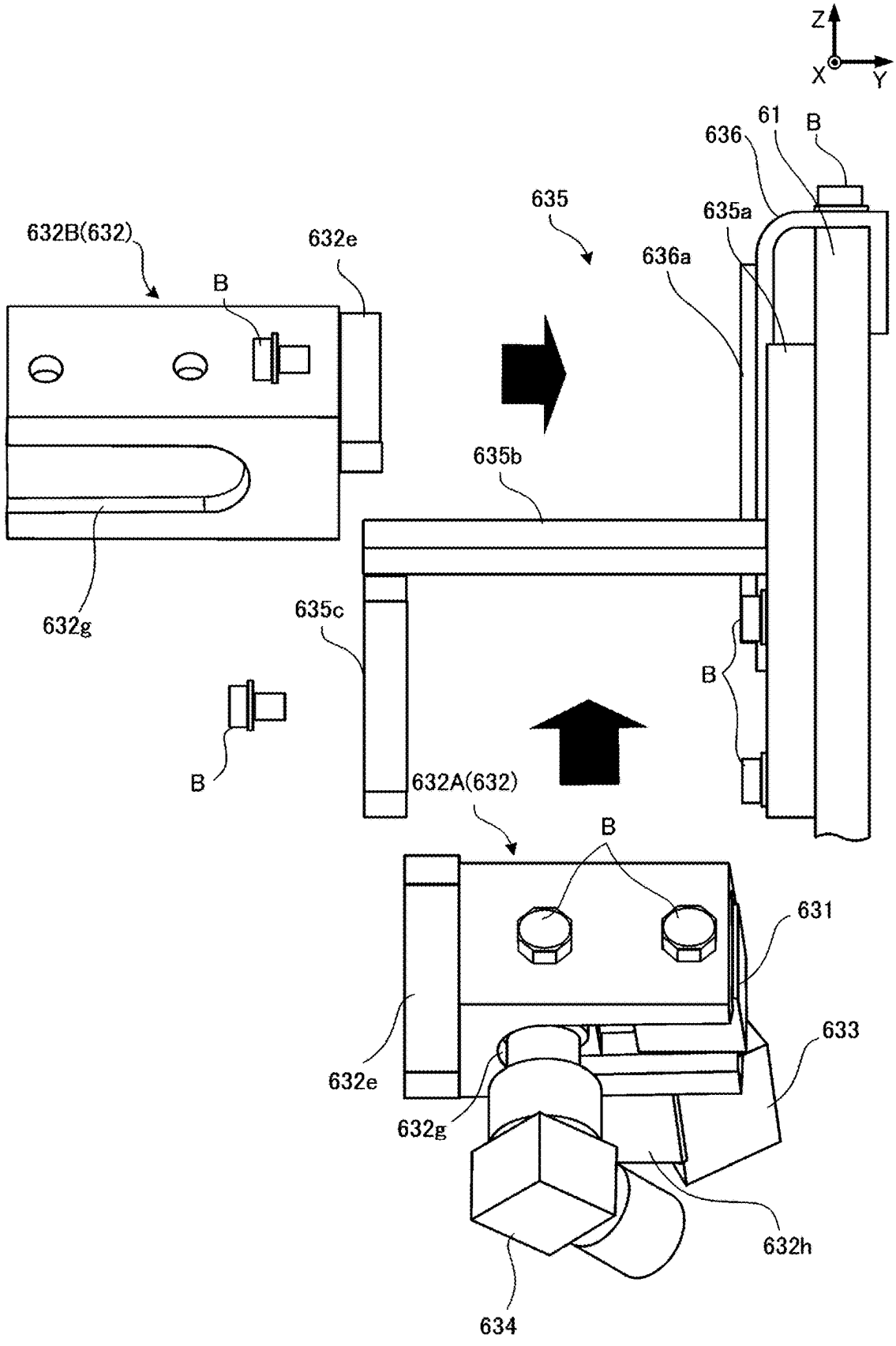


FIG. 11


Z
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635a
632B(632)
632e
636a
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632A(632)
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632e
632g
632h
634

FIG. 12

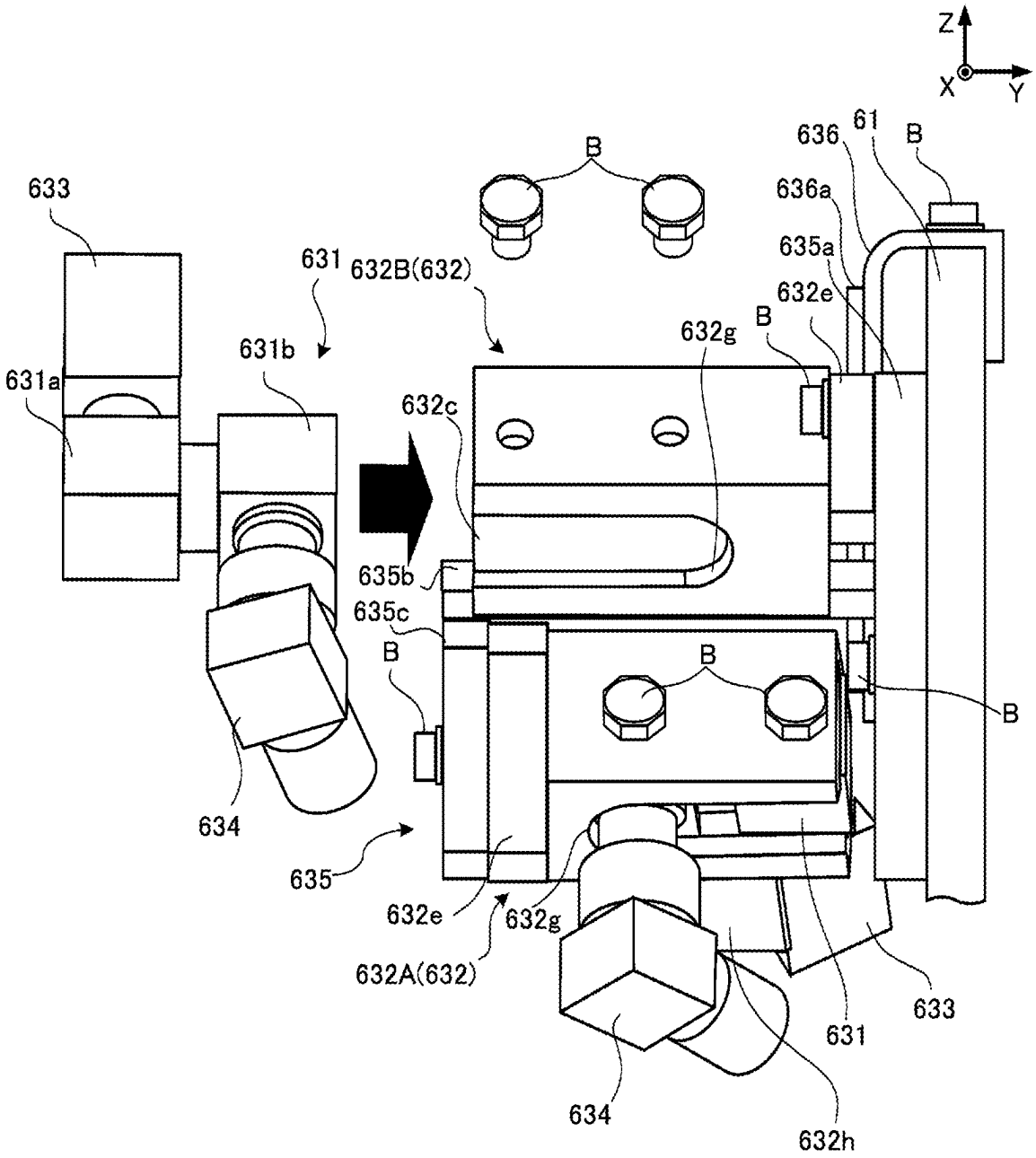
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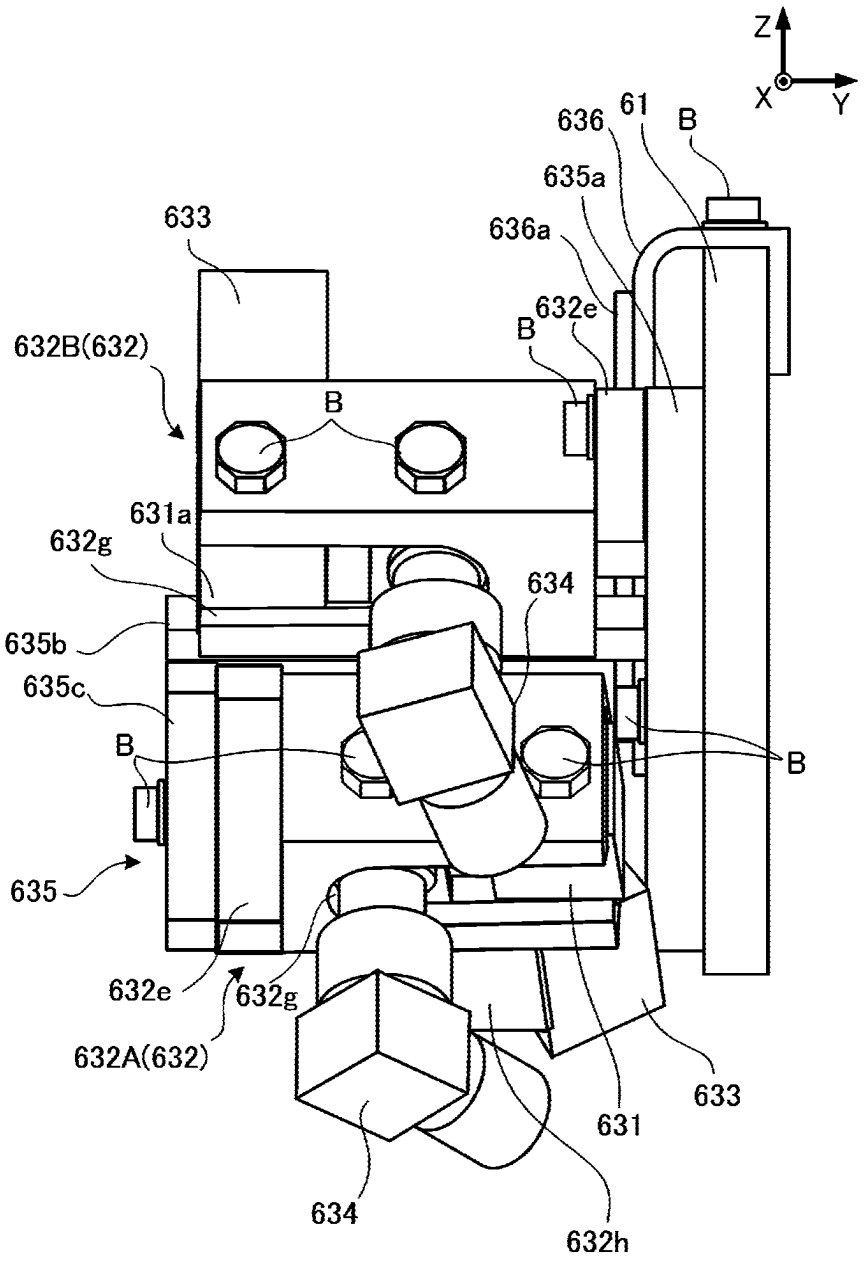
FIG. 13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632A(632)
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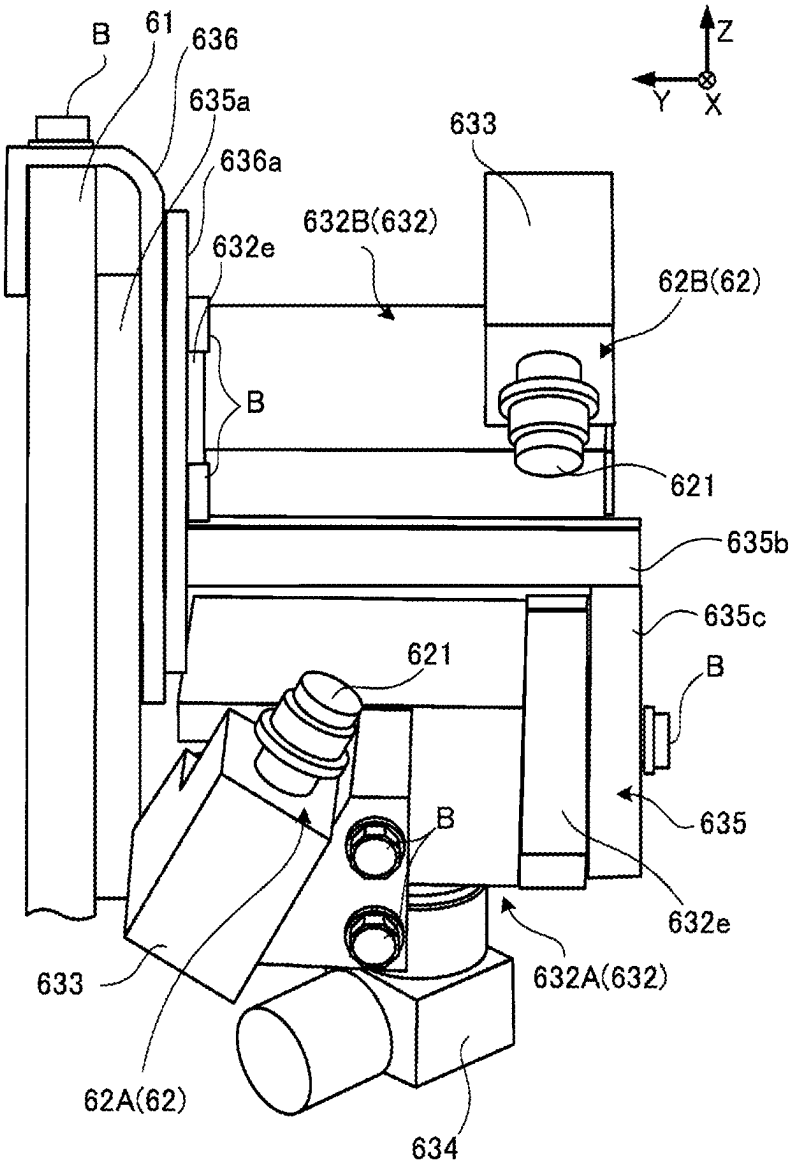
FIG. 14


B
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632e
632B(632)
633
62B(62)
B
621
635b
635c
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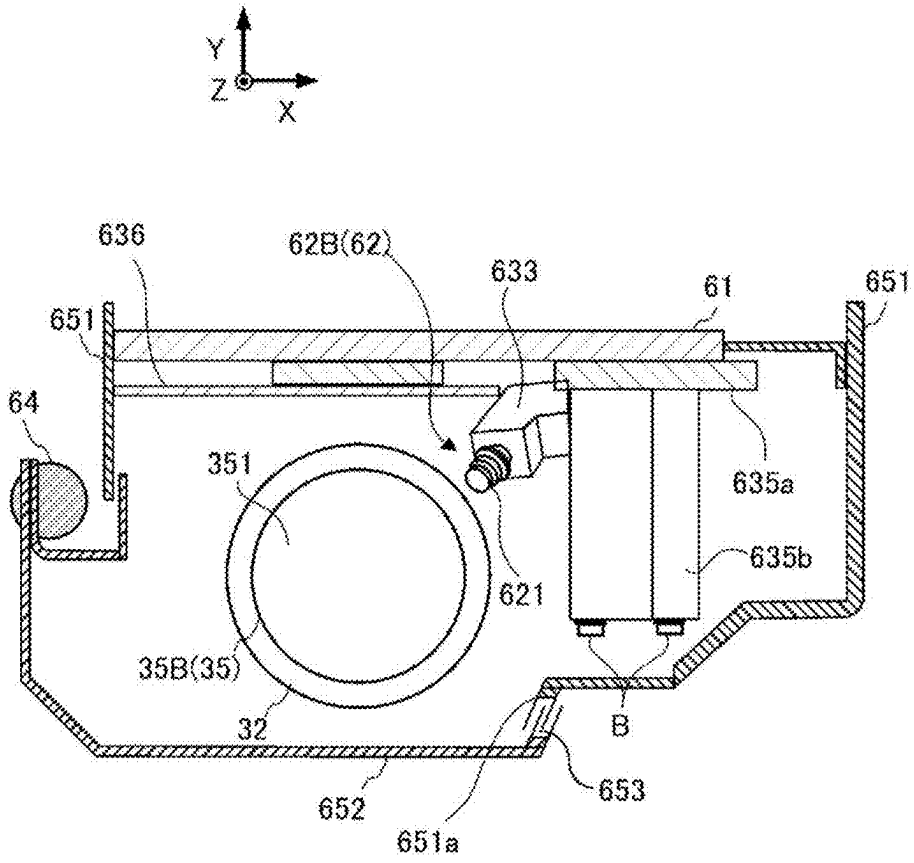
635
632e
633
632A(632)
62A(62)
634
Z
Y
X

FIG. 15


Y
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635a
635b
621
35B(35)
32
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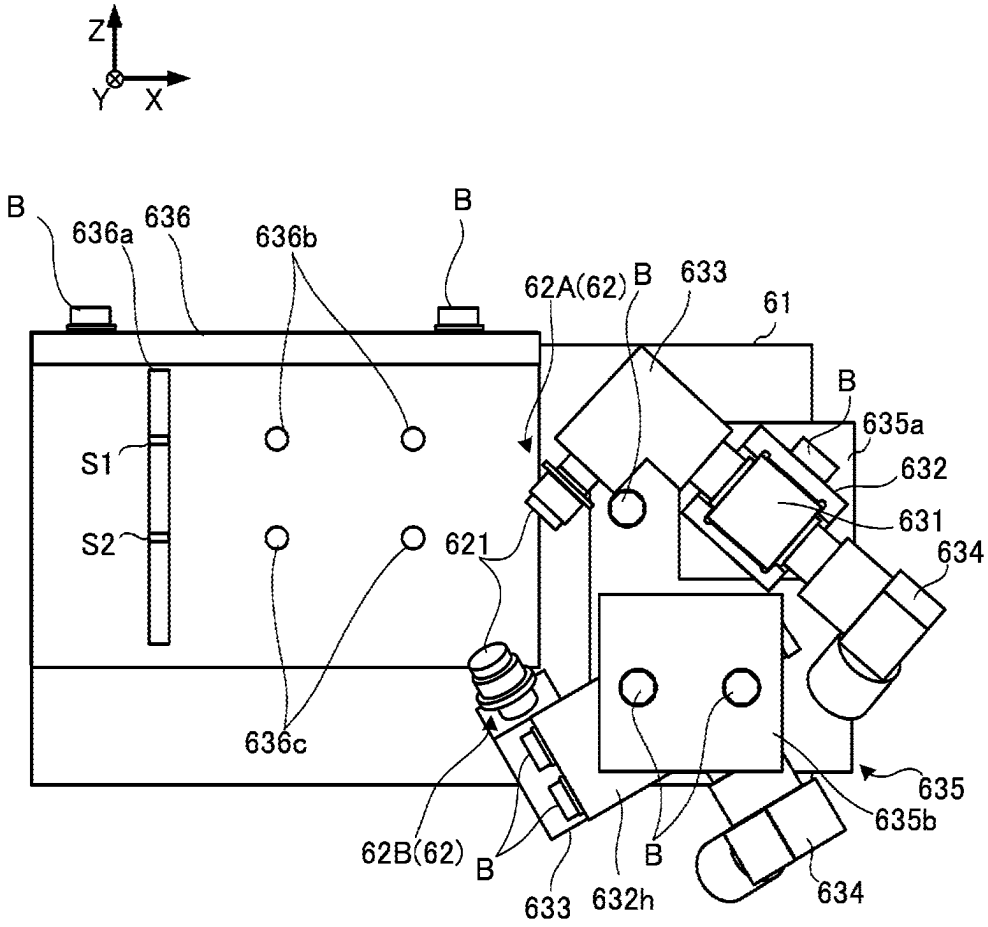
653
652
651a

FIG. 16


Z
Y
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636a
636
636b
B
62A(62)
B
633
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B
635a
632
631
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S1
S2
621
636c
635
635b
62B(62)
B
633
632h
B
634

FIG. 17A

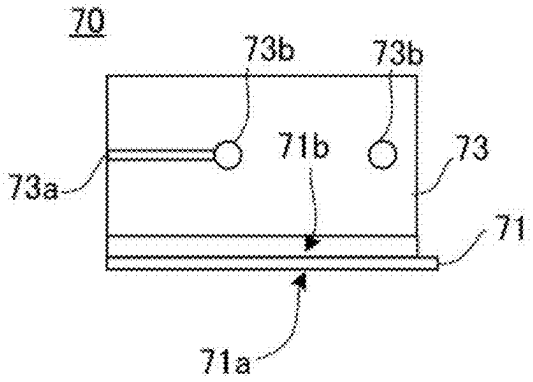


FIG. 17B

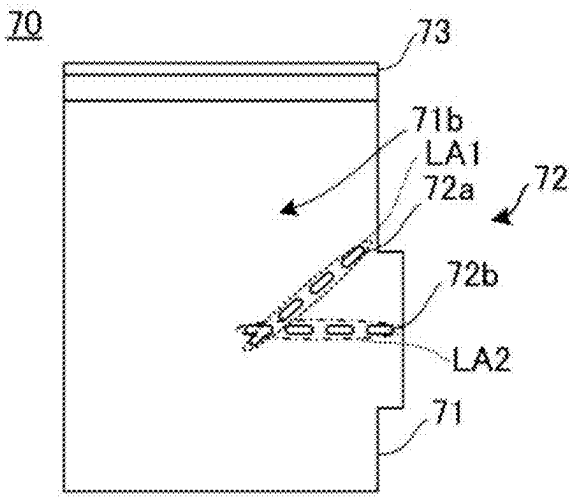


FIG. 17C

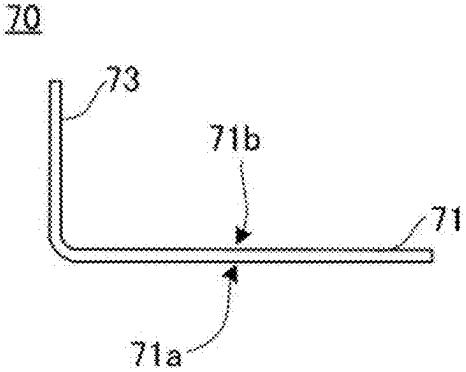


FIG. 18A

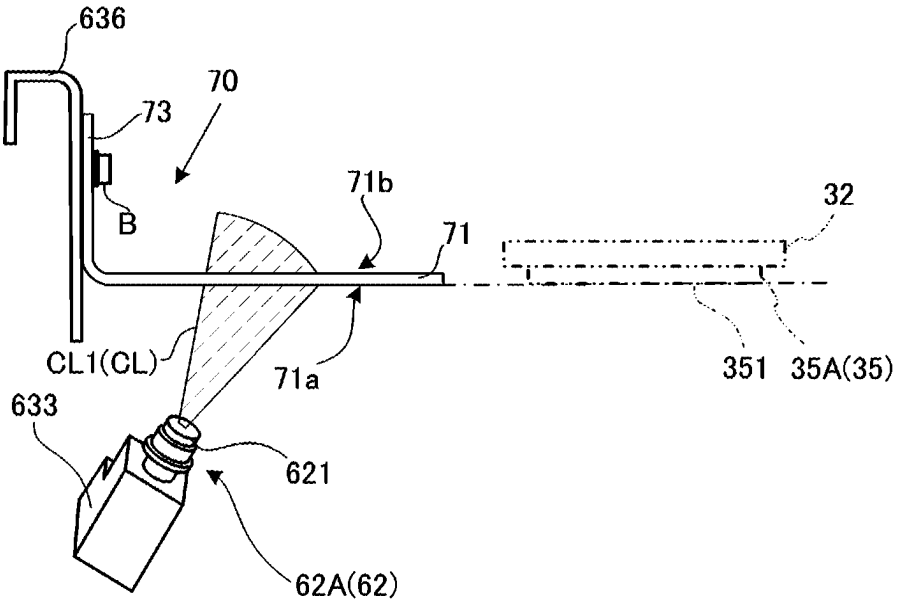
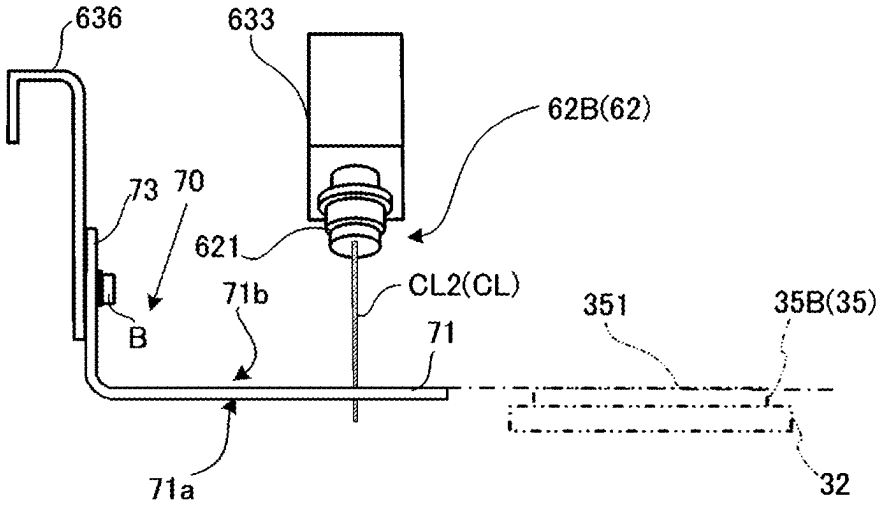


FIG. 18B



CLEANING APPARATUS, ADJUSTMENT JIG, AND ADJUSTMENT METHOD

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is based upon and claims the benefit of priority from Japanese Patent Application No. 2024-018600, filed on Feb. 9, 2024, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to a cleaning apparatus, an adjustment jig, and an adjustment method.

BACKGROUND

[0003] A substrate processing apparatus is an apparatus used in a manufacturing process of a semiconductor, a liquid crystal panel, or the like to process a surface to be processed of a substrate (e.g., a wafer or a liquid crystal substrate) with a chemical solution, rinse the substrate with a rinsing liquid after the chemical solution processing, and dry the substrate after rinsing. In such a substrate processing apparatus, from a viewpoint of uniformity and reproducibility, a single-substrate method is used to process substrates sheet by sheet. In a single-substrate type substrate processing apparatus, a substrate is placed on a rotary table, and a processing liquid such as a chemical solution or the like is supplied to the substrate on the rotating rotary table, so that the substrate is processed with the processing liquid.

[0004] After the substrate processing process using the processing liquid, the substrate is cleaned by a substrate cleaning apparatus in order to maintain a high degree of cleanliness of the substrate. When performing multiple substrate processing processes using several types of processing liquids, the substrate may be cleaned by a substrate cleaning apparatus after each process in order to maintain the high degree of cleanliness of the substrate. As a substrate cleaning method using such a substrate cleaning apparatus, scrub cleaning with a brush is used. In the scrub cleaning, in a state of rotating a substrate, a brush is brought into contact with a surface of a substrate and moved horizontally to remove impurities (metals, organic materials, particles, and the like) on the substrate.

[0005] However, in a substrate cleaning apparatus using the above-mentioned scrub cleaning, impurities removed from the substrate may adhere to the brush and may contaminate a next substrate to be cleaned. Such contamination results in deterioration in quality of the substrate.

SUMMARY

[0006] Some embodiments of the present disclosure provide a cleaning apparatus, an adjustment jig, and an adjustment method, which are capable of maintaining a degree of cleanliness of a brush for cleaning a substrate, and improving quality of a substrate.

[0007] A cleaning apparatus includes: a substrate cleaner configured to clean a first surface and a second surface of a substrate, which is being held and rotated, by bringing a circular contact surface of a rotating first brush into contact with the first surface of the rotating substrate while supplying a substrate cleaning liquid to the first surface of the rotating substrate, and by bringing a circular contact surface of a rotating second brush into contact with the second surface of the rotating substrate while supplying the substrate cleaning liquid to the second surface of the rotating substrate; and a brush cleaner configured to clean the first brush and the second brush by discharging a brush cleaning liquid from a discharger to the contact surface of the first brush and the contact surface of the second brush, in a state in which the first brush and the second brush are located at a retracted position spaced apart from a region where the substrate is held. The discharger includes: a first discharger configured to discharge the brush cleaning liquid so that the brush cleaning liquid lands linearly on the contact surface of the first brush; and a second discharger configured to discharge the brush cleaning liquid so that the brush cleaning liquid lands linearly on the contact surface of the second brush. The brush cleaner includes a support configured to support the first discharger and the second discharger, so that the brush cleaning liquid discharged from the first discharger and the brush cleaning liquid discharged from the second discharger do not interfere with each other until the brush cleaning liquid lands on the contact surface of the first brush and the contact surface of the second brush.

[0008] A cleaning apparatus includes: a substrate cleaner configured to clean one surface of a substrate, which is being held and rotated, by bringing a circular contact surface of a rotating brush into contact with the one surface of the rotating substrate while supplying a substrate cleaning liquid to the one surface of the substrate; a brush cleaner configured to clean the brush by discharging a brush cleaning liquid from a discharger to the contact surface, in a state in which the brush is located at a retracted position spaced apart from a region where the substrate is held; and a support configured to support the discharger. The support includes: a prismatic columnar fixing joint configured to support the discharger and having an internal flow path for supplying the brush cleaning liquid to the discharger; and a fixture including an insertion hole into which the fixing joint is inserted, the insertion hole having a plurality of surfaces brought into contact with a plurality of side surfaces of the fixing joint and being configured to fix an angle of the fixing joint.

[0009] An adjustment jig according to an embodiment is an adjustment jig for adjusting positions of a first discharger and a second discharger of a cleaning apparatus. The adjust jig includes: a liquid landing plate on which a brush cleaning liquid discharged from the first discharger and the second discharger lands at positions corresponding to contact surfaces of the first brush and the second brush; reference holes, which are a plurality of through-holes provided linearly and correspond to liquid landing areas, on which the brush cleaning liquid discharged from the first discharger and the brush cleaning liquid discharged from the second discharger land, respectively, in the liquid landing plate; and a fixer configured to selectively fix the liquid landing plate to any of a position corresponding to the contact surface of the first brush and a position corresponding to the contact surface of the second brush.

[0010] An adjustment method according to an embodiment is a method of adjusting positions of a first discharger and a second discharger of a cleaning apparatus by using an adjustment jig. The method includes: a first fixing process of fixing the liquid landing plate at a position corresponding to the contact surface of the first brush; after the first fixing process, a first liquid landing process of discharging the brush cleaning liquid from the first discharger so that the brush cleaning liquid lands on the liquid landing plate; a first

adjustment process of adjusting the position of the first discharger based on a passing state of the brush cleaning liquid through the reference holes in the first liquid landing process; a second fixing process of fixing the liquid landing plate at a position corresponding to the contact surface of the second brush; after the second fixing process, a second liquid landing process of discharging the brush cleaning liquid from the second discharger so that the brush cleaning liquid lands on the liquid landing plate; and a second adjustment process of adjusting the position of the second discharger based on a passing state of the brush cleaning liquid through the reference holes in the second liquid landing process.

BRIEF DESCRIPTION OF DRAWINGS

[0011] The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the present disclosure.

[0012] FIG. **1** is a transparent side view showing a schematic configuration of a cleaning apparatus according to an embodiment.

[0013] FIG. **2** is a plan view showing the schematic configuration of the cleaning apparatus according to the embodiment.

[0014] FIG. **3** is a front view showing a brush cleaner of the cleaning apparatus according to the embodiment.

[0015] FIG. **4** is a perspective view showing the brush cleaner and an adjustment jig.

[0016] FIGS. **5**A and **5**B are explanatory diagrams showing a discharge angle of a brush cleaning liquid by a discharger to a brush, wherein FIG. **5**A is a view of the brush seen from a rear of a first discharger, and FIG. **5**B is a view of the brush seen from a rear of a second discharger.

[0017] FIG. **6**A is a plan view showing a liquid landing area on a first brush, and FIG. **6**B is a plan view showing a liquid landing area on a second brush.

[0018] FIG. **7** is a perspective view showing a fixing joint.

[0019] FIG. **8**A is a perspective view showing a first fixture, and FIG. **8**B is a perspective view showing a second fixture.

[0020] FIG. **9** is a perspective view showing a state before the fixing joint supporting the first discharger is inserted into the first fixture.

[0021] FIG. **10** is a perspective view showing a state after the fixing joint supporting the first discharger is inserted into the first fixture.

[0022] FIG. **11** is a perspective view showing a state before the first fixture and the second fixture are attached to a holder.

[0023] FIG. **12** is a perspective view showing a state before the fixing joint supporting the second discharger is inserted into the second fixture.

[0024] FIG. **13** is a perspective view showing a state after the fixing joint supporting the second discharger is inserted into the second fixture.

[0025] FIG. **14** is a perspective view showing the first discharger having an angle determined by an angle determinator.

[0026] FIG. **15** is a horizontal cross-sectional view showing a cover.

[0027] FIG. **16** is a front view showing a base plate attached to a fixing plate.

[0028] FIG. **17**A is a front view showing the adjustment jig, FIG. **17**B is a plan view showing the adjustment jig, and FIG. **17**C is a side view showing the adjustment jig.

[0029] FIG. **18**A is an explanatory diagram showing checking discharge of the brush cleaning liquid from the first discharger by the adjustment jig, and FIG. **18**B is an explanatory diagram showing checking discharge of the brush cleaning liquid from the second discharger by the adjustment jig.

DETAILED DESCRIPTION

[0030] Reference will now be made in detail to various embodiments, examples of which are illustrated in the accompanying drawings. In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the present disclosure. However, it will be apparent to one of ordinary skill in the art that the present disclosure may be practiced without these specific details. In other instances, well-known methods, procedures, systems, and components have not been described in detail so as not to unnecessarily obscure aspects of the various embodiments.

[0031] Hereinafter, an embodiment of the present disclosure will be described with reference to the drawings. As shown in FIGS. **1** and **2**, the present embodiment is a cleaning apparatus **1** that cleans a substrate W with a substrate cleaning liquid SL and a brush **35** while rotating the substrate W. The substrate W to be cleaned is typically a semiconductor wafer, but may also be a substrate for a display device, and the like.

[0032] The substrate W has a disk shape. In the following description, an upper surface and a lower surface of the substrate W are referred to as a front surface (first surface) and a back surface (second surface), respectively, and when referring to both the front surface and the back surface, they are referred to as front and back surfaces of the substrate W. In addition, an outer peripheral end surface is a side surface other than the front and back surfaces of the substrate W. In addition, in FIG. **1**, a vertical direction is referred to as a Z direction, and among horizontal directions perpendicular to the Z direction, a left-right direction as viewed from a front (a right-hand side in FIG. **1**) is referred to as an X direction, and a front-rear direction perpendicular to the X direction is referred to as a Y direction.

Configuration

[0033] As shown in FIGS. **1** and **2**, the cleaning apparatus **1** includes a chamber **10**, a rotation driver **20**, a substrate cleaner **30**, a brush driver **40**, a cleaning liquid discharger **50**, a brush cleaner **60**, and a controller **100**. In addition, an adjustment jig **70** is used to adjust positions of a first discharger **62**A and a second discharger **62**B in the brush cleaner **60** (see FIG. **4**). FIG. **1** is a transparent view showing an interior of the chamber **10**, and FIG. **2** is a plan view of the interior of the chamber **10**. In addition, an enlarged view of the brush cleaner **60** is shown in FIG. **3**.

Chamber

[0034] The chamber **10** is a container having a cleaning chamber **11** for cleaning the substrate W loaded thereinto. The chamber **10** is a rectangular parallelepiped housing, and an internal space thereof serves as the cleaning chamber **11**. In addition, a bottom of the chamber **10** is indicated by

reference numeral **10***a*. Although not shown, a load/unload port for loading and unloading the substrate W by a transfer robot is provided on one side surface of the chamber **10**, and a work port for a maintenance work is provided on the other side surface. Each of the load/unload port and the work port is configured to be opened and closed by a door, which is driven by an opening/closing mechanism. In addition, although not shown, a drainage port is formed at the bottom **10***a* of the chamber **10**. A substrate cleaning liquid and a brush cleaning liquid that fall on the bottom **10***a* of the chamber **10** are discharged to outside of the cleaning apparatus **1** via the drainage port.

Rotation Driver

[0035] As shown in FIG. **2**, the rotation driver **20** rotationally drives the substrate W by rotating a plurality of rollers **20***a* that holds an outer periphery of the substrate W. As shown in FIG. **1**, the rotation driver **20** includes a first holder **21** and a second holder **22**. The first holder **21** and the second holder **22** are disposed at positions that face each other in the left-right direction in FIG. **2** with respect to a center of the substrate W.

[0036] Each of the first holder **21** and the second holder **22** includes a pair of rollers **20***a*. The rollers **20***a* are provided to be rotatable about an axis perpendicular to a direction in which the surface of the substrate W extends. Each roller **20***a* includes a cylindrical large diameter portion having a large diameter, and a cylindrical small diameter portion having a small diameter and provided coaxially with the large diameter portion. The rollers **20***a* hold the substrate W by bring side surfaces of the small diameter portions into contact with the outer periphery of the substrate W. The rollers **20***a* are formed of a material having a resistance to the substrate cleaning liquid SL, such as PEEK or the like.

[0037] A rotation mechanism such as a motor or the like for rotating the rollers **20***a* is accommodated inside each of the first holder **21** and the second holder **22**. The first holder **21** and the second holder **22** are configured so that the rollers **20***a* can move to be in contact with or separated from the substrate W by a drive mechanism (not shown). As the first holder **21** and the second holder **22** move to be spaced apart from each other by the drive mechanism, the rollers **20***a* are located at release positions at which the rollers **20***a* are spaced apart from the substrate W. In addition, as the first holder **21** and the second holder **22** are moved toward each other by the drive mechanism, the rollers **20***a* are located at holding positions at which the rollers **20***a* are in contact with and hold the substrate W.

Substrate Cleaner

[0038] The substrate cleaner **30** includes brushes **35** that clean the surface of the substrate W by being rotated and brought into contact with the surface of the rotating substrate W. The brushes **35** include a first brush **35**A and a second brush **35**B. Each of the first brush **35**A and the second brush **35**B has a contact surface **351** that is brought into contact with the substrate W. The first brush **35**A and the second brush **35**B are cylindrical, and the contact surface **351** is circular (see FIGS. **6**A and **6**B). The first brush **35**A and the second brush **35**B are provided on the same axis and are disposed one above the other so that the contact surfaces **351** thereof face each other.

[0039] When it is not necessary to distinguish the first brush **35**A and the second brush **35**B from each other, they are simply referred to as the brush **35**. In addition, the contact between the brush **35** and the surface of the substrate W includes both a case where the contact surface **351** of the brush **35** is in direct contact with the substrate W and a case where the contact surface **351** is in contact with the substrate W via the substrate cleaning liquid SL. The brush **35** is made of a material having flexibility and elasticity.

[0040] The brush **35** uses a spongy-like resin such as PVA (nylon-based resin), PTFE (fluorine-based resin), or the like. Alternatively, a bristle brush made of the same resin may be used. That is, the brush **35** may be a brush using a sponge-like mass, or may be a brush using densely packed bristles. The brush **35** may use, as the spongy-like mass, a mass of densely packed fibrous bodies. In such a case, the contact surface **351**, which is not strictly flat, is brought into contact with the substrate W.

[0041] As shown in FIG. **1**, the brush **35** is detachably attached to a support provided on a cylindrical body **31** via a brush holder **32**. A motor (not shown) as a drive source for rotating the brush **35** is built in the body **31**.

Brush Driver

[0042] The brush driver **40** moves the substrate cleaner **30** in a direction parallel to the surface of the substrate W. As shown in FIG. **1**, the brush driver **40** includes an arm **41** and a drive mechanism **42**. The arm **41** is a member that extends in the direction parallel to the substrate W, and has one end to which the substrate cleaner **30** is attached. A first arm **41**A supports the first brush **35**A, and a second arm **41**B supports the second brush **35**B. When it is not necessary to distinguish the first arm **41**A and the second arm **41**B from each other, they are simply referred to as the arm **41**. The drive mechanism **42** includes a swing mechanism and a lift mechanism.

[0043] As shown in FIG. **2**, the swing mechanism reciprocates the arm **41** in parallel to the substrate W, from a position above the outer periphery of the substrate W to a position above the outer periphery on an opposite side, along an arc trajectory with an end portion of the arm **41** opposite to the substrate cleaner **30** as an axis. In addition, the swing mechanism reciprocates the arm **41** to move from a retracted position outside a region in which the substrate W is held to a position above the outer periphery of the substrate W. In FIG. **2**, the first arm **41**A and the substrate cleaner **30** when the brush **35** is located at the retracted position are indicated by two-dot chain lines. As will be described later, the retracted position is also a brush cleaning position where the brush **35** is cleaned by the brush cleaner **60**. The swing mechanism includes a support shaft extending from the other end of the arm **41** in a direction perpendicular to a surface direction of the substrate W, and a motor (not shown) as a drive source for swinging the support shaft. The arm **41** is positioned so that the brush **35** is located at the retracted position when the cleaning of the substrate W is not performed.

[0044] The lift mechanism moves the arm **41** so that the substrate cleaner **30** is in contact with or separated from the substrate W. As the lift mechanism, a ball screw mechanism, a cylinder, or the like that moves the support shaft of the arm **41** vertically may be used. As shown in FIG. **3**, the lift mechanism of the present embodiment moves the arm **41** vertically so that the contact surface **351** of the first brush

35A and the contact surface 351 of the second brush 35B are spaced apart from each other when the brush 35 is at the retracted position. More specifically, the lift mechanism moves the first arm 41A vertically so that a position of the contact surface 351 of the first brush 35A becomes a position of a first liquid landing surface 71*a* of the adjustment jig 70 when the adjustment jig 70 described later is attached (see FIG. 18A). In addition, the lift mechanism moves the second arm 41B vertically so that a position of the contact surface 351 of the second brush 35B becomes a position of a second liquid landing surface 71*b* of the adjustment jig 70 when the adjustment jig 70 described later is attached (see FIG. 18B).

Cleaning Liquid Discharger

[0045] The cleaning liquid discharger 50 discharges the substrate cleaning liquid SL to the substrate W. The cleaning liquid discharger 50 discharges the substrate cleaning liquid SL from a nozzle 51 toward both surfaces of the rotating substrate W. The substrate cleaning liquid SL in the present embodiment is ozone water, pure water, or SC-1 (a cleaning liquid made by mixing ammonia water and hydrogen peroxide water). The cleaning liquid discharger 50 is connected to a supply mechanism for the substrate cleaning liquid SL (not shown) via a pipe. The supply mechanism includes a liquid sending device, valves, and the like connected to a pure water production device (pure water storage tank), an ozone water production device (ozone water storage tank), and an SC-1 supply device, and can supply any of pure water, ozone water, and SC-1 in a switched manner.

[0046] The substrate cleaner 30, the brush driver 40, and the cleaning liquid discharger 50 as described above are provided in pair vertically with the substrate W interposed therebetween so that the front and back surfaces of the substrate W can be cleaned. That is, the first arm 41A and the second arm 41B of the brush driver 40 are disposed above and below the substrate W, respectively, so that the contact surface 351 of each of the pair of the first brush 35A and the second brush 35B faces the substrate W. The drive mechanism 42 moves the first arm 41A and the second arm 41B between a contact position where the first brush 35A and the second brush 35B are in contact with the substrate W with the substrate W interposed therebetween, and a separation position where the first brush 35A and the second brush 35B are spaced apart from the substrate W.

[0047] Further, the drive mechanism 42 swings the first arm 41A and the second arm 41B to move the first brush 35A and the second brush 35B located at the contact position along an arc trajectory. Furthermore, the first brush 35A and the second brush 35B are cleaned by the brush cleaner 60 described later at the retracted position out of the substrate W.

Brush Cleaner

[0048] As shown in FIG. 3, the brush cleaner 60 cleans the first brush 35A and the second brush 35B with a brush cleaning liquid CL in a state in which the first brush 35A and the second brush 35B are located at the retracted position. In addition, in the following description, a cleaning liquid discharged by the first discharger 62A is referred to as a brush cleaning liquid CL1, and a cleaning liquid discharged by the second discharger 62B is referred to as a brush cleaning liquid CL2. When it is not necessary to distinguish the brush cleaning liquid CL1 and the brush cleaning liquid CL2 from each other, they are referred to as a brush cleaning liquid CL. The brush cleaner 60 includes a fixing plate 61, a discharger 62, a support 63, a support column 64, and a cover 65.

<Fixing Plate>

[0049] The fixing plate 61 is a plate that extends vertically upward from the bottom 10*a* of the chamber 10 as shown in FIGS. 1 and 4.

<Discharger>

[0050] As shown in FIGS. 4 to 5B, the discharger 62 discharges the brush cleaning liquid CL to the contact surfaces 351 to clean the first brush 35A and the second brush 35B. The discharger 62 includes the first discharger 62A and the second discharger 62B. The first discharger 62A discharges the brush cleaning liquid CL1 so that the brush cleaning liquid CL1 lands linearly on the contact surface 351 of the first brush 35A as shown in FIG. 6A. This liquid landing area is referred to as LA1. The second discharger 62B discharges the brush cleaning liquid CL2 so that the brush cleaning liquid CL2 lands linearly on the contact surface 351 of the second brush 35B as shown in FIG. 6B. This liquid landing area is referred to as LA2. In the surface direction of the contact surfaces 351 of the first brush 35A and the second brush 35B, a direction in which the liquid landing area LA1 extends linearly is different from a direction in which the liquid landing area LA2 extends linearly. The first discharger 62A and the second discharger 62B discharge the brush cleaning liquid CL from outside the first brush 35A and the second brush 35B so that a discharge direction (a direction in which an axis of a nozzle tip 621 of the discharger 62 described later extends) is oblique with respect to the contact surface 351. For example, the brush cleaning liquid CL may be discharged so that the discharge direction is 35 degrees to 45 degrees with respect to the contact surface 351. Hereinafter, when the first discharger 62A and the second discharger 62B are not distinguished from each other, they are simply referred to as the discharger 62. In addition, when the liquid landing areas LA1 and LA2 are not distinguished from each other, they are simply referred to as the liquid landing area LA.

[0051] The discharger 62 has the cylindrical nozzle tip 621. That is, the discharger 62 in the present embodiment is a so-called nozzle that discharges the brush cleaning liquid CL. An elliptical discharge port 622 is formed at a front end of the nozzle tip 621. Thus, as shown in FIGS. 3, 5A, and 5B, the brush cleaning liquid CL discharged from the discharge port 622 is spread in a fan-like planar shape from the discharge port 622, and as shown in FIGS. 6A and 6B, forms the linear liquid landing area LA along a major axis direction of the discharge port 622 on the contact surface 351 of the brush 35. Spreading the brush cleaning liquid CL in a fan-like planar shape means that a cross section of a spray pattern of the discharged brush cleaning liquid CL is spread in a flat shape. In addition, the liquid landing area LA may be formed in an elongated ellipse. That is, the discharger 62 (nozzle tip 621) may be one that causes the liquid landing area LA to be a spray pattern of an elongated ellipse. As such, the term "linear" also includes a case in which there is a bulge in a width direction perpendicular to a longitudinal direction of the liquid landing area LA. A thread groove is cut on an outer periphery of a rear end of the nozzle tip 621,

and the nozzle tip **621** is screw-fixed to an end portion of a discharger-side joint **633** described later. By changing an amount of screwing the nozzle tip **621**, it is possible to change an angle of the discharge port **622** about the axis of the nozzle tip **621** to adjust an angle of the liquid landing area LA on the contact surface **351**.

<Support>

[0052] The support **63** supports the first discharger **62**A and the second discharger **62**B. As shown in FIG. **3**, the first discharger **62**A and the second discharger **62**B supported by the support **63** are disposed in a region between the first arm **41**A and the second arm **41**B when the brush **35** is positioned at the retracted position.

[0053] Further, the first discharger **62**A and the second discharger **62**B supported by the support **63** are positioned so that the brush cleaning liquids CL**1** and CL**2** discharged from the first discharger **62**A and the second discharger **62**B, respectively, do not interfere with each other. In other words, the support **63** supports the first discharger **62**A and the second discharger **62**B so that the brush cleaning liquids CL**1** and CL**2** discharged in a fan-like planar shape from the first discharger **62**A and the second discharger **62**B do not collide with each other before landing on the contact surfaces **351**.

[0054] Furthermore, as shown in FIGS. **6**A and **6**B, the linear liquid landing area LA where the brush cleaning liquid CL discharged from the discharger **62** lands on the contact surface **351** of the brush **35** has a length that covers from an outer peripheral edge to a center C of the contact surface **351**. Moreover, as shown in FIGS. **5**A and **5**B, a plane of the brush cleaning liquid CL, which is formed by the brush cleaning liquid CL discharged from the discharger **62** and spread in a planar shape until the brush cleaning liquid CL lands on the contact surface **351** of the brush **35**, is perpendicular to the contact surface **351**.

[0055] As shown in FIG. **4**, the support **63** includes a fixing joint **631**, a fixture **632**, a discharger-side joint **633**, a supply-side joint **634** (see FIG. **9**), a holder **635**, and a base plate **636**.

[0056] As shown in FIGS. **3**, **4**, **7**, and **9**, the fixing joint **631** supports the discharger **62**, has an internal flow path for supplying the brush cleaning liquid CL to the discharger **62**, and has corners on an outer periphery thereof. In the present embodiment, the fixing joint **631** supports the discharger **62** via the discharger-side joint **633**, which will be described later. The fixing joint **631** has a prismatic columnar shape. As shown in FIG. **7**, the fixing joint **631** of the present embodiment includes rectangular parallelepiped blocks **631***a* and **631***b*. The blocks **631***a* and **631***b* are rotatably connected to each other.

[0057] As shown in FIGS. **8**A and **8**B, the fixture **632** has an insertion hole **632***c* that receives the fixing joint **631**, has a plurality of surfaces with which a plurality of side surfaces of the fixing joint **631** is in contact, and fixes an angle of the fixing joint **631**. The insertion hole **632***c* also has a contact surface **632***d* that is brought into contact with an end of the fixing joint **631** to determine a position of the fixing joint **631** in an insertion direction. The fixture **632** of the present embodiment is a cylindrical body having a rectangular parallelepiped shape. One end of the insertion hole **632***c* is open, and the other end is closed by the contact surface **632***d*. Since the fixing joint **631** and the insertion hole **632***c* have a rectangular parallelepiped shape, by bringing four surfaces of the fixing joint **631** and four surfaces of the insertion hole **632***c* into contact with each other, an angle about an axis parallel to the insertion direction of the fixing joint **631** is fixed. In addition, an attachment plate **632***e* is fixed to an end portion of the fixture **632** on a side of the contact surface **632***d*.

[0058] More specifically, as shown in FIG. **9**, by inserting the blocks **631***a* and **631***b* of the fixing joint **631** rotatably connected to each other into the insertion hole **632***c*, four surfaces of the blocks **631***a* and **631***b* are brought into contact with the four surfaces of the insertion hole **632***c*, so that rotation thereof about an axis is restricted. The fixing joint **631** inserted into the insertion hole **632***c* is fixed by fasteners B such as bolts or the like via a hole provided in the fixture **632**, so that movement thereof in the insertion direction is restricted.

[0059] As shown in FIGS. **8**A and **8**B, a discharger groove **632***f* into which a connection portion between the below-described discharger-side joint **633** and the fixing joint **631** is inserted from an open end portion, and a supply groove **632***g* into which a connection portion between the supply-side joint **634** and the fixing joint **631** is inserted from an open end portion, are formed in side surfaces of the fixture **632**. The discharger groove **632***f* and the supply groove **632***g* have different lengths in the insertion direction. In other words, the supply groove **632***g* is a groove deeper than the discharger groove **632***f*.

[0060] Here, the fixture **632** into which the fixing joint **631** supporting the first discharger **62**A is inserted is referred to as a first fixture **632**A, and the fixture **632** into which the fixing joint **631** supporting the second discharger **62**B is inserted is referred to as a second fixture **632**B. As shown in FIG. **8**A, the discharger groove **632***f* and the supply groove **632***g* of the first fixture **632**A are formed in two adjacent side surfaces. As shown in FIG. **8**B, the discharger groove **632***f* and the supply groove **632***g* of the second fixture **632**B are formed in two opposing side surfaces.

[0061] As shown in FIGS. **3**, **9**, and **10**, the discharger-side joint **633** has an internal flow path for supplying the brush cleaning liquid CL to the discharger **62**, and is connected to the fixing joint **631** so that an angle of the discharger **62** fixed to the discharger-side joint **633** can be changed. The discharger-side joint **633** of the present embodiment is an L-shaped block. As described above, the nozzle tip **621** is screw-inserted to one end of the discharger-side joint **633** (see FIG. **3**). The other end of the discharger-side joint **633** is connected to the fixing joint **631**.

[0062] When the fixing joint **631** is inserted into the insertion hole **632***c* of the fixture **632**, and the connection portion between the discharger-side joint **633** and the fixing joint **631** is inserted into the discharger groove **632***f*. As a result, the discharger-side joint **633** is supported to protrude from one side surface of the fixture **632**.

[0063] In addition, as shown in FIG. **10**, the first fixture **632**A corresponding to the first discharger **62**A is provided with an angle determinator **632***h*, which is in contact with the discharger-side joint **633** and determines an angle of the discharger **62**. The angle determinator **632***h* has an inclined surface **632***i*, and the inclined surface **632***i* is in contact a side surface of the discharger-side joint **633** to determine an angle of the discharger-side joint **633**.

[0064] As shown in FIGS. **3**, **9**, and **10**, the supply-side joint **634** is connected to the fixing joint **631**, a flow path for supplying the brush cleaning liquid CL to the discharger **62**

is formed in the supply-side joint **634**, and a pipe **624***a* for supplying the brush cleaning liquid CL is connected to the supply-side joint **634**. In the present embodiment, the supply-side joint **634** is an L-shaped block. As shown in FIG. **3**, one end of the supply-side joint **634** is connected to the fixing joint **631**, and the other end thereof is connected to a liquid supply **624**. The liquid supply **624** includes the pipe **624***a* and a valve **624***b*, which are connected to the other end of the supply-side joint **634**, and a supply device **624***c* for the brush cleaning liquid CL connected to the pipe **624***a*. For example, pure water is used as the brush cleaning liquid CL. Further, the supply device **624***c* may be the same as the cleaning liquid discharger **50**. Furthermore, a part of the supply mechanism, such as a supply source of the brush cleaning liquid CL or the like, may be common to the cleaning liquid discharger **50**.

[0065] When the fixing joint **631** is inserted into the insertion hole **632***c* of the fixture **632**, the connection portion between the supply-side joint **634** and the fixing joint **631** is inserted into the supply groove **632***g*. As a result, the supply-side joint **634** is supported in the fixture **632** to protrude from one side surface different from the surface from which the discharger-side joint **633** protrudes.

[0066] The discharger **62** and the supply-side joint **634** are provided at positions spaced apart from each other in the insertion direction of the fixing joint **631** into the fixture **632**. More specifically, the discharger-side joint **633** and the supply-side joint **634** are connected to different blocks **631***a* and **631***b* of the fixing joint **631**, and the discharger groove **632***f* and the supply groove **632***g* provided in the fixture **632** of the fixing joint **631** have different lengths. As a result, positions of the discharger **62** and the supply-side joint **634** deviate from each other in the insertion direction.

[0067] In addition, a protruding direction of the discharger-side joint **633** and a protruding direction of the supply-side joint **634** are different in the first fixture **632**A and the second fixture **632**B. Since the discharger groove **632***f* and the supply groove **632***g* of the first fixture **632**A are formed in two adjacent side surfaces, the discharger-side joint **633** and the supply-side joint **634** protrude from the two adjacent side surfaces. Since the discharger groove **632***f* and the supply groove **632***g* of the second fixture **632**B are formed in two opposing side surfaces, the discharger-side joint **633** and the supply-side joint **634** protrude from the two opposing side surfaces.

[0068] As shown in FIG. **4**, the holder **635** fixes the support **63** to the cleaning apparatus **1**. The holder **635** includes a main body plate **635***a*, an extension plate **635***b*, and a support plate **635***c*. The main body plate **635***a* is a plate fixed to the fixing plate **61** by fasteners B. As shown in FIG. **11**, the attachment plate **632***e* of the second fixture **632**B is fixed to the main body plate **635***a* by fasteners B. The extension plate **635***b* is a plate provided to extend vertically from the main body plate **635***a* (extend in the left-hand direction in FIG. **11**). The support plate **635***c* is a plate fixed to an end portion of the extension plate **635***b* opposite to the main body plate **635***a* to face the main body plate **635***a* and be in parallel with the main body plate **635***a*. As shown in FIGS. **11** and **12**, the attachment plate **632***e* of the first fixture **632**A is fixed to the support plate **635***c* by fasteners B. The first fixture **632**A and the second fixture **632**B fixed to the holder **635** are in parallel with each other in a longitudinal direction, and the open ends thereof face opposite directions.

[0069] As shown in FIGS. **4** and **16**, the base plate **636** is a plate fixed to the same surface of the fixing plate **61** to which the holder **635** is fixed. A scale member **636***a* for aligning the adjustment jig **70**, which will be described later, is attached to the base plate **636**. In addition, attachment holes **636***b* and **636***c* for attaching the adjustment jig **70** are formed in the base plate **636**. The scale member **636***a* and the attachment holes **636***b* and **636***c* will be described together with the adjustment jig **70**.

<Support Column>

[0070] As shown in FIGS. **1**, **3**, and **15**, the support column **64** extends vertically from the bottom **10***a* of the chamber **10** at a position adjacent to an end portion of the fixing plate **61**.

<Cover>

[0071] The cover **65** is interposed between the first brush **35**A and the second brush **35**B, which are located at the retracted position, and the substrate W to block scattering of the brush cleaning liquid CL to the substrate W. The cover **65** also covers the first discharger **62**A and the second discharger **62**B. As shown in the horizontal cross-sectional view of FIG. **15**, the cover **65** is a plate that covers surroundings of the first brush **35**A and the second brush **35**B, and includes a fixed cover **651** and an openable cover **652**. The fixed cover **651** is fixed to the fixing plate **61**. The fixed cover **651** has an opening **651***a* through which the first brush **35**A and the second brush **35**B can pass.

[0072] The openable cover **652** is fixed to the support column **64**, and opens and closes the opening **651***a* by rotating about the support column **64** as an axis. In addition, since the support column **64** is provided to be rotatable by a drive source such as a motor (not shown) or the like, the openable cover **652** rotates according to rotation of the support column **64**. An end portion of the openable cover **652** and an end portion of the fixed cover **651** are not in contact with each other when the opening **651***a* is closed, and a curved ventilation path such as a labyrinth structure is formed between the end portion of the openable cover **652** and the end portion of the fixed cover **651**. In addition, a lower side of the cover **65** is open, and the brush cleaning liquid CL flows down to a lower side of the chamber **10**. Although not shown, upper portions of the fixed cover **651** and the openable cover **652** have notches at positions corresponding to the body **31** of the first brush **35**A. As a result, when the openable cover **652** is closed, a surrounding of the body **31** is covered by the fixed cover **651** and the openable cover **652**.

Adjustment Jig

[0073] The adjustment jig **70** is a tool for adjusting positions of the first discharger **62**A and the second discharger **62**B in the cleaning apparatus **1**. As shown in FIGS. **17**A to **17**C, the adjustment jig **70** includes a liquid landing plate **71**, reference holes **72**, and a fixer **73**. The liquid landing plate **71** is a plate on which the brush cleaning liquids CL**1** and CL**2** discharged from the first discharger **62**A and the second discharger **62**B land at positions corresponding to the contact surfaces **351** of the first brush **35**A and the second brush **35**B at the retracted position. One surface of the liquid landing plate **71** is a first liquid landing surface **71***a* on which the brush cleaning liquid CL**1** discharged from the first discharger **62**A lands, and the other side is a second liquid

landing surface **71***b* on which the brush cleaning liquid CL**2** discharged from the second discharger **62**B lands.

[0074] The reference holes **72** are a plurality of through-holes corresponds to the liquid landing areas LA**1** and LA**2** of the brush cleaning liquids CL**1** and CL**2** discharged from the first and second dischargers **62**A and **62**B, respectively, and is provided linearly in the liquid landing plate **71**. In the present embodiment, the reference holes **72** provided for checking the liquid landing area LA**1** of the first discharger **62**A are referred to as first reference holes **72***a*, and the reference holes **72** provided for checking the liquid landing area LA**2** of the second discharger **62**B are referred to as second reference holes **72***b*.

[0075] The first reference holes **72***a* are configured by a plurality of (four in FIG. **17**B) through-holes formed in a row in, for example, an elliptical region, which has a major axis in parallel to the linear liquid landing area LA**1** (see FIG. **6**A) and corresponds to the liquid landing area LA**1**. The second reference holes **72***b* are configured by a plurality of (four in FIG. **17**B) through-holes formed in a row in, for example, an elliptical region, which has a major axis in parallel to the linear liquid landing area LA**2** (see FIG. **6**B) and corresponds to the liquid landing area LA**2**. Arrangement directions of the first reference holes **72***a* and the second reference holes **72***b* of the present embodiment have different angles in a plan view, but through-holes on respective one end sides are formed to be combined. Therefore, the through-holes on the respective one end sides have a shape obtained by synthesizing elliptical shapes at different angles. These one end sides correspond to the centers C of the contact surfaces **351**.

[0076] The fixer **73** selectively fixes the liquid landing plate **71** to any of a position corresponding to the contact surface **351** of the first brush **35**A and a position corresponding to the contact surface **351** of the second brush **35**B (see FIGS. **18**A and **18**B). The fixer **73** is a plate obtained by bending one end side of the liquid landing plate **71** in a direction perpendicular to the liquid landing plate **71**. The fixer **73** is provided with a reference mark **73***a* and attachment holes **73***b*. The reference mark **73***a* is a linear groove in parallel to the liquid landing plate **71**. The attachment holes **73***b* are through-holes for fixing the fixer **73** to the base plate **636** by fasteners B.

[0077] On the other hand, as shown in FIG. **16**, the scale member **636***a* provided on the base plate **636** of the cleaning apparatus **1** has a first scale S**1** for positioning the liquid landing plate **71** at a position corresponding to the contact surface **351** of the first brush **35**A and a second scale S**2** for positioning the liquid landing plate **71** at a position corresponding to the contact surface **351** of the second brush **35**B. The first scale S**1** and the second scale S**2** are grooves formed in the scale member **636***a*. Further, the attachment holes **636***b* provided in the base plate **636** are holes for positioning the liquid landing plate **71** at a position corresponding to the contact surface **351** of the first brush **35**A. The attachment holes **636***c* are holes for positioning the liquid landing plate **71** at a position corresponding to the contact surface **351** of the second brush **35**B.

[0078] By aligning the reference mark **73***a* of the fixer **73** with the first scale S**1** and fastening fasteners B to the attachment holes **636***b* via the attachment holes **73***b*, as shown in FIG. **18**A, the first liquid landing surface **71***a* of the liquid landing plate **71** can be set to a height position of the contact surface **351** of the first brush **35**A located at the retracted position. By aligning the reference mark **73***a* of the fixer **73** with the second scale S**2** and fastening the fasteners B to the attachment holes **636***c* via the attachment holes **73***b*, as shown in FIG. **18**B, the second liquid landing surface **71***b* of the liquid landing plate **71** can be set to a height position of the contact surface **351** of the second brush **35**B. The first brush **35**A and the brush holder **32** in FIG. **18**A are shown imaginarily by two-dot chain lines to explain the height position of the first liquid landing surface **71***a* (shown by a one-dot chain line). In addition, the second brush **35**B and the brush holder **32** in FIG. **18**B are shown imaginarily by two-dot chain lines to explain the height position of the second liquid landing surface **71***b* (shown by a one-dot chain line).

Controller

[0079] As shown in FIG. **1**, the controller **100** is a computer that controls individual components of the cleaning apparatus **1**, and includes a memory configured to store various information and programs related to substrate cleaning and a processor configured to execute the various programs.

[0080] The controller **100** controls individual mechanisms by outputting operation commands to a drive circuit that drives the door opening/closing mechanisms for the load/unload port and the work port of the chamber **10**, the rotation mechanism for the rollers **20***a* of the rotation driver **20**, the drive mechanism for moving the first holder **21** and the second holder **22**, the drive mechanism **42** of the brush driver **40**, the supply mechanism of the cleaning liquid discharger **50**, the liquid supply **624** for supplying the brush cleaning liquid CL to the discharger **62** of the brush cleaner **60**, and the drive source for rotating the openable cover **652**. In the present embodiment, the controller **100** is set so that the discharger **62** discharges the brush cleaning liquid CL only when the brush **35** is at the retracted position. In addition, the controller **100** may be set so that the discharger **62** discharges the brush cleaning liquid CL only when the openable cover **652** closes the opening **651***a*.

[0081] Although not shown, a display part and an input part are connected to the controller **100**. The display is an output device such as a display, a lamp, a meter, or the like, by which information for checking a state of the cleaning apparatus **1** becomes visible to the operator. The input part is an input device such as a switch, a touch panel, a keyboard, a mouse, or the like, by which the operator operates the cleaning apparatus **1** via the controller **100** or inputs settings.

Attachment of Discharger

[0082] A procedure for attaching the discharger **62** so that the discharger **62** is supported by the support **63** will be described. In addition, the holder **635** is attached to the fixing plate **61** by fixing the main body plate **635***a* to the fixing plate **61** with the fasteners B.

Attachment of First Discharger

[0083] First, a procedure for attaching the first discharger **62**A will be described. As shown in FIG. **9**, the discharger-side joint **633** and the supply-side joint **634** are connected to the fixing joint **631**. More specifically, the discharger-side joint **633** is connected to one side surface of the block **631***a*, and the supply-side joint **634** is connected to one side

surface of the block **631***b*. Since these one side surfaces are parallel to the longitudinal direction of the fixing joint **631**, the discharger-side joint **633** and the supply-side joint **634** protrude in a direction perpendicular to the longitudinal direction of the fixing joint **631**.

[0084] At this time, angles of the blocks **631***a* and **631***b* can be changed by rotating them about an axis in the longitudinal direction of the fixing joint **631**. In addition, angles of the discharger-side joint **633** and the supply-side joint **634** can be changed by rotating them about an axis in a direction perpendicular to the longitudinal direction of the fixing joint **631**.

[0085] By inserting the fixing joint **631** into the insertion hole **632***c* of the first fixture **632**A until the fixing joint **631** is brought into contact with the contact surface **632***d* and screw-inserting the fasteners B into the holes, the fixing joint **631** is fixed. At this time, the angles of the blocks **631***a* and **631***b* are adjusted, so that the connection portion with the discharger-side joint **633** enters the discharger groove **632***f* and the connection portion with the supply-side joint **634** enters the supply groove **632***g*. In addition, as shown in FIG. **10**, the discharger-side joint **633** is rotated so that a side surface thereof is aligned with the inclined surface **632***i* of the angle determinator **632***h*.

[0086] As a result, since the four surfaces of the blocks **631***a* and **631***b* are brought into contact with the four surfaces of the insertion hole **632***c*, rotation of the fixing joint **631** about the axis thereof is restricted. Further, since the end portion of the fixing joint **631** is brought into contact with the contact surface **632***d*, the position in the insertion direction is determined. Furthermore, since the side surface of the discharger-side joint **633** is brought into contact with the inclined surface **632***i* of the angle determinator **632***h*, the angle of the discharger-side joint **633** is determined. Since the angle of the discharger-side joint **633** is determined, an axial angle of the first discharger **62**A fixed to the discharger-side joint **633** is determined.

[0087] In addition, as shown in FIG. **11**, the first fixture **632**A is attached to the holder **635**. That is, the first fixture **632**A to which the fixing joint **631** is fixed as described above is inserted between the support plate **635***c* and the main body plate **635***a*, and the attachment plate **632***e* of the first fixture **632**A is attached to the support plate **635***c* with the fasteners B.

[0088] Here, the first discharger **62**A is connected to the discharger-side joint **633** (see FIG. **14**). That is, the nozzle tip **621** is screw-inserted into an end portion of the discharger-side joint **633**. The first discharger **62**A is fixed in a direction facing the first brush **35**A located at the retracted position. Further, by adjusting the amount of screwing the nozzle tip **621**, the extension direction of the liquid landing area LA**1** formed by the brush cleaning liquid CL**1** discharged from the elliptical discharge port **622** is set to a radial direction of the contact surface **351** of the first brush **35**A.

[0089] As a result, as shown in FIGS. **3**, **5**A, and **5**B, the first discharger **62**A is positioned to discharge the brush cleaning liquid CL**1** in an obliquely upward direction, which intersects with the direction in which the axis of the first brush **35**A extends, from outside the first brush **35**A and the second brush **35**B located at the retracted position toward the first brush **35**A. The fan-like plane of the brush cleaning liquid CL**1** discharged from the first discharger **62**A is perpendicular to the contact surface **351** of the first brush **35**A. Further, as shown in FIG. **6**A, the first discharger **62**A is attached so that the liquid landing area LA**1** of the brush cleaning liquid CL**1** on the first brush **35**A has a length that covers from the outer peripheral edge to the center C of the contact surface **351**. For example, a position of one end of the liquid landing area LA**1** is slightly beyond the center C of the contact surface **351**, and a position of the other end thereof corresponds to a lower surface of the brush holder **32**. Therefore, the brush cleaning liquid CL**1** lands on an area equal to or larger than a radius of the contact surface **351** of the first brush **35**A and on an entire side surface of the first brush **35**A in the axial direction of the first brush **35**A.

Attachment of Second Discharger

[0090] Next, a procedure for attaching the second discharger **62**B will be described. First, as shown in FIG. **11**, the second fixture **632**B is attached to the holder **635**. That is, the second fixture **632**B is attached to the main body plate **635***a* by the fasteners B so that the second fixture **632**B is in parallel with the axis of the first fixture **632**A.

[0091] Subsequently, the discharger-side joint **633** to which the second discharger **62**B is attached and the supply-side joint **634** are connected to the fixing joint **631**. This procedure is similar to that of the first discharger **62**A described above.

[0092] Then, as shown in FIGS. **12** and **13**, the fixing joint **631** is inserted into the insertion hole **632***c* of the second fixture **632**B until the fixing joint **631** is brought into contact with the contact surface **632***d*, and the fasteners B are screw-inserted into the holes to fix the fixing joint **631**. At this time, the angles of the blocks **631***a* and **631***b* are adjusted so that the connection portion with the discharger-side joint **633** enters the discharger groove **632***f* and the connection portion with the supply-side joint **634** enters the supply groove **632***g*. Therefore, as described above, the rotation of the fixing joint **631** about the axis thereof is restricted and the position in the insertion direction is determined.

[0093] Here, as shown in FIG. **14**, the second discharger **62**B is connected to the discharger-side joint **633**. That is, the nozzle tip **621** is screw-inserted into the end portion of the discharger-side joint **633**. An axial direction of the second discharger **62**B is set to be perpendicular to the axis of the fixing joint **631**. As a result, the second discharger **62**B is fixed in a direction facing the second brush **35**B. Further, by adjusting the amount of screwing the nozzle tip **621**, the extension direction of the liquid landing area LA**2** formed by the brush cleaning liquid CL**2** discharged from the elliptical discharge port **622** is set to be a radial direction of the contact surface **351** of the second brush **35**B.

[0094] As a result, as shown in FIGS. **3**, **5**A, and **5**B, the second discharger **62**B is positioned to discharge the brush cleaning liquid CL**2** in an obliquely downward direction, which intersects with the direction in which the axis of the second brush **35**B extends, from outside the first brush **35**A and the second brush **35**B located at the retracted positions toward the second brush **35**B. The fan-like plane of the brush cleaning liquid CL**2** discharged from the second discharger **62**B is perpendicular to the contact surface **351** of the second brush **35**B. Further, as shown in FIG. **6**B, the second discharger **62**B is attached so that the liquid landing area LA**2** of the brush cleaning liquid CL**2** on the second brush **35**B has a length that covers from the outer peripheral edge to the center C of the contact surface **351**. For example, a

position of one end of the liquid landing area LA**2** is slightly beyond the center C of the contact surface **351**, and a position of the other end thereof corresponds to an upper surface of the brush holder **32**. Therefore, the brush cleaning liquid CL**2** lands on an area equal to or larger than a radius of the contact surface **351** of the second brush **35**B and on an entire side surface of the second brush **35**B in the axial direction of the second brush **35**B.

[0095] In addition, since the first discharger **62**A is inclined by the inclined surface **632***i* of the angle determinator **632***h*, the brush cleaning liquid CL**1**, which is spread in a fan-like plane shape from the discharge port **622** of the first discharger **62**A and lands linearly on the contact surface **351**, lands on the liquid landing area LA**1** having the length that covers from the outer peripheral edge to the center C of the contact surface **351** of the first brush **35**A, without interfering with the brush cleaning liquid CL**2** discharged from the discharge port **622** of the second discharger **62**B and spread in a fan-like plane shape.

Adjustment of Attachment Position

[0096] A method of adjusting positions of the first discharger **62**A and the second discharger **62**B attached as described above by using the adjustment jig **70** will be described.

<Adjustment of First Discharger>

[0097] First, adjustment of the position of the first discharger **62**A will be described. As shown in FIGS. **4** and **18**A, the reference mark **73***a* of the fixer **73** of the adjustment jig **70** is aligned with the first scale S**1**, and the fasteners B are fastened to the attachment holes **636***b* via the attachment holes **73***b*. Thus, the liquid landing plate **71** is fixed to a position corresponding to the contact surface **351** of the first brush **35**A located at the retracted position (first fixing process). That is, the first liquid landing surface **71***a* of the liquid landing plate **71** is set to be flush with the contact surface **351** of the first brush **35**A.

[0098] Then, the brush cleaning liquid CL**1** is discharged from the first discharger **62**A so that the brush cleaning liquid CL**1** lands on the liquid landing plate **71** (first liquid landing process). As a result, the brush cleaning liquid CL**1** lands on the first liquid landing surface **71***a*. The operator adjusts the position of the first discharger **62**A based on a passing state of the brush cleaning liquid CL**1** through the reference holes **72** (first adjustment process).

[0099] That is, the operator checks whether the brush cleaning liquid CL**1** passes through the four through-holes of the first reference holes **72***a*. When the brush cleaning liquid CL**1** passes through the four through-holes, it can be determined that the position of the first discharger **62**A is normal.

[0100] On the other hand, when there is at least one through-hole among the four through-holes through which the brush cleaning liquid CL**1** has not passed, it can be determined that the position of the first discharger **62**A is not normal. When it is determined that the position is not normal, the operator adjusts the position of the first discharger **62**A. For example, the operator adjusts an angle of the linear liquid landing area LA**1** by adjusting the amount of screwing the nozzle tip **621**.

<Adjustment of Second Discharger>

[0101] Next, adjustment of the position of the second discharger **62**B will be described. As shown in FIGS. **4** and **18**B, the reference mark **73***a* of the fixer **73** of the adjustment jig **70** is aligned with the second scale S**2**, and the fasteners B are fastened to the attachment holes **636***c* via the attachment holes **73***b*. Thus, the liquid landing plate **71** is fixed to a position corresponding to the contact surface **351** of the second brush **35**B located at the retracted position (second fixing process). That is, the second liquid landing surface **71***b* of the liquid landing plate **71** is set to be flush with the contact surface **351** of the second brush **35**B.

[0102] Then, the brush cleaning liquid CL**2** is discharged from the second discharger **62**B so that the brush cleaning liquid CL**2** lands on the liquid landing plate **71** (second liquid landing process). As a result, the brush cleaning liquid CL**2** lands on the second liquid landing surface **71***b*. The operator adjusts the position of the second discharger **62**B based on a passing state of the brush cleaning liquid CL**2** through the reference holes **72** (second adjustment process).

[0103] That is, the operator checks whether the brush cleaning liquid CL**2** passes through the four through-holes of the second reference holes **72***b*. When the brush cleaning liquid CL**2** passes through the four through-holes, it can be determined that the position of the second discharger **62**B is normal.

[0104] On the other hand, when there is at least one through-hole among the four through-holes through which the brush cleaning liquid CL**2** has not passed, it can be determined that the attachment position of the second discharger **62**B is not normal. When it is determined that the attachment position of the second discharger **62**B is not normal, the operator adjusts the position of the second discharger **62**B. For example, an angle of the linear liquid landing area LA**2** is adjusted by adjusting the amount of screwing the nozzle tip **621**. Further, the angle of the second discharger **62**B is adjusted by adjusting the angle of the discharger-side joint **633** with respect to the fixing joint **631**.

[0105] After the attachment positions of the first discharger **62**A and the second discharger **62**B have been adjusted as described above, the adjustment jig **70** is removed from the base plate **636**.

Operations

[0106] Operations of the cleaning apparatus **1** configured as above will be described.

Loading Substrate

[0107] First, an operation of loading the substrate W will be described. The transfer robot loads the substrate W transferred from the previous process into a location between the rollers **20***a* of the first holder **21** and the second holder **22** via the load/unload port of the cleaning apparatus **1**. The first holder **21** and the second holder **22** move in directions approaching each other. Then, the four rollers **20***a* move toward the substrate W and are brought into contact with the outer periphery of the substrate W, thereby holding the substrate W. At this time, the upper and lower arms **41** are in a state retracted outside the substrate W so that the brushes **35** are located at the retracted position.

Cleaning Front and Back Surfaces of Substrate

[0108] Next, a cleaning operation for the substrate W will be described. As shown in FIG. **2**, as the rollers **20***a* rotate clockwise in the figure, the substrate W rotates counter-clockwise.

[0109] The substrate cleaning liquid SL is discharged from the discharge port of the nozzle **51** of the cleaning liquid discharger **50**. By a centrifugal force generated by the rotation of the substrate W, the substrate cleaning liquid SL supplied to the substrate W flows over the front and back surfaces of the substrate W and is scattered outward from the substrate W.

[0110] The upper and lower arms **41** (indicated by two-dot chain lines in FIG. **2**) located at the retracted positions swing to above the outer periphery of the substrate W while rotating the brushes **35** by the motor, and then stop temporarily. Then, the upper and lower arms **41** move toward the substrate W, so that the brushes **35** of the upper and lower substrate cleaners **30** are brought into contact with the front and back surfaces of the substrate W.

[0111] Then, as the upper and lower arms **41** swing, the upper and lower brushes **35** move horizontally while being in contact with the substrate W. At this time, since the substrate cleaning liquid SL is discharged from the discharge port of the nozzle **51**, the substrate cleaning liquid SL flows between the brushes **35** and the substrate W. That is, the brushes **35**, which start moving from one side of the outer periphery of the substrate W, move along the arc trajectory to push out contaminants together with the substrate cleaning liquid SL to the outer periphery of the substrate W.

[0112] As shown in FIG. **2**, the brushes **35** move while passing a vicinity of the center of the substrate W. Thereafter, when the brushes **35** pass the other side of the outer periphery of the substrate W and move away from the substrate W, the cleaning process for the substrate W by the brushes **35** ends.

[0113] Then, as the upper and lower arms **41** move in directions separating from each other, the upper and lower brushes **35** are separated from each other, and the arms **41** swing to retract to the retracted position outside the outer periphery of the substrate W. Thereafter, by repeating the above-described operation, cleaning with the brushes **35** may be performed a plurality of times.

[0114] The cleaning liquid discharger **50** continues to discharge the substrate cleaning liquid SL for a predetermined period of time even after the brushes **35** get out of the substrate W. Thus, a rinsing process is performed on the substrate W. That is, the rinsing process is started with the movement of the brushes **35** to the retracted position, and cleaning the brushes **35**, which will be described later, is performed in parallel with the rinsing process. When a predetermined period of time has elapsed after the start of the rinsing process, the discharge of the substrate cleaning liquid SL is stopped to terminate the rinsing process, and the cleaning process for the substrate W ends. When the cleaning process for the substrate W ends, the first holder **21** and the second holder **22** move in directions separating from each other and the substrate W is released. The transfer robot unloads the released substrate W via the load/unload port of the cleaning apparatus **1**. In addition, the rinsing process may be performed by supplying a liquid other than the substrate cleaning liquid SL to the substrate W.

Cleaning Brush

[0115] An operation of cleaning the brushes **35** will be described. First, the arm **41** is swung to move the brushes **35**, which has been used to clean the substrate W, to the retracted position. At this time, the openable cover **652** is open, and the brushes **35** enter the cover **65** via the opening **651***a* of the fixed cover **651**. Then, the openable cover **652** is closed to cover the brushes **35**.

[0116] Subsequently, the first arm **41**A and the second arm **41**B move vertically, so that the position of the contact surface **351** of the first brush **35**A becomes the position of the first liquid landing surface **71***a* when the adjustment jig **70** is attached, and the position of the contact surface **351** of the second brush **35**B becomes the position of the second liquid landing surface **71***b* when the adjustment jig **70** is attached. Further, a rotation speed (the number of rotations per unit time) of the brushes **35** is set to be lower than a rotation speed thereof when the substrate W is being cleaned.

[0117] In this state, the first discharger **62**A and the second discharger **62**B discharge the brush cleaning liquids CL**1** and CL**2** to the first brush **35**A and the second brush **35**B which are rotating at the low rotation speed. At this time, as shown in FIG. **5**B, the brush cleaning liquid CL**1** discharged by the first discharger **62**A is spread in a fan-like plane shape, and as shown in FIG. **6**A, the brush cleaning liquid CL**1** reaches the contact surface **351** to form the linear liquid landing area LA**1**. Further, as shown in FIG. **5**A, the brush cleaning liquid CL**2** discharged by the second discharger **62**B is spread in a fan-like plane shape, and as shown in FIG. **6**B, the brush cleaning liquid CL**2** reaches the contact surface **351** to form the linear liquid landing area LA**2**. The brush cleaning liquid CL**1** discharged from the first discharger **62**A and the brush cleaning liquid CL**2** discharged from the second discharger do not collide with each other before the landing. That is, a portion where the brush cleaning liquids CL**1** and CL**2** interfere with each other and are hindered from landing is not generated. Furthermore, since the rotation speed of the brushes **35** is set to be lower than the rotation speed thereof when cleaning the substrate W, a water pressure by the brush cleaning liquid CL can be increased in the liquid landing area LA. Since the water pressure is high, particles adhering to the brushes **35** are pushed out easily, and it is possible to clean the brushes **35** more cleanly.

Effects

[0118] (1) The cleaning apparatus **1** of the present embodiment as described above includes: the substrate cleaner **30** configured to clean the first surface and the second surface of the substrate W, which is being held and rotated, by bringing the circular contact surface **351** of the rotating first brush **35**A into contact with the first surface of the rotating substrate W while supplying the substrate cleaning liquid SL to the first surface of the rotating substrate W, and by bringing the circular contact surface **351** of the rotating second brush **35**B into contact with the second surface of the rotating substrate W while supplying the substrate cleaning liquid SL to the second surface of the rotating substrate W; and the brush cleaner **60** configured to clean the first brush **35**A and the second brush **35**B by discharging the brush cleaning liquids CL**1** and CL**2** from the discharger **62** to the contact surface **351** of the first brush

35A and the contact surface 351 of the second brush 35B, in a state in which the first brush 35A and the second brush 35B are located at the retracted position spaced apart from the substrate W. The discharger 62 includes the first discharger 62A configured to discharge the brush cleaning liquid CL1 so that the brush cleaning liquid CL1 lands linearly on the contact surface 351 of the first brush 35A; and the second discharger 62B configured to discharge the brush cleaning liquid CL2 so that the brush cleaning liquid CL2 lands linearly on the contact surface 351 of the second brush 35B. The brush cleaner 60 includes the support 63 configured to support the first discharger 62A and the second discharger 62B, so that the brush cleaning liquids CL1 and CL1 discharged from the first discharger 62A and the second discharger 62B do not interfere with each other until the brush cleaning liquids CL1 and CL2 land on the contact surface 351 of the first brush 35A and the contact surface 351 of the second brush 35B.

[0119] With this configuration, since the brush cleaning liquid CL1 discharged by the first discharger 62A and the brush cleaning liquid CL2 discharged by the second discharger 62B do not collide with each other, the brush cleaning liquid CL is not scattered before reaching the contact surface 351, and the brush cleaning liquids CL1 and CL2 can be efficiently supplied to the first brush 35A and the second brush 35B, respectively, to clean the first brush 35A and the second brush 35B. Thus, it is possible to maintain a degree of cleanliness of the first brush 35A and the second brush 35B and improve a quality of the substrate W. Further, since scattering of the brush cleaning liquid CL due to collision does not occur, it is possible to suppress adhesion of the brush cleaning liquid CL to the substrate W and improve the quality of the substrate W. Furthermore, even after the substrate W is unloaded, it is possible to prevent the brush cleaning liquid CL from being scattered and adhering to components in the cleaning chamber 11, particularly the rollers 20*a*. Thus, adhesion of the brush cleaning liquid CL to a next loaded substrate W via the rollers 20*a* can be suppressed, and it is possible to improve the quality of the substrate W.

[0120] (2) The support 63 supports the first discharger 62A and the second discharger 62B so that an extension direction of the linear liquid landing area LA1, on which the brush cleaning liquid CL1 lands, in the contact surface 351 of the first brush 35A is different from an extension direction of the linear liquid landing area LA2, on which the brush cleaning liquid CL2 lands, in the contact surface 351 of the second brush 35B. With this configuration, the brush cleaning liquid CL1 discharged by the first discharger 62A can reach the contact surface 351 of the first brush 35A without colliding with the brush cleaning liquid CL2 discharged by the second discharger 62B. In addition, the brush cleaning liquid CL2 discharged by the second discharger 62B can reach the contact surface 351 of the second brush 35B without colliding with the brush cleaning liquid CL1 discharged by the first discharger 62A.

[0121] (3) The linear liquid landing area LA, on which the brush cleaning liquid CL discharged from the discharger 62 lands, in each of the contact surfaces 351 has a length that covers from the outer peripheral edge to the center C of each of the contact surface 351. With this configuration, since the brush cleaning liquid CL hits a region exceeding a radius of the rotating brush 35, the entire rotating contact surface 351 can be cleaned with the brush cleaning liquid CL being in contact with the entire rotating contact surface 351. Since it is not necessary to expand the liquid landing area LA to a diameter of the brush 35, it is possible to suppress scattering of the brush cleaning liquid CL due to diffusion thereof.

[0122] (4) A discharge direction of the discharger 62 is set so that a plane, over which the brush cleaning liquid CL discharged from the discharger 62 is spread until the brush cleaning liquid CL lands on each of the contact surface 351, is perpendicular to each of the contact surface 351. With this configuration, the brush cleaning liquid CL can hit the contact surface 351 strongly, thereby improving cleaning ability.

[0123] (5) The first brush 35A and the second brush 35B are provided to be swingable via the first arm 41A and the second arm 41B, respectively, and the first discharger 62A and the second discharger 62B are disposed in a region between the first arm 41A and the second arm 41B when the first brush 35A and the second brush 35B are located at the retracted position.

[0124] With this configuration, since the first discharger 62A and the second discharger 62B are accommodated between the first arm 41A and the second arm 41B, it is possible to reduce a space in a plan view and to suppress an increase in size of the apparatus.

[0125] (6) The support 63 includes: the prismatic columnar fixing joint 631 configured to support the discharger 62 and having an internal flow path for supplying the brush cleaning liquid CL to the discharger 62; and the fixture 632 including the insertion hole 632*c* into which the fixing joint 631 is inserted, the insertion hole 632*c* having a plurality of surfaces brought into contact with a plurality of side surfaces of the fixing joint 631 and being configured to fix an angle of the fixing joint 631.

[0126] With this configuration, by inserting the fixing joint 631 into the insertion hole 632*c* of the fixture 632, it is possible to perform positioning of the discharger 62.

[0127] (7) The portion of the fixing joint 631 inserted into the insertion hole 632*c* includes a rectangular parallelepiped block. With this configuration, positioning of the discharger 62 can be performed by the fixing joint 631 with a simple shape.

[0128] (8) The support 63 further includes the discharger-side joint 633 having an internal flow path for supplying the brush cleaning liquid CL to the discharger 62 and connected to the fixing joint 631 so that an angle of the discharger 62 becomes changeable, and the fixture 632 further includes the angle determinator 632*h* configured to be in contact with the discharger-side joint 633 to determine the angle of the discharger 62.

[0129] With this configuration, the angle of the discharger 62 can be determined easily by inserting the fixing joint 631 into the fixture 632 and bringing the discharger-side joint 633 into contact with the angle determinator 632*h*.

[0130] (9) The insertion hole 632*c* has the contact surface 632*d* with which an end portion of the inserted fixing joint 631 is in contact to determine a position of

the fixing joint **631** in the insertion direction. With this configuration, when the fixing joint **631** is inserted until the fixing joint **631** is brought into contact with the contact surface **632***d*, the position of the discharger **62** in the insertion direction can be determined easily.

[0131] (10) The cleaning apparatus **1** further includes the supply-side joint **634** connected to the fixing joint **631**, having an internal flow path for supplying the brush cleaning liquid CL to the discharger **62**, and connected to the pipe **624***a* for supplying the brush cleaning liquid CL, wherein the discharger **62** and the supply-side joint **634** are provided at positions spaced apart from each other in the insertion direction of the fixing joint **631** into the fixture **632**.

[0132] With this configuration, since the discharger **62** and the supply-side joint **634** can deviate from each other in a horizontal direction, it is possible to suppress an increase of a space in a vertical direction.

[0133] (11) The brush cleaner **60** further includes the cover **65** interposed between the first brush **35**A and the second brush **35**B, which are located at the retracted position, and the substrate cleaner **30**, and configured to block the brush cleaning liquid CL from being scattered to the substrate W. With this configuration, it is possible to prevent the brush cleaning liquid CL from adhering to the substrate W during brush cleaning.

[0134] (12) The cover **65** includes: the fixed cover **651** having the opening **651***a* that allows the first brush **35**A and the second brush **35**B to pass through the opening **651***a;* and the openable cover **652** configured to open and close the opening **651***a*. With this configuration, it is possible to move the first brush **35**A and the second brush **35**B into and out of the cover **65** and to prevent the brush cleaning liquid CL from being scattered to the substrate W during brush cleaning.

[0135] (13) A bent path **653** is formed between the openable cover **652** that closes the opening **651***a* and the fixed cover **651**. With this configuration, it is possible to prevent the brush cleaning liquid CL from leaking from a location between the openable cover **652** and the fixed cover **651** and adhering to the substrate W.

[0136] (14) The adjustment jig **70** according to the present embodiment, which is used for adjusting positions of the first discharger **62**A and the second discharger **62**B of the cleaning apparatus **1**, includes: the liquid landing plate **71** on which the brush cleaning liquids CL**1** and CL**2** discharged from the first discharger **62**A and the second discharger **62**B land at positions corresponding to the contact surfaces **351** of the first brush **35**A and the second brush **35**B; the reference holes **72**, which are a plurality of through-holes provided linearly and correspond to the liquid landing areas LA**1** and LA**2**, on which the brush cleaning liquids CL**1** and CL**2** discharged from the first discharger **62**A and the second discharger **62**B land, respectively, in the liquid landing plate **71**; and the fixer **73** configured to selectively fix the liquid landing plate **71** to any of a position corresponding to the contact surface **351** of the first brush **35**A and a position corresponding to the contact surface **351** of the second brush **35**B.

[0137] The adjustment method of adjusting positions of the first discharger **62**A and the second discharger **62**B of the cleaning apparatus **1** by using the adjustment jig **70** includes: the first fixing process of fixing the liquid landing plate **71** at a position corresponding to the contact surface **351** of the first brush **35**A; after the first fixing process, the first liquid landing process of discharging the brush cleaning liquid CL**1** from the first discharger **62**A so that the brush cleaning liquid CL**1** lands on the liquid landing plate **71**; the first adjustment process of adjusting the position of the first discharger **62**A based on a passing state of the brush cleaning liquid CL**1** through the reference holes **72** in the first liquid landing process; the second fixing process of fixing the liquid landing plate **71** at a position corresponding to the contact surface **351** of the second brush **35**B; after the second fixing process, the second liquid landing process of discharging the brush cleaning liquid CL**2** from the second discharger **62**B so that the brush cleaning liquid CL**2** lands on the liquid landing plate **71**; and the second adjustment process of adjusting the position of the second discharger **62**B based on a passing state of the brush cleaning liquid CL**2** through the reference holes **72** in the second liquid landing process.

[0138] With this configuration, it is possible to check in advance a liquid landing state on the contact surface **351** of the first brush **35**A and a liquid landing state on the contact surface **351** of the second brush **35**B and to adjust the positions of the first discharger **62**A and the second discharger **62**B.

[0139] (15) The cleaning apparatus **1** includes the first scale S**1** configured to locate the liquid landing plate **71** at a position corresponding to the contact surface **351** of the first brush **35**A, and the second scale S**2** configured to locate the liquid landing plate **71** at a position corresponding to the contact surface **351** of the second brush **35**B, and the fixer **73** has the reference mark **73***a* configured to be aligned with the first scale S**1** to locate the liquid landing plate **71** at the position corresponding to the contact surface **351** of the first brush **35**A, and configured to be aligned with the second scale S**2** to locate the liquid landing plate **71** at the position corresponding to the contact surface **351** of the second brush **35**B.

[0140] With this configuration, by aligning the reference mark **73***a* with the first scale S**1** or the second scale S**2**, the position of the liquid landing plate **71** can be determined easily and accurately.

Modifications

[0141] The present embodiment is not limited to the above-described aspects, and the following modifications can be also made.

[0142] (1) In the above-described embodiment, the first discharger **62**A is disposed on the lower side and the second discharger **62**B is disposed on the upper side. However, the first discharger **62**A may be disposed on the upper side and the second discharger **62**B may be disposed on the lower side. In addition, the angle determinator **632***h* may be provided in the second discharger **62**B.

[0143] (2) The retracted position where the brush **35** is cleaned may be any location outside the region where the substrate W is held. Thus, the position to which the brush **35** is retracted may be provided separately from the brush cleaning position.

[0144] (3) A flow rate of the brush cleaning liquid CL**1** discharged from the first discharger **62**A and a flow rate of the brush cleaning liquid CL**2** discharged from the second discharger **62**B may be the same or different from each other.

[0145] (4) The number of the reference holes **72** is not limited to four, but may be any plural number.

[0146] (5) The first scale S**1**, the second scale S**2**, and the reference mark **73***a* may be grooves formed in members, or may be ones attached or printed on members, as long as they are visible to the operator.

[0147] (6) The brush cleaning liquid CL is not limited to pure water. For example, various liquids such as those exemplified as the substrate cleaning liquid SL may be used. In addition, multiple types of liquids may be switched and supplied to the brush **35**.

[0148] (7) A two-fluid nozzle may be used for the discharger **62**. For example, a nozzle that discharges a mixture of N_2 gas and pure water may be used.

[0149] (8) The cleaning apparatus **1** may be an apparatus that cleans only one surface of the substrate W, without including the second brush **35**B. That is, the cleaning apparatus **1** may include: the substrate cleaner **30** configured to clean one surface of the substrate W, which is being held and rotated, by bringing the circular contact surface **351** of the rotating brush **35** into contact with the one surface of the rotating substrate W while supplying the substrate cleaning liquid SL to the one surface of the rotating substrate W; the brush cleaner **60** configured to clean the brush **35** by discharging the brush cleaning liquid CL from the discharger **62** to the contact surface **351**, in a state in which the brush **35** is located at a retracted position spaced apart from the substrate W; and the support **63** configured to support the discharger **62**.

[0150] In this case, all of the configurations illustrated in the above-described aspect are applicable except for the absence of the second brush **35**B and the second discharger **62**B. For example, the support **63** may include: the prismatic columnar fixing joint **631** configured to support the discharger **62** and having an internal flow path for supplying the brush cleaning liquid CL to the discharger **62**; and the fixture **632** including the insertion hole **632***c* into which the fixing joint **631** is inserted, the insertion hole **632***c* having a plurality of surfaces brought into contact with a plurality of side surfaces of the fixing joint **631** and being configured to fix an angle of the fixing joint **631**.

Other Embodiments

[0151] The embodiments of the present disclosure and the modifications of individual components have been described above. However, the embodiments of the present disclosure and the modifications of individual components are presented as examples and are not intended to limit the scope of the present disclosure. These novel embodiments described above can be implemented in various other forms, and various omissions, substitutions, and modifications can be made without departing from the gist of the present disclosure. These embodiments and their modifications are included in the scope and gist of the present disclosure, and are included in the present disclosure described in the claims.

[0152] According to the present disclosure in some embodiments, it is possible to maintain a degree of cleanliness of a brush for cleaning a substrate and to improve a quality of the substrate.

[0153] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the disclosures. Indeed, the embodiments described herein may be embodied in a variety of other forms. Furthermore, various omissions, substitutions, and changes in the form of the embodiments described herein may be made without departing from the spirit of the disclosures. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the disclosures.

What is claimed is:

1. A cleaning apparatus comprising:

a substrate cleaner configured to clean a first surface and a second surface of a substrate, which is being held and rotated, by bringing a circular contact surface of a rotating first brush into contact with the first surface of the rotating substrate while supplying a substrate cleaning liquid to the first surface of the rotating substrate, and by bringing a circular contact surface of a rotating second brush into contact with the second surface of the rotating substrate while supplying the substrate cleaning liquid to the second surface of the rotating substrate; and

a brush cleaner configured to clean the first brush and the second brush by discharging a brush cleaning liquid from a discharger to the contact surface of the first brush and the contact surface of the second brush, in a state in which the first brush and the second brush are located at a retracted position spaced apart from a region where the substrate is held,

wherein the discharger includes:

a first discharger configured to discharge the brush cleaning liquid so that the brush cleaning liquid lands linearly on the contact surface of the first brush; and

a second discharger configured to discharge the brush cleaning liquid so that the brush cleaning liquid lands linearly on the contact surface of the second brush, and

wherein the brush cleaner includes a support configured to support the first discharger and the second discharger, so that the brush cleaning liquid discharged from the first discharger and the brush cleaning liquid discharged from the second discharger do not interfere with each other until the brush cleaning liquid lands on the contact surface of the first brush and the contact surface of the second brush.

2. The cleaning apparatus of claim **1**, wherein the support supports the first discharger and the second discharger so that an extension direction of a linear liquid landing area, on which the brush cleaning liquid lands, in the contact surface of the first brush is different from an extension direction of a linear liquid landing area, on which the brush cleaning liquid lands, in the contact surface of the second brush.

3. The cleaning apparatus of claim **1**, wherein a linear liquid landing area, on which the brush cleaning liquid discharged from the discharger lands, in each of the contact surfaces has a length that covers from an outer peripheral edge to a center of each of the contact surfaces.

4. The cleaning apparatus of claim 1, wherein a discharge direction of the discharger is set so that a plane, over which the brush cleaning liquid discharged from the discharger is spread until the brush cleaning liquid lands on each of the contact surfaces, is perpendicular to each of the contact surfaces.

5. The cleaning apparatus of claim 1, wherein the first brush and the second brush are provided to be swingable via a first arm and a second arm, respectively, and wherein the first discharger and the second discharger are disposed in a region between the first arm and the second arm when the first brush and the second brush are located at the retracted position.

6. The cleaning apparatus of claim 1, wherein the support includes:

a prismatic columnar fixing joint configured to support the discharger and having an internal flow path for supplying the brush cleaning liquid to the discharger; and

a fixture including an insertion hole into which the fixing joint is inserted, the insertion hole having a plurality of surfaces brought into contact with a plurality of side surfaces of the fixing joint and being configured to fix an angle of the fixing joint.

7. The cleaning apparatus of claim 6, wherein a portion of the fixing joint inserted into the insertion hole includes a rectangular parallelepiped block.

8. The cleaning apparatus of claim 6, wherein the support further includes a discharger-side joint having an internal flow path for supplying the brush cleaning liquid to the discharger, and connected to the fixing joint so that an angle of the discharger becomes changeable, and

wherein the fixture further includes an angle determinator configured to be in contact with the discharger-side joint to determine the angle of the discharger.

9. The cleaning apparatus of claim 6, wherein the insertion hole has a contact surface with which an end portion of the inserted fixing joint is in contact to determine a position of the fixing joint in an insertion direction.

10. The cleaning apparatus of claim 6, further comprising a supply-side joint connected to the fixing joint, having an internal flow path for supplying the brush cleaning liquid to the discharger, and connected to a pipe for supplying the brush cleaning liquid,

wherein the discharger and the supply-side joint are provided at positions spaced apart from each other in an insertion direction of the fixing joint into the fixture.

11. The cleaning apparatus of claim 1, wherein the brush cleaner further includes a cover interposed between the first brush and the second brush, which are located at the retracted position, and the substrate cleaner, and configured to block the brush cleaning liquid from being scattered to the substrate.

12. The cleaning apparatus of claim 11, wherein the cover includes:

a fixed cover having an opening that allows the first brush and the second brush to pass through the opening; and

an openable cover configured to open and close the opening.

13. The cleaning apparatus of claim 12, wherein a bent path is formed between the openable cover that closes the opening and the fixed cover.

14. A cleaning apparatus comprising:

a substrate cleaner configured to clean one surface of a substrate, which is being held and rotated, by bringing a circular contact surface of a rotating brush into contact with the one surface of the rotating substrate while supplying a substrate cleaning liquid to the one surface of the rotating substrate;

a brush cleaner configured to clean the brush by discharging a brush cleaning liquid from a discharger to the contact surface, in a state in which the brush is located at a retracted position spaced apart from a region where the substrate is held; and

a support configured to support the discharger,

wherein the support includes:

a prismatic columnar fixing joint configured to support the discharger and having an internal flow path for supplying the brush cleaning liquid to the discharger; and

a fixture including an insertion hole into which the fixing joint is inserted, the insertion hole having a plurality of surfaces brought into contact with a plurality of side surfaces of the fixing joint and being configured to fix an angle of the fixing joint.

15. An adjustment jig for adjusting positions of the first discharger and the second discharger of the cleaning apparatus of claim 1, comprising:

a liquid landing plate on which the brush cleaning liquid discharged from the first discharger and the second discharger lands at positions corresponding to the contact surfaces of the first brush and the second brush;

reference holes, which are a plurality of through-holes provided linearly and correspond to liquid landing areas, on which the brush cleaning liquid discharged from the first discharger and the brush cleaning liquid discharged from the second discharger land, respectively, in the liquid landing plate; and

a fixer configured to selectively fix the liquid landing plate to any of a position corresponding to the contact surface of the first brush and a position corresponding to the contact surface of the second brush.

16. The adjustment jig of claim 15, wherein the cleaning apparatus includes a first scale configured to locate the liquid landing plate at a position corresponding to the contact surface of the first brush, and a second scale configured to locate the liquid landing plate at a position corresponding to the contact surface of the second brush, and

wherein the fixer has a reference mark configured to be aligned with the first scale to locate the liquid landing plate at the position corresponding to the contact surface of the first brush, and configured to be aligned with the second scale to locate the liquid landing plate at the position corresponding to the contact surface of the second brush.

17. An adjustment method of adjusting positions of the first discharger and the second discharger of the cleaning apparatus by using the adjustment jig of claim 15, comprising:

a first fixing process of fixing the liquid landing plate at a position corresponding to the contact surface of the first brush;

after the first fixing process, a first liquid landing process of discharging the brush cleaning liquid from the first discharger so that the brush cleaning liquid lands on the liquid landing plate;

a first adjustment process of adjusting the position of the first discharger based on a passing state of the brush cleaning liquid through the reference holes in the first liquid landing process;

a second fixing process of fixing the liquid landing plate at a position corresponding to the contact surface of the second brush;

after the second fixing process, a second liquid landing process of discharging the brush cleaning liquid from the second discharger so that the brush cleaning liquid lands on the liquid landing plate; and

a second adjustment process of adjusting the position of the second discharger based on a passing state of the brush cleaning liquid through the reference holes in the second liquid landing process.

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