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(54) SUBSTRATE POLISHING DEVICE AND SUBSTRATE POLISHING METHOD

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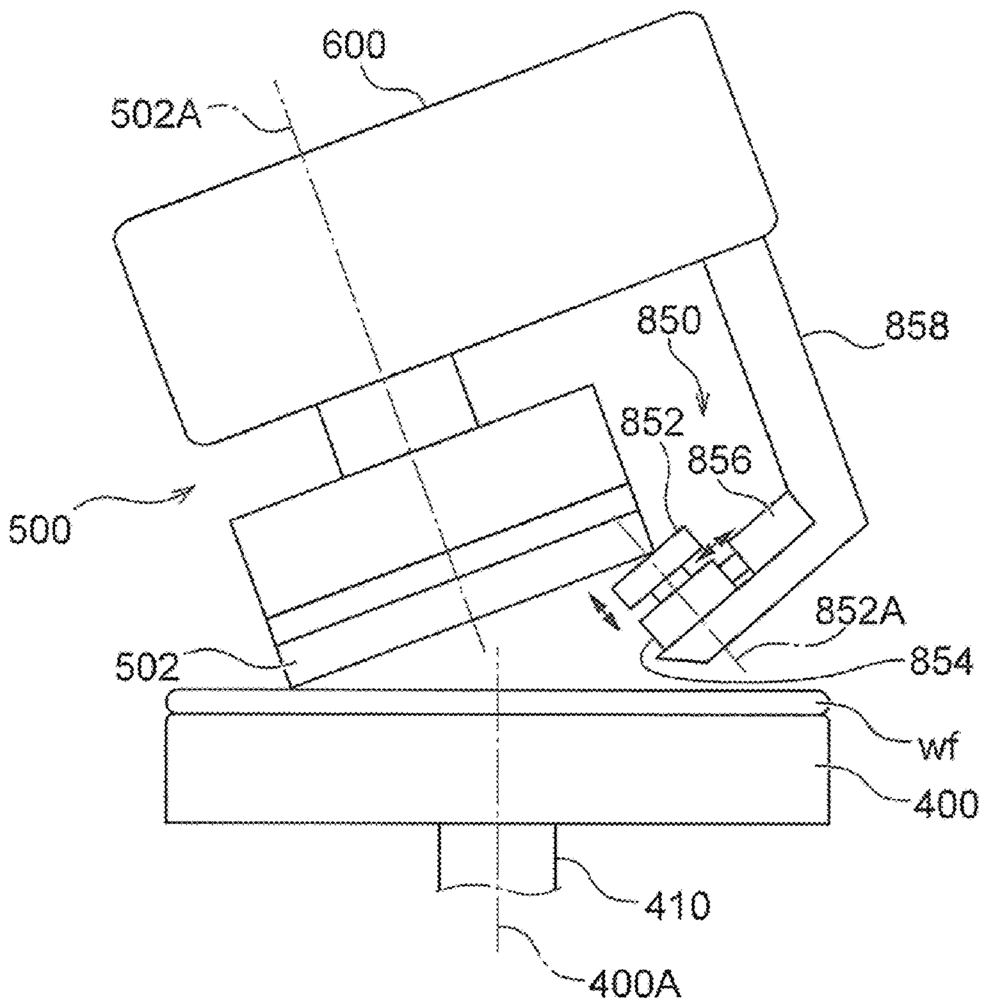
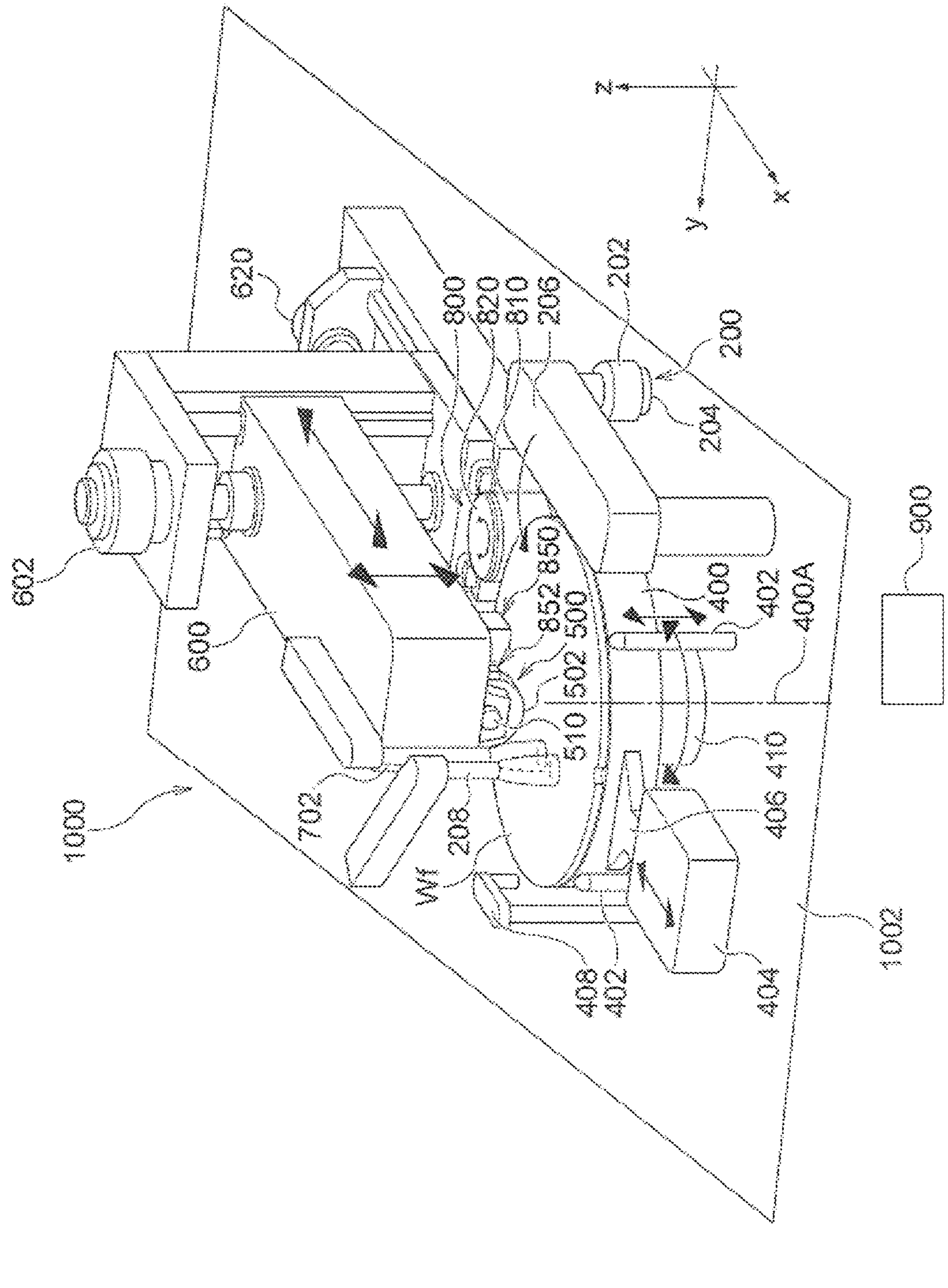
(57) **ABSTRACT**

Provided is a polishing device for appropriately retaining a polishing member in an appropriate state in polishing. The polishing device for partially polishing a substrate includes a polishing member having a processing surface which comes into contact with the substrate and which is smaller than the substrate, a conditioning member for performing conditioning on the polishing member, a first pressing mechanism for pressing the conditioning member against the polishing member in polishing the substrate, and a control unit for controlling an operation of the polishing device. The control unit is configured to control the first pressing mechanism when the substrate is partially polished by the polishing member.

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620
600
800
820
810
206
202
200
204
850
852
500
502
510
400
402
400A
410
406
404
408
702
208
Wf
1000
1002
900
z
y
x

Fig. 1

Fig. 2

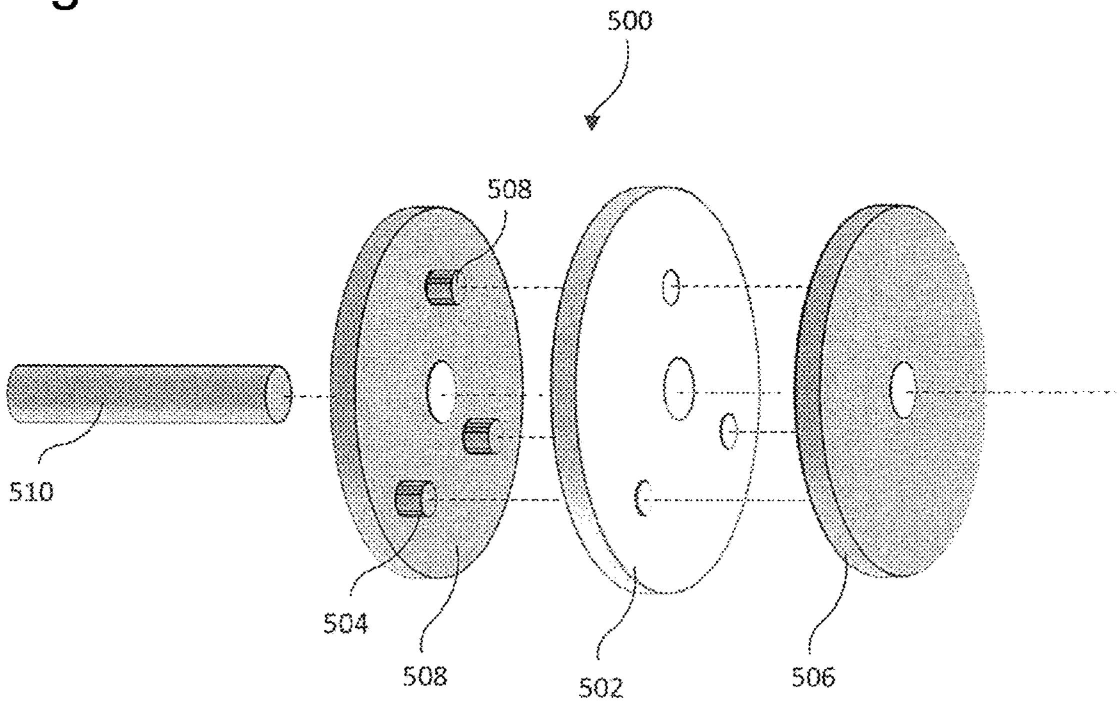


Fig. 3

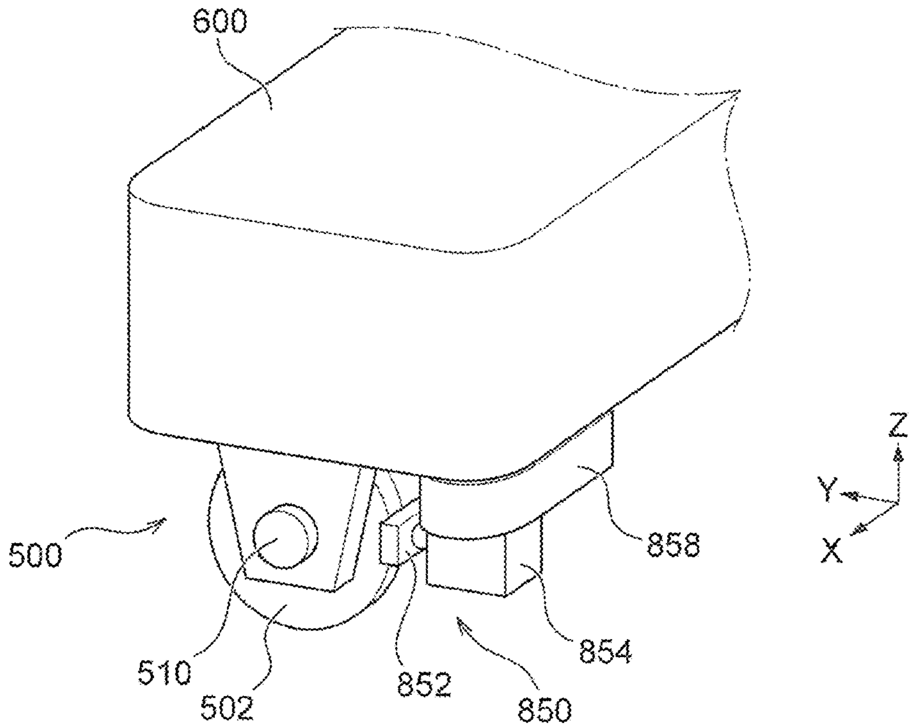
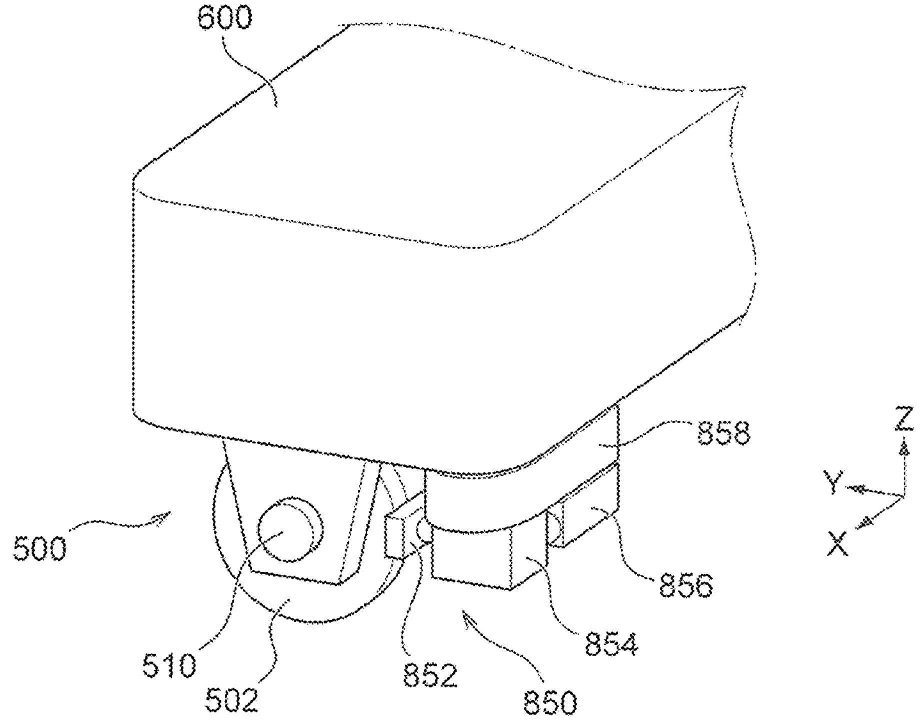


Fig. 4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858
Z
Y
X
500
856
854
510
502
852
850

Fig. 5

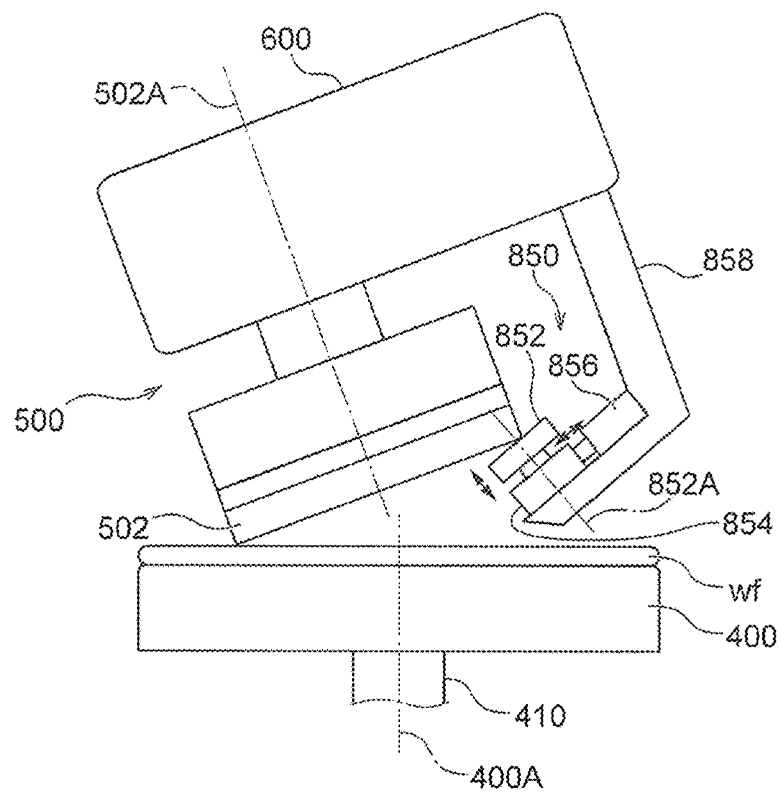

600
502A
850
858
852
856
500
852A
502
854
wf
400
410
400A

Fig. 6

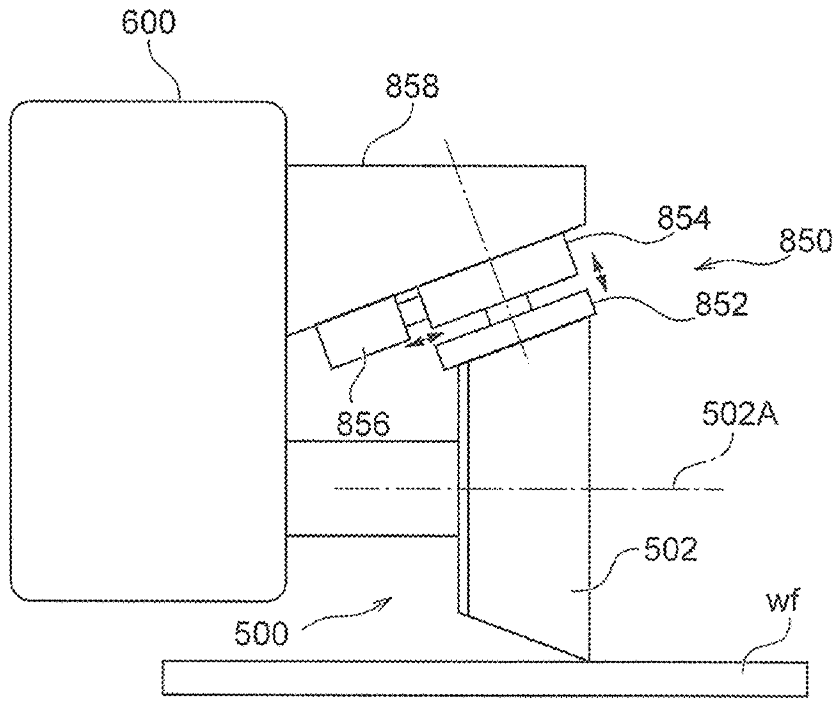

600
858
854
850
852
856
502A
502
wf
500

Fig. 7

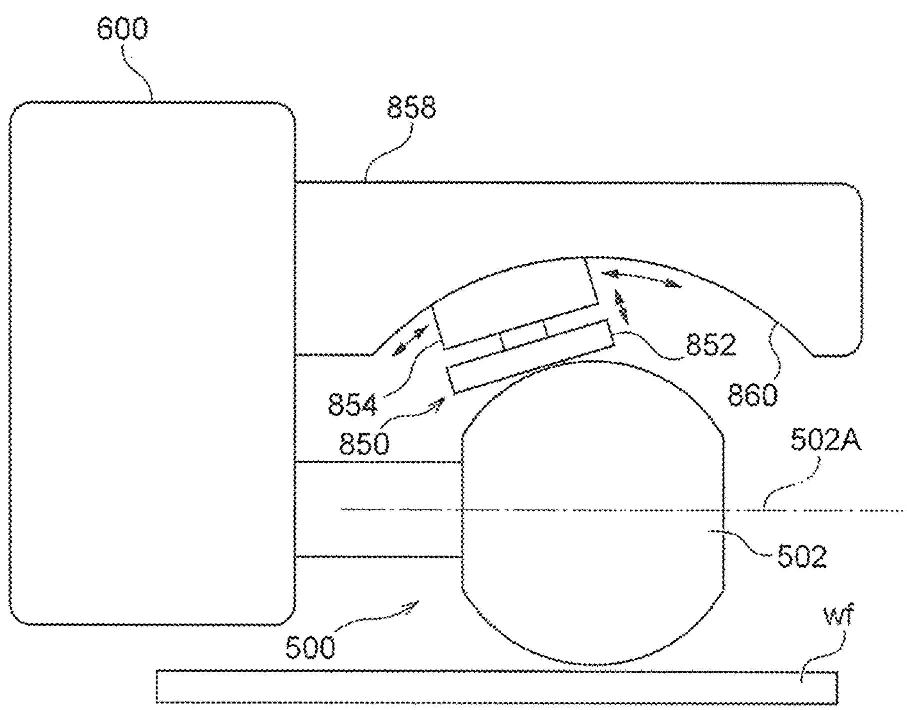

600
858
852
860
854
850
502A
502
wf
500

Fig. 8

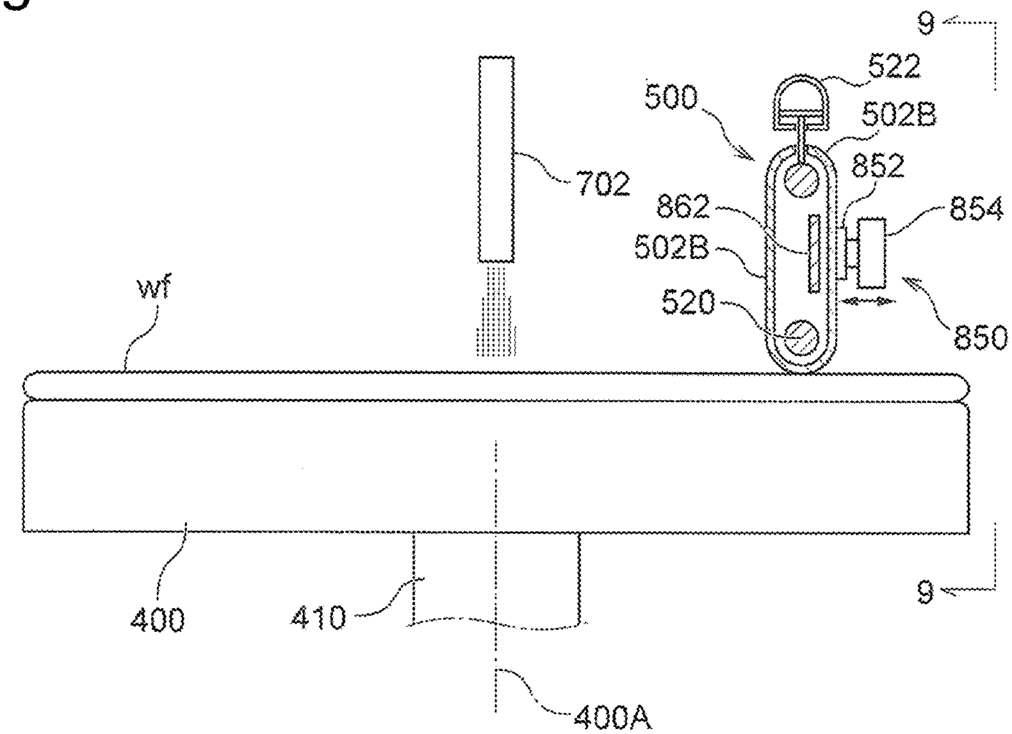

9
522
500
502B
702
852
862
854
502B
wf
520
850
400
410
9
400A

Fig. 9

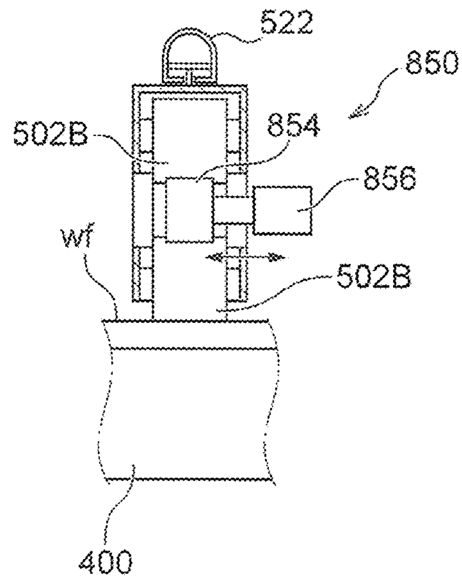

522
850
502B
854
856
wf
502B
400

Fig. 10

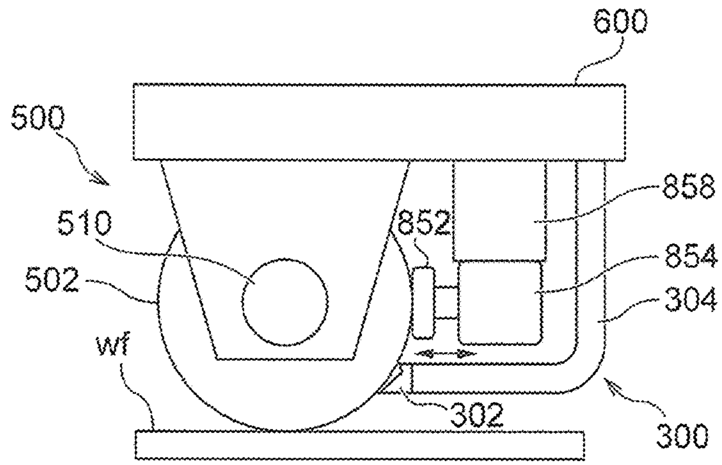


Fig. 11

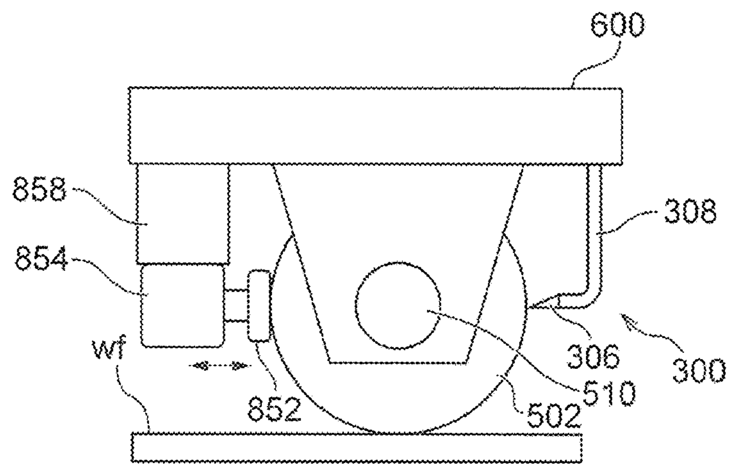


Fig. 12

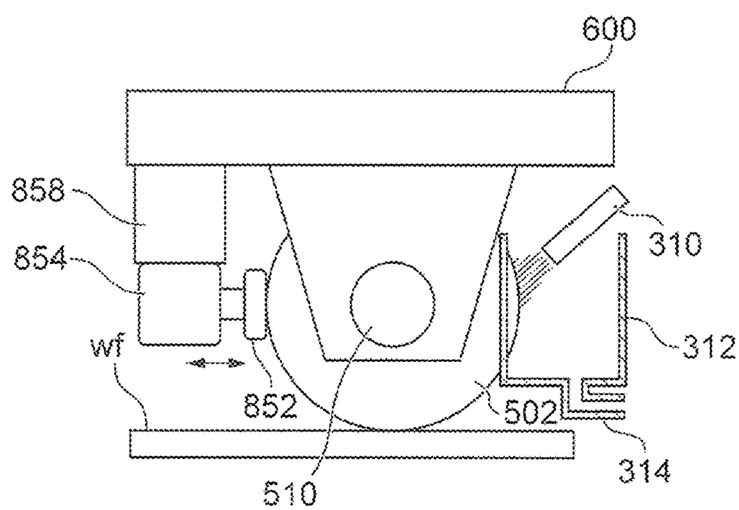


Fig. 13A

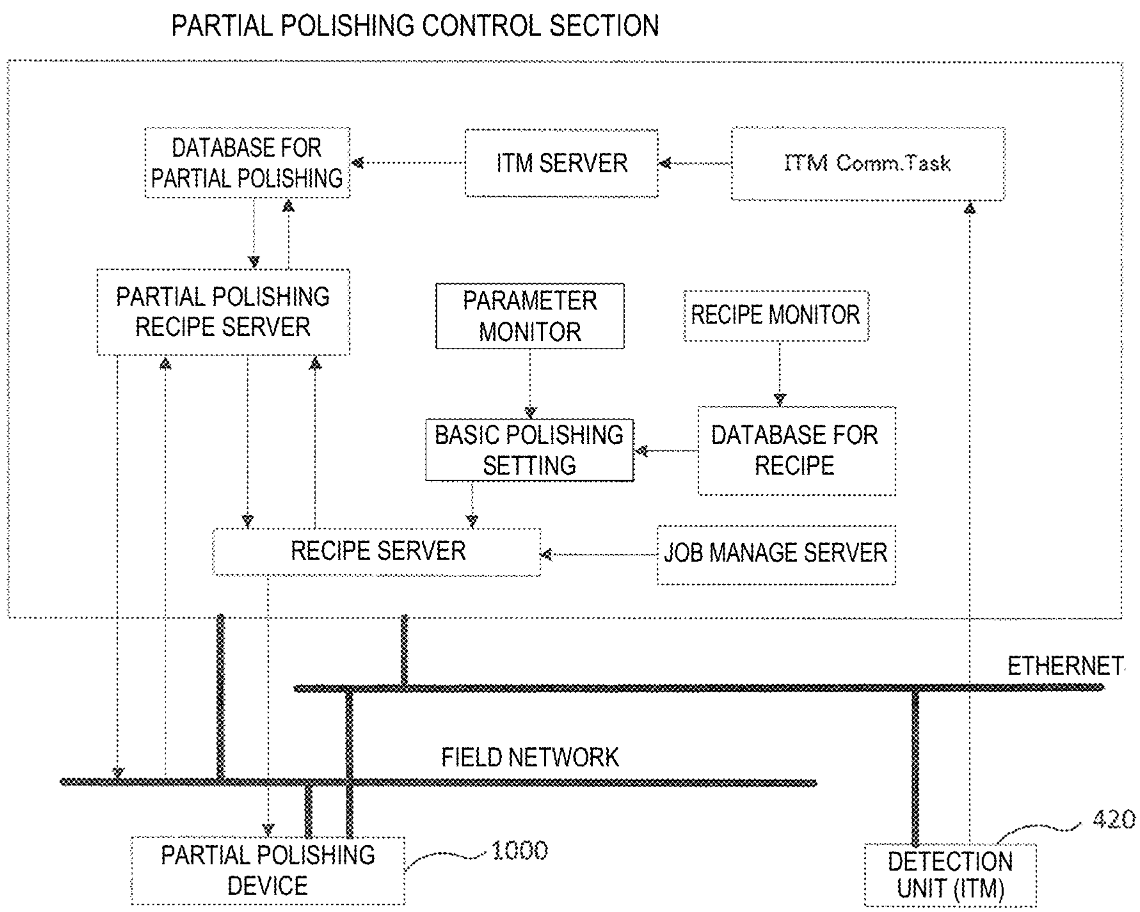

PARTIAL POLISHING CONTROL SECTION
DATABASE FOR PARTIAL POLISHING
ITM SERVER
ITM Comm.Task
PARTIAL POLISHING RECIPE SERVER
PARAMETER MONITOR
RECIPE MONITOR
BASIC POLISHING SETTING
DATABASE FOR RECIPE
RECIPE SERVER
JOB MANAGE SERVER
ETHERNET
FIELD NETWORK
PARTIAL POLISHING DEVICE
1000
420
DETECTION UNIT (ITM)

Fig. 13B

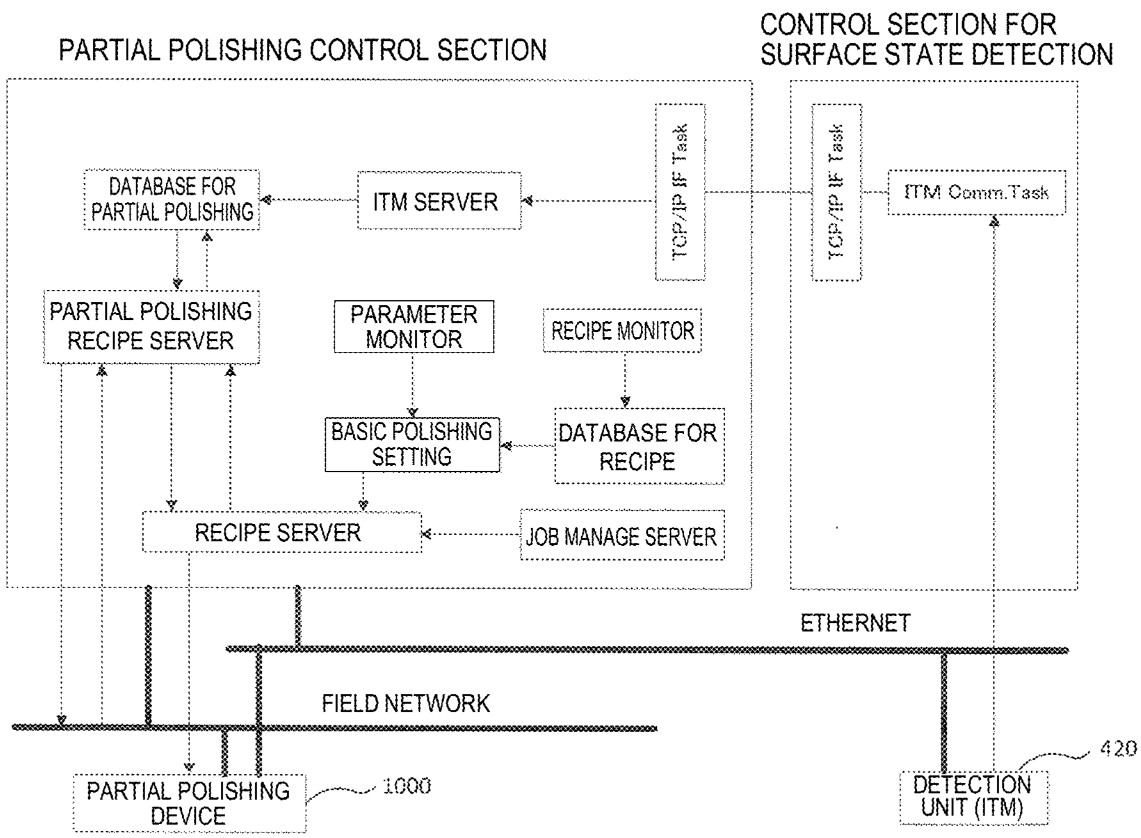


Fig. 14

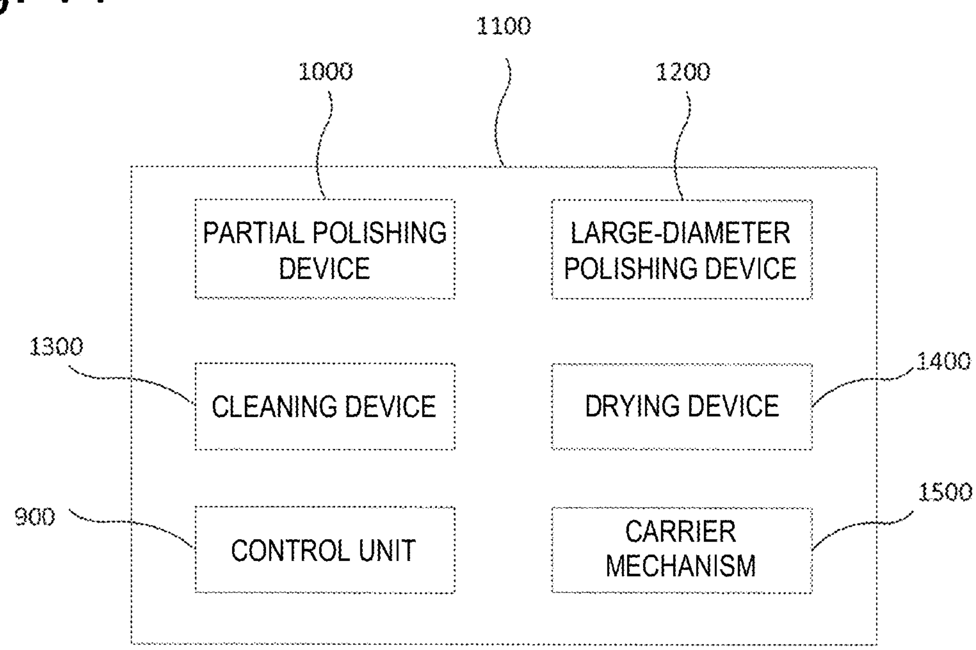
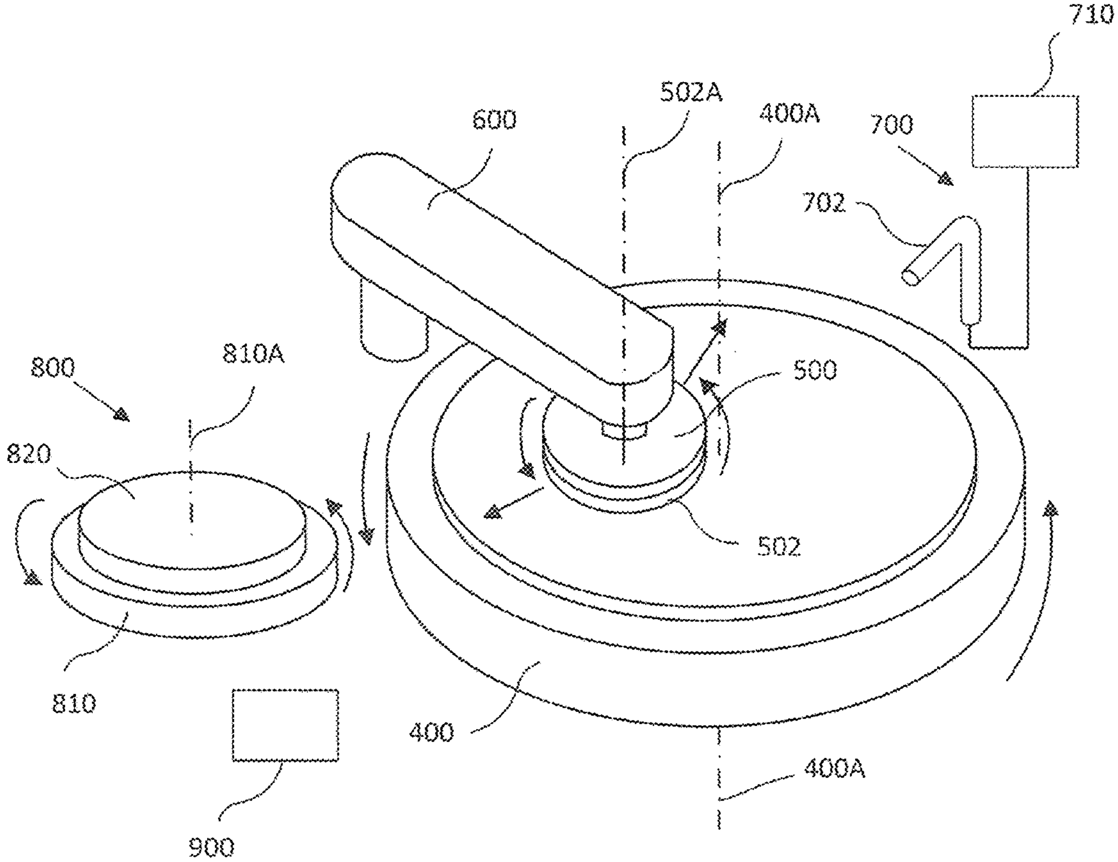


Fig. 15



SUBSTRATE POLISHING DEVICE AND SUBSTRATE POLISHING METHOD

TECHNICAL FIELD

[0001] The present invention relates to a device and a method for polishing a substrate.

BACKGROUND ART

[0002] Recently there has been a processor used for performing various process steps to a processed object (for example, a substrate such as a semiconductor substrate, or various kinds of films formed on the substrate surface). An example of the processor may be a CMP (Chemical Mechanical Polishing) device which performs polishing and the like of the processed object.

[0003] The CMP device includes a polishing unit for performing a polishing process to the processed object, a cleaning unit for performing cleaning/drying process to the processed object, and a load/unload unit for delivering the processed object to the polishing unit, and receiving the processed object which has been cleaned and dried by the cleaning unit. The CMP device further includes a carrier mechanism for carrying the processed object among the polishing unit, the cleaning unit, and the load/unload unit. The CMP device sequentially performs various process steps of polishing, cleaning, and drying while having the processed object carried by the carrier mechanism.

[0004] Recently, the accuracy required to be achieved by the respective process steps in manufacturing the semiconductor device has reached the order of several nm. The CMP is no exception to the requirement. In order to satisfy the requirement, both polishing and cleaning conditions for the CMP are optimized. Although the optimum conditions have been determined, the polishing and cleaning performances will inevitably change owing to variation in control of the components, and aging of the consumable material. Furthermore, variation exists in the semiconductor substrate to be processed in itself. For example, variations exist in the thickness of the film or shape of the device to be formed on the processed object before performing the CMP. Those variations may bring about the variation in the residual film and incomplete removal of the step height in or after the CMP, resulting in the residue of the film that ought to be completely removed remaining. The variations in the plane of the substrate will occur among chips, across the chips, and furthermore, among the substrates and the lots. Currently, efforts have been made to narrow down those variations to be in the range of a predetermined threshold value by controlling the polishing condition to the substrate in or before polishing (for example, pressure distribution applied into the plane of the substrate in polishing, rotating speed of the substrate holding stage, and slurry), and/or reworking (re-polishing) the substrate that has exceeded the threshold value.

[0005] However, the suppression of the variation resulting from the above-described polishing condition may be observed mainly in the radial direction of the substrate. It is difficult to adjust the variations in the circumferential direction of the substrate. The polishing amount distribution may partially vary within the substrate depending on the processing condition in the CMP, and the state of the lower layer of the film to be polished through the CMP. In the CMP process steps which involve control of polishing distribution on the substrate in the radial direction, the device region in the substrate plane has been expanded for coping with the recent need of improving the yield. This necessitates adjusting the polishing distribution up to the edge portion of the substrate. The influence of variations in the polishing pressure distribution or the inflow of the slurry as the polishing material to the edge portion of the substrate is larger than the influence on around the center of the substrate. Basically, the polishing unit which performs the CMP also controls the polishing condition and the cleaning condition, and performs reworking. In most cases, the entire surface of the polishing pad comes into contact with the substrate surface. In the case where the polishing pad partially comes into contact with the substrate surface, the contact area between the polishing pad and the substrate needs to be enlarged for maintaining the processing rate. In the above-described circumstance, when correcting the variation in excess of the threshold value, which has occurred in the specific region in the substrate plane, for example, through the reworking, the part requiring no reworking may be unnecessarily polished because of the large contact area. As a result, it is difficult to correct the part in the threshold region which has been originally required. It has been demanded to provide the method and the device capable of controlling processing conditions and performing the re-processing as the reworking to the arbitrary point in the substrate plane while allowing the control of the polishing and cleaning state further in the smaller region.

[0006] FIG. **15** is a view schematically showing an example of a structure of a partial polishing device **1000** which performs the polishing process using a polishing pad with a diameter smaller than that of the processed object. The partial polishing device **1000** as shown in FIG. **15** uses a polishing pad **502** with diameter smaller than that of a substrate Wf as the processed object. As FIG. **15** shows, the partial polishing device **1000** includes a stage **400** on which the substrate Wf is placed, a polishing head **500** to which the polishing pad **502** is attached for processing the processed surface of the substrate Wf, a holding arm **600** for holding the polishing head **500**, a processing solution supply system **700** for supplying the processing solution, and a conditioning unit **800** for conditioning (dressing) the polishing pad **502**. Operations of the partial polishing device **1000** are entirely controlled by a control unit **900**. The partial polishing device as shown in FIG. **15** supplies DIW (pure water), cleaning chemical solution, and the polishing solution such as slurry from the processing solution supply system **700** to the substrate, and presses the polishing pad **502** against the substrate while the polishing pad **502** is rotated to partially polish the substrate.

[0007] As FIG. **15** shows, the polishing pad **502** has a size smaller than that of the substrate Wf. The diameter C of the polishing pad **502** is substantially equal to or smaller than the variation region of the film thickness and the shape of the processed object. For example, the diameter Q of the polishing pad **502** may be equal to or smaller than 50 mm, or in the range from 10 to 30 mm. The larger the diameter of the polishing pad **502** becomes, the smaller the area ratio to the substrate becomes. Therefore, the substrate polishing rate is increased. Meanwhile, the smaller the diameter of the polishing pad becomes, the more the accuracy of polishing of the desired processing region is improved because of the unit processing area which is reduced with the increase in the polishing pad diameter.

[0008] In the partial polishing process to the substrate Wf by the partial polishing device **1000** as shown in FIG. **15**, the polishing pad **502** is pressed against the substrate Wf while being rotated around a rotating axis **502**A. In this moment, the holding arm **600** may be swung in the radial direction of the substrate Wf. It is also possible to rotate the stage **400** around a rotating axis **400**A. The conditioning unit **800** includes a dress stage **810** which holds a dresser **820**. The dress stage **810** is rotatable around a rotating axis **810**A. In the partial polishing device **1000** as shown in FIG. **15**, the polishing pad **502** is pressed against the dresser **820** so as to be rotated together. The polishing pad **502**, thus may be conditioned. In the partial polishing device **1000** as shown in FIG. **15**, the control unit **900** controls the rotating speed of the stage **400**, the rotating speed of the polishing pad **502**, the pressing force to the polishing pad **502**, the swinging speed of the holding arm **600**, supply of the processing solution from the processing solution supply system **700**, the processing time period and the like so as to achieve the partial polishing of the arbitrary region on the substrate Wf.

CITATION LIST

Patent Literature

[0009] PTL 1: US Unexamined Patent Application Publication No. 2015/0352686

SUMMARY OF INVENTION

Technical Problem

[0010] In the polishing process of the substrate performed by pressing the polishing member such as the polishing pad against the substrate, the micro-particles in the polishing solution, those generated from the chipped substrate, and the like adhere to the polishing member, thus clogging the polishing member. The clogging of the polishing member may change the polishing rate and the distribution within the substrate Wf. The above-described conditioning will be performed to retain the polishing member in the optimized state by eliminating the clogging of the polishing member. The conditioning may be performed in the interval between the end of polishing the single substrate, and start of polishing the next substrate. In the case of the partial polishing device **1000** as shown in FIG. **15**, as the contact area between the polishing pad **502** and the substrate Wf is small, the clogging of the polishing pad **502**, which occurs in polishing is earlier than the clogging which occurs in polishing using the larger polishing pad of the polishing device. Accordingly, in the polishing device using the smaller polishing member, the polishing rate and the distribution within the substrate Wf are more likely to change in polishing than the polishing device using the larger polishing member. The partial polishing device using the smaller polishing member is required to keep the polishing member in the appropriate state in polishing.

[0011] It is an object of the present application to provide a polishing device capable of keeping the polishing member in the appropriate state in polishing.

Solution to Problem

[0012] [Embodiment 1] According to Embodiment 1, a polishing device for partially polishing a substrate is provided. The polishing device includes a polishing member having a processing surface which comes into contact with the substrate and which is smaller than the substrate, a conditioning member for performing conditioning on the polishing member, a first pressing mechanism for pressing the conditioning member against the polishing member in polishing the substrate, and a control unit for controlling an operation of the polishing device. The control unit is configured to control the first pressing mechanism when the substrate is partially polished by the polishing member. The above-described polishing member may be conditioned simultaneously with polishing the substrate with the polishing member. This makes it possible to retain the polishing member in the appropriate state in polishing.

[0013] [Embodiment 2] According to Embodiment 2, the polishing device of Embodiment 1 includes a pressing mechanism for pressing the polishing member against the substrate, and a first drive mechanism for imparting a motion to the polishing member in a first motion direction parallel to a surface of the substrate.

[0014] [Embodiment 3] According to Embodiment 3, the polishing device of Embodiment 2, includes a second drive mechanism for imparting a motion to the conditioning member to have a component contained in a second motion direction perpendicular to the first motion direction, and parallel to the surface of the substrate.

[0015] [Embodiment 4] According to Embodiment 4, in the polishing device of Embodiment 3, the second drive mechanism is configured to impart a linear motion and/or a rotating motion to the conditioning member.

[0016] [Embodiment 5] According to Embodiment 5, in the polishing device of any one of Embodiments 1 to 4, the control unit is configured to control the first pressing mechanism so that the conditioning is performed at a predetermined cycle in polishing the substrate.

[0017] [Embodiment 6] According to Embodiment 6, in the polishing device of any one of Embodiments 1 to 5, the polishing member and the conditioning member are held with a holding arm.

[0018] [Embodiment 7] According to Embodiment 7, the polishing device of any one of Embodiments 1 to 6 includes a collection unit for collecting waste generated from the polishing member in performing the conditioning.

[0019] [Embodiment 8] According to Embodiment 8, in the polishing device of Embodiment 7, the collection unit includes a suction unit which removes the waste generated from the polishing member through suction in performing the conditioning.

[0020] [Embodiment 9] According to Embodiment 9, in the polishing device of Embodiment 7, the collection unit includes a scraper or a wiper for collecting the waste generated from the polishing member in performing the conditioning.

[0021] [Embodiment 10] According to Embodiment 10, in the polishing device of any one of Embodiments 7 to 9, the collection unit includes a liquid supply mechanism for cleaning the conditioned polishing member, and a liquid collection mechanism for collecting the liquid which has been used for cleaning the polishing member.

[0022] [Embodiment 11] According to Embodiment 11, in the polishing device of any one of Embodiments 1 to 10, the polishing member is formed into any one of structures including (1) a disc shaped or a cylindrically shaped structure, having a center axis parallel to the surface of the substrate, (2) a disc shaped structure, having a center axis tilting from a direction perpendicular to the surface of the substrate, (3) a conically shaped or a truncated conically shaped structure, having a center axis parallel to the surface of the substrate, (4) a spherically shaped or a partially spherically shaped structure, and (5) a structure as a belt member.

[0023] [Embodiment 12] According to Embodiment 12, a method for polishing a substrate includes the steps of pressing a polishing member against the substrate, which has a processing surface which comes into contact with the substrate and which is smaller than the substrate, polishing the substrate by imparting relative motions to the polishing member and the substrate while pressing the polishing member against the substrate, and conditioning the polishing member while bringing a conditioning member into contact with the polishing member in polishing the substrate. The above-described polishing method allows the polishing member to be conditioned simultaneously with polishing the substrate with the polishing member. This makes it possible to retain the polishing member in the appropriate state in polishing.

[0024] [Embodiment 13] According to Embodiment 13, the method of Embodiment 12 includes a step of imparting a linear motion and/or a rotating motion to the conditioning member.

[0025] [Embodiment 14] According to Embodiment 14, the method of Embodiment 12 or 13 includes a step of collecting waste generated from the polishing member while the polishing member is conditioned.

BRIEF DESCRIPTION OF DRAWINGS

[0026] FIG. **1** is a schematic view showing a structure of a partial polishing device according to an embodiment;

[0027] FIG. **2** is a schematic view showing a mechanism which holds a polishing pad **502** of a polishing head according to an embodiment;

[0028] FIG. **3** is a perspective view schematically showing an example of a second conditioner usable in the partial polishing device according to an embodiment;

[0029] FIG. **4** is a perspective view schematically showing an example of the second conditioner usable in the partial polishing device according to an embodiment;

[0030] FIG. **5** is a side view schematically showing an example of the polishing head and the second conditioner which are usable in the partial polishing device according to an embodiment;

[0031] FIG. **6** is a side view schematically showing an example of the polishing head and the second conditioner which are usable in the partial polishing device according to an embodiment;

[0032] FIG. **7** is a side view schematically showing an example of the polishing head and the second conditioner which are usable in the partial polishing device according to an embodiment;

[0033] FIG. **8** is a side view schematically showing an example of the polishing head and the second conditioner which are usable in the partial polishing device according to an embodiment;

[0034] FIG. **9** is a view seen from a direction of an arrow **9** of FIG. **8**.

[0035] FIG. **10** is a side view schematically showing a collection unit according to an embodiment;

[0036] FIG. **11** is a side view schematically showing a collection unit according to an embodiment;

[0037] FIG. **12** is a side view schematically showing a collection unit according to an embodiment;

[0038] FIG. **13**A shows an example of a control circuit which processes information on a film thickness, irregularities and height of the substrate according to an embodiment;

[0039] FIG. **13**B shows a circuit diagram in which a control section for substrate surface state detection is separated from a partial polishing control section as shown in FIG. **13**A;

[0040] FIG. **14** is a schematic view showing a substrate processing system according to an embodiment, in which the partial polishing device is installed; and

[0041] FIG. **15** is a view schematically showing a structure of an example of the partial polishing device which performs polishing using a polishing pad with a diameter smaller than that of a processed object.

DESCRIPTION OF EMBODIMENTS

[0042] Embodiments of a partial polishing device according to the present invention will be described referring to the attached drawings. In the attached drawings, the same or similar components will be designated with the same or similar reference signs, and repetitive explanations of the embodiments, thus will be omitted from description of the respective embodiments. Features to be described in the respective embodiments may be applied to other embodiments so long as those features do not mutually conflict.

[0043] FIG. **1** is a schematic view showing a structure of a partial polishing device **1000** according to an embodiment. As FIG. **1** shows, the partial polishing device **1000** is formed on a base surface **1002**. The partial polishing device **1000** may be formed as an independent device, or as a module constituting a substrate processing system **1100** including a large-diameter polishing device **1200** using a large-diameter polishing pad together with the partial polishing device **1000** (see FIG. **14**). The partial polishing device **1000** is placed in a not shown casing. The casing includes a not shown exhaust mechanism so that the polishing solution or the like is not exposed outside the casing in the polishing process.

[0044] As FIG. **1** shows, the partial polishing device **1000** includes a stage **400** which holds the substrate Wf directed upward. In the embodiment, the substrate Wf may be placed on the stage **400** by means of a not shown carrier device. The illustrated partial polishing device **1000** includes four lift pins **402** each movable up and down around a circumference of the stage **400**. The substrate Wf may be received by the four lift pins **402** while the lift pins **402** are lifted, from the carrier device. After receiving the substrate Wf on the lift pins **402**, the lift pins **402** moves down to a substrate delivery position toward the stage **400** where the substrate Wf is delivered so as to be temporarily placed on the stage. It is therefore possible to position the substrate Wf in the internal region defined by those four lift pins **402**. For further positioning with higher accuracy, a positioning mechanism **404** may be used to position the substrate Wf at the predetermined position on the stage **400**. In the embodiment as shown in FIG. **1**, the substrate Wf may be positioned with positioning pins (not shown) and a positioning pad **406**. The positioning mechanism **404** includes the positioning pad **406** movable to the direction in the plane of the substrate Wf, and a plurality of positioning pins (not shown) located opposite the positioning pad **406** with respect to the stage **400** interposed between the positioning pad and the positioning pins. In the state where the substrate Wf is placed on the lift pins **402**, the positioning pad **406** is pressed against the substrate Wf so as to be positioned with the positioning pad **406** and the positioning pins. After the positioning of the substrate Wf, the substrate Wf is fixed onto the stage **400**. Then the lift pins **402** are moved down to place the substrate Wf on the stage **400**. The stage **400** may be configured to fix the substrate Wf thereto by vacuum suction, for example. The partial polishing device **1000** includes a detection unit **408** for detecting the position of the substrate Wf placed on the stage **400**. The detection unit detects a notch or an orientation flat which is formed on the substrate Wf, or an outer circumference of the substrate so as to detect the position of the substrate Wf on the stage **400**. In reference to the position of the notch or the orientation flat, an arbitrary point on the substrate Wf may be identified, thus allowing the partial polishing of the desired region. The information on the position of the substrate Wf on the stage **400** (for example, an amount of deviation from the ideal position) may be derived from the information on the position of the outer circumference of the substrate. Therefore, the moving position of the polishing pad **502** may be corrected by the control unit **900** based on the above-described information. The substrate Wf may be unloaded from the stage **400** by moving the lift pins **402** to a position receiving the substrate from the stage **400**, and then releasing the stage **400** from the vacuum suction state. Then lift pins **402** are lifted to the position at which the substrate Wf is delivered to the carrier device so that the substrate Wf on the lift pins **402** is received by a not shown carrier device. The substrate Wf may be carried to an arbitrary place by the carrier device for performing the subsequent process.

[0045] The stage **400** of the partial polishing device **1000** includes a rotary drive mechanism **410** which is rotatable and/or angular rotatable around a rotating axis **400**A. In the specification, the term "rotation" refers to a motion of continuous unidirectional rotation, and the term "angular rotation" refers to a motion (including reciprocating motion) in the circumferential direction in a predetermined angular range. Another embodiment allows the stage **400** to include a movement mechanism which imparts a linear motion to the substrate Wf which has been held. In the specification, the term "linear motion" refers to the predetermined linearly directed motion, and includes the linear reciprocating motion.

[0046] The partial polishing device **1000** as shown in FIG. **1** includes the polishing head **500**. The polishing head **500** holds the polishing pad **502**. FIG. **2** is a schematic view showing a mechanism which holds the polishing pad **502** of the polishing head **500**. As FIG. **2** shows, the polishing head **500** includes a first holding member **504** and a second holding member **506**. The polishing pad **502** is held between the first holding member **504** and the second holding member **506**. Referring to the drawing, each of the first holding member **504**, the polishing pad **502**, and the second holding member **506** is formed into a disc shape. Each diameter of the first holding member **504** and the second holding member **506** is smaller than the diameter of the polishing pad **502**. Accordingly, while the polishing pad **502** is held between the first holding member **504** and the second holding member **506**, it will be partially exposed from the respective circumferential edges of those members. Each of the first holding member **504**, the polishing pad **502**, and the second holding member **506** has an opening at the center, through which a rotary shaft **510** is inserted. On a surface of the first holding member **504** at a side facing the polishing pad **502**, one or more guide pins **508** are formed while protruding toward the polishing pad **502**. Meanwhile, through holes are formed in the polishing pad **502** at positions corresponding to the guide pins **508**. In a surface of the second holding member **506** at a side facing the polishing pad **502**, recess portions are formed to accommodate the guide pins **508**. When the first holding member **504** and the second holding member **506** are rotated by the rotary shaft **510**, the polishing pad **502** may be rotated together with the holding members **504**, **506** without being slipped. The polishing pad **502** is constituted by such material as the commercial CMP pad.

[0047] In the embodiment as shown in FIG. **1**, the polishing head **500** holds the polishing pad **502** so that the side surface of the disc shaped polishing pad **502** is directed to the substrate Wf. The polishing pad **502** is not limited to the disc shape, but may be a polishing pad in any other shape. The partial polishing device **1000** as shown in FIG. **1** includes the holding arm **600** for holding the polishing head **500**. The holding arm **600** includes a first drive mechanism so that the polishing pad **502** imparts the motion in the first motion direction to the substrate Wf. The term "first motion direction" refers to the motion of the polishing pad **502** for polishing the substrate Wf, that is, the rotating motion of the polishing pad **502** in the case of the partial polishing device **1000** as shown in FIG. **1**. The first drive mechanism may be constituted by a generally used motor, for example. The polishing pad **502** moves parallel to the surface of the substrate Wf in the contact part between the substrate Wf and the polishing pad **502** (tangential direction of the polishing pad; y-direction in FIG. **1**). Therefore, despite the rotating motion of the polishing pad **502**, the "first motion direction" may be considered as the constant linear direction.

[0048] Referring to the partial polishing device **1000** as shown in FIG. **15** as described above, the polishing pad **502** has the disc shape, and the rotating axis is perpendicular to the surface of the substrate Wf. Therefore, as described above, a linear speed distribution occurs in the radial direction of the polishing pad **502**, thus causing a polishing rate distribution in the radial direction of the polishing pad **502**. Therefore, the partial polishing device **1000** as shown in FIG. **15** generates a large variation in the unit processing trace shape corresponding to the area of the contact between the polishing pad **502** and the substrate Wf from the predetermined shape. On the contrary, the rotating axis of the polishing pad **502** of the partial polishing device **1000** as shown in FIG. **1** is parallel to the surface of the substrate Wf. The linear speed in the contact region between the polishing pad **502** and the substrate Wf is kept constant. Therefore, in the partial polishing device **1000** according to the embodiment as shown in FIG. **1**, variation in the polishing rate owing to the linear speed distribution in the contact region between the polishing pad **502** and the substrate Wf is smaller than the variation in the case of the partial polishing device **1000** as shown in FIG. **15**. The partial polishing device **1000** as shown in FIG. **1** reduces the variation of the unit processing trace shape from the predetermined shape. In the partial polishing device **1000** as shown in FIG. **1**, the rotating axis of the polishing pad **502** is parallel to the surface of the substrate Wf. Unlike the partial polishing device **1000** as shown in FIG. **15**, the contact region between the polishing pad **502** and the substrate Wf may be reduced to a minute size. For example, in the case where the contact region between the polishing pad **502** and the substrate Wf may be minutely sized, the relative linear speed between the polishing pad **502** and the substrate Wf may be accelerated by increasing the diameter of the polishing pad **502**. In the end, it is possible to increase the polishing rate. The contact region between the polishing pad **502** and the substrate Wf is determined by the diameter and the thickness of the polishing pad **502**. For example, the diameter D and the thickness of the polishing pad **502** may be combined in the diameter range from approximately 50 mm to approximately 300 mm, and in the thickness range from approximately 1 mm to approximately 10 mm, respectively.

[0049] In the embodiment, the first drive mechanism is capable of changing the rotating speed of the polishing pad **502** in polishing. The polishing rate may be adjusted by changing the rotating speed. This makes it possible to efficiently polish the substrate Wf even if the large polishing amount is necessary for the processed region on the substrate Wf. For example, even in the case where the polishing pad **502** gets worn in polishing so badly that its diameter is changed, the polishing rate may be maintained by adjusting the rotating speed. In the embodiment as shown in FIG. **1**, the first drive mechanism serves to impart the rotating motion to the disc shaped polishing pad **502**. Another embodiment may have the polishing pad **502** formed into a shape other than the disc shape. The first drive mechanism may be configured to impart the linear motion to the polishing pad **502**. In this embodiment, the linear motion includes the linear reciprocating motion.

[0050] The partial polishing device **1000** as shown in FIG. **1** includes a perpendicular drive mechanism **602** for moving the holding arm **600** in the direction (z-direction in FIG. **1**) perpendicular to the surface of the substrate Wf. The perpendicular drive mechanism **602** allows the polishing head **500** and the polishing pad **502** to be movable together with the holding arm **600** in the direction perpendicular to the surface of the substrate Wf. The perpendicular drive mechanism **602** serves as a pressing mechanism for pressing the polishing pad **502** against the substrate Wf to be partially polished. In the embodiment as shown in FIG. **1**, the perpendicular drive mechanism **602** is constituted by the motor and the ball screw. However, another embodiment may select the drive mechanism of either pneumatic type or hydraulic type, or the drive mechanism using the spring. It is also possible to combine those mechanisms for executing, for example, the constant pressure control by combining the air cylinder and the precision regulator, the constant pressure control by combining the air cylinder and the elastic member (spring or the like), the open-loop control by combining the air cylinder and the electropneumatic regulator, the closed-loop control by combining the air cylinder and the electropneumatic regulator using pressure values from the external pressure sensor, the closed-loop control by combining the air cylinder and the electropneumatic regulator using load values from the load cell, the closed-loop control by combining the servo motor and the ball screw using the load values from the load cell, and the like. In an embodiment, it is possible to select two different drive mechanisms for coarse motion and micro motion, respectively to constitute the perpendicular drive mechanism **602** for the polishing head **500**. For example, the drive mechanism for coarse motion may be the one using the motor, and the drive mechanism for micro motion to press the polishing pad **502** against the substrate Wf may be the one using the air cylinder. In the above-described case, it is possible to control the pressing force for pressing the polishing pad **502** against the substrate Wf by adjusting the air pressure in the air cylinder while monitoring the pressing force applied to the polishing pad **502**. Conversely, it is also possible to select the air cylinder as the drive mechanism for coarse motion, and to select the motor as the drive mechanism for micro motion. In the above-described case, it is possible to control the pressing force applied to press the polishing pad **502** against the substrate Wf by controlling the motor while monitoring the torque of the motor for micro motion. The piezo element may also be selected as the other drive mechanism so as to adjust a moving amount by the voltage applied to the piezo element. In the case where the perpendicular drive mechanism **602** is divided into those for micro motion and coarse motion, the drive mechanism for micro motion may be disposed at a position of the holding arm **600** where the polishing pad **502** is held, that is, the top end of the holding arm **600** in the example as shown in FIG. **1**.

[0051] The partial polishing device **1000** as shown in FIG. **1** includes a horizontal drive mechanism **620** for moving the holding arm **600** in the horizontal direction (x-direction in FIG. **1**). The horizontal drive mechanism **620** allows the polishing head **500** and the polishing pad **502** to be horizontally movable together with the holding arm **600**. The horizontal direction (x-direction) is a second motion direction perpendicular to the first motion direction as described above, and parallel to the substrate surface. Therefore, the partial polishing device **1000** is allowed to polish the substrate Wf while moving the polishing pad **502** in the first motion direction (y-direction), and at the same time, allowed to make the processing trace shape on the substrate Wf more uniform by imparting the motion to the polishing pad **502** in the second motion direction (x-direction) perpendicular to the first motion direction. In the above-described partial polishing device **1000** as shown in FIG. **1**, the linear speed is kept constant in the contact region between the polishing pad **502** and the substrate Wf. However, in the case of non-uniformity in the contact state between the polishing pad **502** and the substrate owing to unevenness in the shape and material of the polishing pad **502**, the polishing rate may fluctuate on the processing trace shape of the substrate Wf, especially the contact surface between the polishing pad **502** and the substrate Wf in the direction perpendicular to the first motion direction. However, the polishing rate variation may be alleviated by imparting the motion to the polishing pad **502** in the direction perpendicular to the first motion direction in polishing. As a result, the processing trace shape may be made further uniform. In the embodiment as shown in FIG. **1**, the perpendicular drive mechanism **602** uses the motor and the ball screw. In the embodiment as shown in FIG. **1**, the horizontal drive mechanism **620** is configured to move the holding arm **600** together with the perpendicular drive mechanism **602**. The second motion direction is not exactly perpendicular to the first motion direction so long as it contains the component perpendicular to the first motion direction. This makes it possible to provide the effect of making the processing trace shape uniform.

[0052] The partial polishing device **1000** according to the embodiment as shown in FIG. **1** includes a polishing solution supply nozzle **702**. The polishing solution supply nozzle **702** is fluidly connected to a supply source **710** (see FIG. **15**) of the polishing solution, for example, slurry. In the partial polishing device **1000** according to the embodiment as shown in FIG. **1**, the polishing solution supply nozzle **702** is held with the holding arm **600** so that the polishing solution is efficiently supplied only to the region to be polished on the substrate Wf through the polishing solution supply nozzle **702**.

[0053] The partial polishing device **1000** according to the embodiment as shown in FIG. **1** includes a cleaning mechanism **200** for cleaning the substrate Wf. In the embodiment as shown in FIG. **1**, the cleaning mechanism **200** includes a cleaning head **202**, a cleaning member **204**, a cleaning head holding arm **206**, and a rinse nozzle **208**. The cleaning member **204** serves to clean the partially polished substrate Wf while rotatively coming in contact therewith. The cleaning member **204** may be constituted by a PVA sponge in an embodiment. However, the cleaning member **204** may be replaced with the PVA sponge, or additionally provided with a cleaning nozzle for implementing the mega-sonic cleaning, high pressure water cleaning, and two-fluid cleaning. The cleaning member **204** is held by the cleaning head **202**. The cleaning head **202** is held with the cleaning head holding arm **206**. The cleaning head holding arm **206** includes a drive mechanism for rotating the cleaning head **202** and the cleaning member **204**. The above-described drive mechanism may be constituted by the motor, for example. The cleaning head holding arm **206** includes a swing mechanism for swinging in the plane of the substrate Wf. The cleaning mechanism **200** includes the rinse nozzle **208**. The rinse nozzle **208** is connected to a not shown cleaning solution supply source. The cleaning solution may be, for example, pure water, chemical liquid, and the like. In an embodiment, the rinse nozzle **208** may be attached to the cleaning head holding arm **206**. The rinse nozzle **208** includes a swing mechanism for a swinging motion in the plane of the substrate Wf.

[0054] The partial polishing device **1000** according to the embodiment as shown in FIG. **1** includes the conditioning unit **800** for conditioning the polishing pad **502**. The conditioning unit **800** is disposed outside the stage **400**. The conditioning unit **800** includes a dress stage **810** for holding a dresser **820**. In the embodiment as shown in FIG. **1**, the dress stage **810** is rotatable around the rotating axis **810**A. In the partial polishing device **1000** as shown in FIG. **1**, the polishing surface (surface to be in contact with the substrate Wf) of the polishing pad **502** is pressed against the dresser **820** to rotate the polishing pad **502** and the dresser **820** for conditioning the polishing pad **502**. Another embodiment may be configured to impart the linear motion (including the reciprocating motion) to the dress stage **810** instead of the rotating motion. In the partial polishing device **1000** as shown in FIG. **1**, the conditioning unit **800** is used for conditioning the polishing pad **502** in the interval between the end of the partial polishing of mainly the specific point on the substrate Wf and the start of partially polishing the next point or the next substrate. The conditioning may be performed in the middle of the partial polishing process to the substrate Wf by temporarily retracting the polishing pad **502** to the conditioning unit **800**. The dresser **820** may be any one of the following (1) to (3), or an arbitrary combination thereof: (1) a diamond dresser having its surface on which diamond particles are electrodeposited, (2) a diamond dresser on which abrasive grains of diamond are distributed entirely or partially on the contact surface with the polishing pad, and (3) a brush dresser on which resin brush bristles are distributed entirely or partially on the contact surface with the polishing pad.

[0055] The partial polishing device **1000** according to the embodiment as shown in FIG. **1** includes a second conditioner **850**. The second conditioner **850** conditions the polishing surface (surface to be in contact with the substrate Wf) of the polishing pad **502** in polishing the substrate Wf with the polishing pad **502**. Therefore, the second conditioner **850** may be an in situ conditioner. The second conditioner **850** is held with the holding arm **600** around the polishing pad **502**. The second conditioner **850** includes a movement mechanism **854** (see FIGS. **3** to **9**) for moving the conditioning member **852** in the direction where the conditioning member **852** is pressed against the polishing pad **502**. The conditioning member **852** may be any one of the following (1) to (3), or an arbitrary combination thereof: (1) a diamond dresser having its surface on which diamond particles are electrodeposited, (2) a diamond dresser on which abrasive grains of diamond are distributed entirely or partially on the contact surface with the polishing pad, and (3) a brush dresser on which resin brush bristles are distributed entirely or partially on the contact surface with the polishing pad. In the embodiment as shown in FIG. **1**, the conditioning member **852** is held around the polishing pad **502** while being apart therefrom in the y-direction so as to be movable by the movement mechanism **854** in the y-direction. The movement mechanism **854** serves as the pressing mechanism for pressing the conditioning member **852** against the polishing pad **502**, and may be constituted by the motor and the ball screw, the drive mechanism of either pneumatic type or hydraulic type, or a combination of those mechanisms. It is possible to execute, for example, the constant pressure control by combining the air cylinder and the precision regulator, the constant pressure control by combining the air cylinder and the elastic member (spring or the like), the open-loop control by combining the air cylinder and the electropneumatic regulator, the closed-loop control by combining the air cylinder and the electropneumatic regulator using pressure values from the external pressure sensor, the closed-loop control by combining the air cylinder and the electropneumatic regulator using load values from the load cell, the closed-loop control by combining the servo motor and the ball screw using the load values from the load cell, and the like. In an embodiment, a not shown drive mechanism may be configured to input the rotating motion and/or linear motion to the conditioning member **852**. Therefore, while the polishing pad **502** is polishing the substrate Wf, the conditioning member **852** is pressed against the polishing pad **502** while being in the rotating motion and the like so as to allow the polishing pad **502** to be conditioned in polishing the substrate Wf. Detailed explanation of the second conditioner **850** will be made later.

[0056] In the embodiment as shown in FIG. **1**, the partial polishing device **1000** includes the control unit **900**. Various drive mechanisms in the partial polishing device **1000** are connected to the control unit **900**. The control unit **900** is capable of controlling operations of the partial polishing device **1000**. The control unit includes an arithmetic unit for calculating a target polishing amount of the polished region on the substrate Wf. The control unit **900** is configured to control the polishing device in accordance with the target polishing amount calculated by the arithmetic unit. The control unit **900** may be constituted by installing a predetermined program in a generally used computer having a storage unit, a CPU, and an input/output mechanism.

[0057] In the embodiment, the partial polishing device **1000** may be provided with a state detection unit **420** (not shown in FIG. **1**, see FIGS. **13**A, **13**B, and the like) which is configured to detect the state of the polished surface of the substrate Wf. The state detection unit may be constituted by a Wet-ITM (In-line Thickness Monitor) **420**, for example. The Wet-ITM **420** is capable of detecting (measuring) the film thickness distribution (or distribution of information relevant to the film thickness) of the film formed on the substrate Wf by moving the detection head above the substrate Wf over the entire surface of the substrate Wf in a contactless manner. Besides the Wet-ITM, the detector of arbitrary type may be selected as the state detection unit **420**. For example, it is possible to select the detection method of contactless type, for example, known eddy current type, optical type, and the like as the implementable detection method. It is also possible to select the detection method of contact type. In the case of the detection method of contact type, the detection head with an energizable probe is prepared to bring the probe into contact with the substrate Wf for energization to scan the plane in the substrate Wf so as to detect the film resistance distribution through the detection process of electric resistance type. It is also possible to select the detection method of other contact type, that is, step height detection method for scanning the plane in the substrate Wf while keeping the probe in contact with the surface of the substrate Wf, and monitoring the vertical movement of the probe so as to detect distribution of the irregularities on the surface. In the detection method of either contact type or contactless type, the output to be detected is the film thickness or the signal corresponding to the film thickness. It is possible to recognize the film thickness difference rather than the difference in the color tone on the surface of the substrate Wf for the detection of optical type beside the reflection-light amount of the light projected to the surface of the substrate Wf. Preferably, in the detection of the film thickness on the substrate Wf, the thickness of the film on the substrate Wf is detected while rotating the substrate Wf, and swinging the detector in the radial direction. This makes it possible to acquire the information on the state of the entire surface of the substrate Wf such as the film thickness and the step height. It is possible to correlate the data such as the film thickness not only with the position in the radial direction, but also the circumferential position in reference to the notch and the orientation flat position detected by the detection unit **408**. This makes it possible to acquire the distribution of the film thickness or the step height on the substrate Wf, or the signals relevant thereto. Upon partial polishing, it is possible to control operations of the stage **400** and the holding arm **600** based on the position data.

[0058] The above-described state detection unit **420** is connected to the control unit **900** which processes signals detected by the state detection unit **420**. The hardware which is the same as the control unit **900** for controlling operations of the stage **400**, the polishing head **500**, and the holding arm **600** may be used as the control unit **900** for the detector of the state detection unit **420**. It is also possible to use hardware different from the control unit **900** as described above. The use of different hardware for the control unit **900** which controls operations of the stage **400**, the polishing head **500**, and the holding arm **600**, and for the control unit **900** used for the detector, respectively allows dispersion of the hardware resource to be used for the polishing process of the substrate Wf, the detection of the surface state of the substrate Wf, and the subsequent signal processing. This makes it possible to accelerate the processing as a whole.

[0059] Detection by the state detection unit **420** may be performed at the timing before, in, and/or after polishing the substrate Wf. If the state detection unit **420** is independently installed, the detection at the timing before, in, or after polishing is not interfered with the operation of the holding arm **600** so long as the timing is in the interval of the polishing process. When detecting the film thickness of the substrate Wf simultaneously with the process performed by the polishing head **500** in processing the substrate Wf, the state detection unit **420** is operated for scanning in accordance with the operation of the holding arm **600** so as not to cause the delay in the process of the film thickness or the signal related to the film thickness of the substrate Wf. In the embodiment, the state detection unit **420** for detection of the surface state of the substrate Wf is provided in the partial polishing device **1000**. For example, if it takes time for the partial polishing device **1000** to perform the polishing process, it is possible to provide the detection unit outside the partial polishing device **1000** for keeping the productivity. For example, the Wet-ITM is effective for measuring in execution of the process. Otherwise, the ITM does not have to be necessarily provided in the partial polishing device **1000** for acquiring the film thickness or the signal corresponding to the film thickness before or after the processing. The ITM may be provided outside the partial polishing module so as to perform measurements upon loading/unloading of the substrate Wf in/from the partial polishing device **1000**. It is possible to determine the polishing end point in the respective polished region on the substrate Wf based on the film thickness or the signal relating thereto, irregularities and height, which have been acquired from the state detection unit **420**.

[0060] FIG. **3** is a perspective view schematically showing an example of the second conditioner **850** usable in the partial polishing device **1000** as shown in FIG. **1**. FIG. **3** shows a peripheral region of the polishing head **500** at the top end of the holding arm **600**. As FIG. **3** shows, the polishing head **500** holds the rotatable disc shaped polishing pad **502**. In the embodiment as shown in FIG. **3**, the polishing pad **502** is rotatably movable in the y-direction as the first motion direction with respect to the substrate Wf. As FIG. **3** shows, the second conditioner **850** is attached to the holding arm **600**. The second conditioner **850** includes a conditioning member **852** for conditioning the polishing pad **502**. Around the polishing pad **502**, the conditioning member **852** is held with the movement mechanism **854** apart from the polishing pad **502** in the y-direction so that the movement mechanism **854** makes the conditioning member **852** movable in the y-direction. The movement mechanism **854** serves as a pressing mechanism for pressing the conditioning member **852** against the polishing pad **502**. The second conditioner **850** is capable of conditioning the polishing pad **502** in polishing by pressing the conditioning member **852** against the polishing pad **502** in polishing. The motor or the like may be used for constituting the movement mechanism **854**. Alternatively, the movement mechanism of either hydraulic type or pneumatic type may be selected.

[0061] FIG. **4** is a perspective view schematically showing an example of the second conditioner **850** usable in the partial polishing device **1000** as shown in FIG. **1**. FIG. **4** shows a peripheral region of the polishing head **500** at the top end of the holding arm **600**. The second conditioner **850** as shown in FIG. **4** is derived from adding a swing mechanism **856** to the second conditioner **850** as shown in FIG. **3**. The swing mechanism **856** allows the movement mechanism **854** and the conditioning member **852** to move in the direction perpendicular to the first motion direction of the polishing pad **502**, and in the direction containing the component in the second motion direction parallel to the surface of the substrate Wf. In the embodiment as shown in FIG. **4**, the swing mechanism **856** allows the movement mechanism **854** and the conditioning member **852** to move in the x-direction perpendicular to the first motion direction (y-direction) of the polishing pad **502**, and parallel to the substrate Wf. Therefore, it is possible to change the position at which the conditioning member **852** comes in contact with the polishing pad **502** in conditioning of the polishing pad **502**. As described above, addition of the second motion direction component perpendicular to the first motion direction of the polishing pad **502** allows further uniform conditioning of the contact surface between the polishing pad **502** and the substrate Wf. It is possible to use the motor or the like, or the movement mechanism of either hydraulic type or pneumatic type for forming the swing mechanism **856**. In the embodiment, the swing motion has been described as an example of the mechanism for imparting the second motion direction component. It is possible to use the motion mechanism containing the second motion direction component such as the rotating motion and a translational rotating motion (the motion derived from combining the linear motion and the rotating motion). This applies to the other embodiments to be described later. In the embodiment, the conditioning member **852** has a flat shape, which may be changed suitably for the shape of the polishing pad **502** and the type of the second motion mechanism. This applies to the other embodiments to be described later. For example, if the second motion mechanism is of the rotating type or the translational rotating type, the conditioning member **852** may be formed to have the disc shape. If the polishing pad **502** has the disc-like, cylindrical, or spherical curved surface, the conditioning member **852** may be formed to have the contact surface with the polishing pad **502** conforming to the above-described curved surface. This makes it possible to efficiently condition the polishing pad **502**. It is possible to, for example, chamfer the end of the conditioning member **852** so as to suppress the load concentration in conditioning.

[0062] FIG. **5** is a side view schematically showing an example of the polishing head **500** and the second conditioner **850** which are usable in the partial polishing device **1000** according to an embodiment. In the embodiment as shown in FIG. **5**, the polishing pad **502** has the disc shape. The disc shaped polishing pad **502** is held with the rotatable polishing head **500**. As FIG. **5** shows, the rotating axis **502**A of the polishing head **500** tilts from the direction perpendicular to the surface of the substrate Wf. In other words, the surface of the disc shaped polishing pad **502** is not parallel to the substrate Wf. Therefore, when the polishing pad **502** is pressed against the substrate Wf while rotating the polishing head **500**, only an edge portion of the disc shaped polishing pad **502** in the unidirection comes in contact with the substrate Wf, while having the other edge portion in the opposite direction apart from the substrate Wf. In the above-described state, as only the edge portion of the polishing pad **502** comes in contact with the substrate Wf, the micro-region polishing may be performed.

[0063] The second conditioner **850** of the partial polishing device **1000** as shown in FIG. **5** includes the conditioning member **852**. The conditioning member **852** is linked to the movement mechanism **854**. The movement mechanism **854** allows the conditioning member **852** to move toward the polishing pad **502** so as to be pressed thereby. In the embodiment, the movement mechanism **854** is linked to the swing mechanism **856**. The swing mechanism **856** allows the movement mechanism **854** and the conditioning member **852** to move in the direction having the component perpendicularly directed to the rotating axis **502**A of the polishing pad **502**. As FIG. **5** shows, the movement mechanism **854** and the swing mechanism **856** are held with a support member **858**. The support member **858** is fixed to the holding arm **600**. As FIG. **5** shows, the substrate Wf is pressed by the edge portion of the polishing pad **502** in the unidirection so that the substrate Wf may be polished. Simultaneously, the other opposite edge portion of the polishing pad **502** is apart from the substrate Wf. Then the conditioning member **852** is pressed against the opposite edge portion to allow conditioning of the polishing pad **502** while polishing the substrate Wf. In an embodiment, the second conditioner **850** may include the rotating mechanism, or the translational rotating motion mechanism to rotate the conditioning member **852** as shown in FIG. **5** around the rotating axis **852**A. The rotating mechanism as described above does not have to be provided. The motor may be used for forming the movement mechanism **854**, and the swing mechanism **856**. Alternatively, the movement mechanism of either hydraulic type or pneumatic type may be selected.

[0064] FIG. **6** is a side view schematically showing an example of the polishing head **500** and the second conditioner **850** which are usable in the partial polishing device **1000** according to an embodiment. In the embodiment as shown in FIG. **6**, the polishing pad **502** has a truncated conical shape. Alternatively, the polishing pad may be disposed on a truncated conically shaped base. The truncated conically shaped polishing pad **502** is held with the rotatable polishing head **500**. As FIG. **6** shows, the rotating axis **502**A of the polishing head **500** is parallel to the surface of the substrate Wf while coinciding with the center of the truncated conical shape. In the above-described state, as only one edge portion of the polishing pad **502** comes in contact with the substrate Wf, the micro-region polishing may be performed.

[0065] The second conditioner **850** of the partial polishing device **1000** as shown in FIG. **6** includes the conditioning member **852**. The conditioning member **852** is disposed contactably with the side surface of the truncated conically shaped polishing pad **502**. The conditioning member **852** is linked to the movement mechanism **854**. The movement mechanism **854** allows the conditioning member **852** to move toward the side surface of the truncated conically shaped polishing pad **502** so as to be pressed thereby. In the embodiment, the movement mechanism **854** is linked to the swing mechanism **856**. The swing mechanism **856** allows the movement mechanism **854** and the conditioning member **852** to move in the direction along the side surface of the truncated conically shaped polishing pad **502**. As FIG. **6** shows, the movement mechanism **854** and the swing mechanism **856** are held with the support member **858**. The support member **858** is fixed to the holding arm **600**. In the embodiment as shown in FIG. **6**, the polishing pad **502** may be conditioned by the second conditioner **850** simultaneously with polishing the substrate Wf with the polishing pad **502**. It is possible to use the motor or the like for forming the movement mechanism **854** and the swing mechanism **856**. Alternatively, the movement mechanism of either hydraulic type or pneumatic type may be selected.

[0066] FIG. **7** is a side view schematically showing an example of the polishing head **500** and the second conditioner **850** which are usable in the partial polishing device **1000** according to an embodiment. In the embodiment as shown in FIG. **7**, the polishing pad **502** has a partially spherical shape. Alternatively, the polishing pad may be disposed on a partially spherical shaped base. The polishing pad **502** is held with the rotatable polishing head **500**. As FIG. **7** shows, the rotating axis **502**A of the polishing head **500** is parallel to the surface of the substrate Wf.

[0067] The second conditioner **850** of the partial polishing device **1000** as shown in FIG. **7** includes the conditioning member **852**. The conditioning member **852** has a curved surface with the disc shape, the rectangular shape, or the curved shape along the spherical shape of the polishing pad **502**, and is disposed contactably on the side surface of the polishing pad **502**. The conditioning member **852** is linked to the movement mechanism **854**. The movement mechanism **854** allows the conditioning member **852** to move toward the polishing pad **502** so as to be pressed thereby. In the embodiment as shown in FIG. **7**, the movement mechanism **854** is held with the support member **858**. The support member **858** includes a curved recess portion **860**. As FIG. **7** shows, the curved surface of the recess portion **860** has the same center as that of the spherical shape of the polishing pad **502**. The movement mechanism **854** is positioned on the curved surface of the recess portion **860** of the support member **858**, while being swingably disposed along the curved surface. The support member **858** is fixed to the holding arm **600**. In the embodiment as shown in FIG. **7**, the polishing pad **502** may be conditioned by the second conditioner **850** simultaneously with polishing the substrate Wf with the polishing pad **502**. It is possible to use the motor or the like for forming the movement mechanism **854** and the swing mechanism **856**. Alternatively, the movement mechanism of either hydraulic type or pneumatic type may be selected.

[0068] FIG. **8** is a side view schematically showing an example of the polishing head **500** and the second conditioner **850** which are usable in the partial polishing device **1000** according to an embodiment. In the embodiment as shown in FIG. **8**, the polishing member includes a polishing belt member **502**B. The polishing belt member **502**B is supported with a support member **520**, and may be pressed against the substrate Wf. A rotating mechanism **522** allows the polishing belt member **502**B to be longitudinally movable. The polishing belt member **502**B may be constituted by such material as a commercial CMP pad. In the embodiment as shown in FIG. **8**, the second conditioner **850** includes the conditioning member **852**. The conditioning member **852** has a disc shape or a rectangular shape, and is contactably disposed on the polishing surface of the polishing belt member **502**B. The conditioning member **852** is linked to the movement mechanism **854**. The movement mechanism **854** allows the conditioning member **852** to move toward the polishing belt member **502**B. As FIG. **8** shows, the second conditioner **850** includes a belt back surface support member **862** at the position corresponding to the conditioning member **852** inside the polishing belt member **502**B. In the embodiment as shown in FIG. **8**, the polishing belt member **502**B may be conditioned while being pressed by the conditioning member **852** in the state where the polishing belt member **502**B is supported with the belt back surface support member **862**.

[0069] FIG. **9** is a view seen from a direction of an arrow **9** of FIG. **8**. As FIG. **9** shows, the second conditioner **850** includes the swing mechanism **856**. The swing mechanism **856** allows the movement mechanism **854** and the conditioning member **852** to move in a width direction of the polishing belt member **502**B. It is possible to use the motor or the like for forming the movement mechanism **854** and the swing mechanism **856**. Alternatively, the movement mechanism of either hydraulic type or pneumatic type may be selected.

[0070] The partial polishing device **1000** according to an embodiment includes a collection unit **300** for collecting the waste generated from the polishing member in conditioning the polishing pad **502**. FIG. **10** is a side view schematically showing the collection unit **300** according to an embodiment. As FIG. **10** shows, the collection unit **300** is attached to the holding arm **600**. The collection unit **300** as shown in FIG. **10** includes a suction unit **302**. The suction unit **302** is disposed adjacent to the surface of the polishing pad **502**, which comes in contact with the substrate Wf. In the embodiment as shown in FIG. **10**, the polishing pad **502** has the disc shape or the cylindrical shape. The suction unit **302** is disposed adjacent to the side surface of the disc shaped or cylindrically shaped polishing pad **502**. The suction unit **302** is linked to a suction passage **304** to be communicated with a not shown vacuum source. The suction unit **302** is disposed at the downstream side of the position where the conditioning member **852** comes in contact with the polishing pad **502** in the motion direction thereof (rotating direction in the embodiment as shown in FIG. **10**). In the embodiment as shown in FIG. **10**, the polishing pad **502** rotates clockwise. The suction unit **302** is disposed at the downstream side of the position where the conditioning member **852** comes in contact with the polishing pad **502**. As FIG. **10** shows, the partial polishing device **1000** allows the second conditioner **850** to condition the polishing pad **502** while polishing the substrate Wf with the polishing pad **502**. The waste is generated from the polishing pad **502** as a result of conditioning. The collection unit **300** as shown in FIG. **10** is capable of removing the waste generated in conditioning through suction. The collection unit is capable of suppressing the polishing pad waste generated in conditioning performed by the second conditioner **850** from reaching the surface of the substrate Wf. It is therefore possible to suppress contamination on the surface of the substrate WF by the polishing pad waste.

[0071] FIG. **11** is a side view schematically showing the collection unit **300** according to an embodiment. As FIG. **11** shows, the collection unit **300** is attached to the holding arm **600**. The collection unit **300** as shown in FIG. **11** includes a wiper (or scraper) **306**. The wiper **306** is disposed to come in contact with the surface of the polishing pad **502**, which comes in contact with the substrate Wf. In the embodiment as shown in FIG. **11**, the polishing pad **502** has the disc shape or the cylindrical shape. The wiper **306** is disposed to come in contact with the side surface of the disc shaped or the cylindrically shaped polishing pad **502**. The wiper **306** is supported with a support member **308** which is connected to the holding arm **600**. As FIG. **11** shows, the partial polishing device **1000** allows the second conditioner **850** to condition the polishing pad **502** while polishing the substrate Wf with the polishing pad **502**. The waste is generated from the polishing pad **502** as a result of conditioning. The collection unit **300** as shown in FIG. **11** allows the wiper **306** to remove the waste generated in conditioning from the polishing pad **502**. The wiper **306** may be provided with the additional collection unit **300** (not shown) for collecting the waste generated from the polishing member as shown in FIG. **10** at the position downstream the wiper **306** in the rotating direction of the polishing pad **502**.

[0072] FIG. **12** is a side view schematically showing a collection unit **300** according to an embodiment. The collection unit **300** as shown in FIG. **12** includes a liquid supply mechanism **310** for cleaning the conditioned polishing pad **502**, and a liquid collection mechanism **312** for collecting the liquid which has been used for cleaning the polishing pad **502**. The liquid supply mechanism **310** may be formed as a nozzle for spraying pure water to the polishing pad **502**, for example. The liquid collection mechanism **312** may be formed as a container for receiving the pure water which has been sprayed to the polishing pad **502**. The container as described above may be provided with a liquid discharge unit **314**. As FIG. **12** shows, the partial polishing device **1000** allows the second conditioner **850** to condition the polishing pad **502** while polishing the substrate Wf with the polishing pad **502**. The waste is generated from the polishing pad **502** as a result of conditioning. The collection unit **300** as shown in FIG. **12** allows removal of the waste generated in conditioning from the polishing pad **502** by spraying the liquid thereto.

[0073] Explanations have been made with respect to the collection units **300** applied to the partial polishing device **1000** including the disc shaped or the cylindrically shaped polishing pad **502**. It is possible to add the similar collection unit **300** to the partial polishing device **1000** including the polishing member **502** with the shape other than the disc shape or the cylindrical shape. For example, the collection unit **300** is applicable to the arbitrary polishing pad **502**, the polishing belt member **502**B or other arbitrary polishing member as disclosed in the specification.

[0074] FIG. **13**A shows an example of a control circuit for processing information on a film thickness, irregularities and height of the substrate Wf. At first, a partial polishing control section combines a polishing process recipe set in a HMI (Human Machine Interface) and parameters to determine a basic partial polishing process recipe. In this case, it is possible to use the partial polishing process recipe and the parameter which have been downloaded from the HOST to the partial polishing device **1000**. Then a recipe server combines the basic partial polishing process recipe and the polishing process information of the process Job to generate the basic partial polishing process recipe for each substrate Wf to be processed. The partial polishing recipe server generates the partial polishing process recipe for each substrate by combining the partial polishing process recipe for each substrate Wf to be processed, substrate surface shape data stored in a partial polishing database, and polishing rate data with respect to past data relevant to the similar substrate such as the substrate surface shape after the partial polishing, and the respective parameters of the previously acquired polishing conditions. At this time, it is possible to use the data of the substrate Wf measured in the partial polishing device **1000**, or the data preliminarily downloaded from the HOST to the partial polishing device **1000** as the substrate surface shape data stored in the partial polishing database. The partial polishing recipe server transmits the partial polishing process recipe to the partial polishing device **1000** via the recipe server or directly. The partial polishing device **1000** partially polishes the substrate Wf in accordance with the received partial polishing process recipe.

[0075] FIG. **13**B shows a circuit diagram in which a control section for substrate surface state detection is separated from the partial polishing control section as shown in FIG. **13**A. By separating the control section for substrate surface state detection, which involves a large-sized data processing from the partial polishing control section, it is expected to provide effects of reducing the data processing load to the partial polishing control section, and decreasing the processing time period required to create the process Job as well as generate the partial polishing process recipe. This makes it possible to improve throughput of the entire partial polishing module.

[0076] FIG. **14** is a schematic view showing a substrate processing system **1100** according to an embodiment, in which the partial polishing device **1000** is installed. As FIG. **14** shows, the substrate processing system **1100** includes the partial polishing device **1000**, the large-diameter polishing device **1200**, a cleaning device **1300**, a drying device **1400**, the control unit **900**, and a carrier mechanism **1500**. The partial polishing device **1000** of the substrate processing system **1100** may be provided with arbitrary features as described above. The large-diameter polishing device **1200** polishes the substrate using a polishing pad with its area larger than that of the substrate Wf to be polished. The known CMP device may be used as the large-diameter polishing device **1200**. Arbitrary known devices may be selected for the cleaning device **1300**, the drying device **1400**, and the carrier mechanism **1500**, respectively. The control unit **900** may be configured to control not only the partial polishing device **1000** as described above, but also entire operations of the substrate processing system **1100**. In the embodiment as shown in FIG. **14**, the partial polishing device **1000** and the large-diameter polishing device **1200** are installed in the single substrate processing system **1100**. Combining the partial polishing performed by the partial polishing device **1000**, the overall polishing of the substrate Wf performed by the large-diameter polishing device **1200**, and detection of the surface state of the substrate Wf performed by the state detection unit makes it possible to execute various kinds of polishing processes. The partial polishing performed by the partial polishing device **1000** allows polishing only to a part of the surface of the substrate Wf other than the entire surface thereof. Alternatively, in the polishing process to the entire surface of the substrate Wf, which is performed by the partial polishing device **1000**, it is possible to change the condition for polishing a part of the surface of the substrate Wf.

[0077] An explanation will be made with respect to a partial polishing method implemented by the substrate processing system **1100**. At first, the surface state of the substrate Wf to be polished is detected. The above-described state detection unit **420** provides detected information including the film thickness of the film to be formed on the substrate Wf, and the irregularities on the surface (position, size, and height). Then the polishing recipe is generated in accordance with the detected surface state of the substrate Wf. In this case, the polishing recipe constitutes a plurality of process steps. Parameters for the respective steps to be executed in the partial polishing device **1000**, for example, include processing time period, the contact pressure or load applied from the polishing pad **502** to the substrate Wf, or applied to the dresser **820** disposed on the dress stage **810**, the motion speed, the load applied by the conditioning member **852** of the second conditioner **850** to press the polishing pad **502**, the moving pattern and the moving speed caused by the movement mechanism **854**, the conditioning time, conditioning cycle, the rotating speed of the polishing pad **502** or the substrate Wf, the moving pattern and moving speed of the polishing head **500**, selection and flow rate of the polishing pad processing solution, the rotating speed of the dress stage **810**, and the condition for detecting the polishing end point. In the partial polishing process, the operation of the polishing head **500** in the plane of the substrate Wf has to be determined based on the information on the film thickness or the irregularities in the plane of the substrate Wf, which has been acquired from the above-described state detection unit **420**. For example, target values corresponding to desired film thickness and irregularities state, and the polishing rate in the above-described polishing condition may be the parameters for determining a staying time of the polishing head **500** in the respective polished regions in the plane of the substrate Wf, for example. In this case, the polishing rate varies depending on the polishing condition. Therefore, those values may be stored as the database in the control unit **900** so that the polishing rate is automatically calculated in response to setting of the polishing condition. In this case, the polishing rate as the basis corresponding to the respective parameters are preliminarily acquired so as to be stored as the database. Based on those parameters and the information on the film thickness and the irregularities in the plane of the substrate Wf, the staying time of the polishing head **500** in the plane of the substrate Wf may be calculated. As described below, each route of the preliminary measurement, the partial polishing, the overall polishing, and the cleaning route may vary depending on the state of the substrate Wf and the processing solution to be used. Therefore, it is possible to set the carrier route of those components. It is also possible to set the condition for acquiring the data of the film thickness and the irregularities in the plane of the substrate Wf. If the state of the processed substrate Wf fails to reach the allowable level as described below, re-polishing has to be performed. It is possible to set the condition for the re-polishing (the number of times of repeatedly performing the re-polishing). Thereafter, the partial polishing and the overall polishing are performed in accordance with the generated polishing recipe. In the examples, and those to be described below, the substrate Wf may be cleaned at the arbitrary timing. For example, assuming that different processing solution is used for the partial polishing and the overall polishing, if contamination to the solution for the overall polishing by the processing solution used for the partial polishing cannot be ignored, the substrate Wf may be cleaned after each performance of the partial polishing and the overall polishing, respectively for preventing the contamination. Conversely, if the same processing solution can be used, or the contamination to the processing solution is ignorable, the substrate Wf may be cleaned after performance of both the partial polishing and the overall polishing.

[0078] The embodiments of the present invention have been described in reference to various examples. The embodiments of the present invention as described above are not intended to restrict the present invention, but to facilitate understanding of the invention. It is to be readily understood that the present invention may be modified and improved as well as have the equivalents inclusive without departing from its gist. It is also possible to combine the respective components described in the claims and the specification arbitrarily or omit them so long as the problem as described above is at least partially solved, or the resultant effect is at least partially obtained.

REFERENCE SIGNS LIST

[0079] **300** collection unit
[0080] **302** suction unit
[0081] **306** wiper
[0082] **310** liquid supply mechanism
[0083] **312** liquid collection mechanism
[0084] **314** liquid discharge unit
[0085] **500** polishing head
[0086] **502** polishing pad
[0087] **600** holding arm
[0088] **602** perpendicular drive mechanism
[0089] **620** horizontal drive mechanism
[0090] **800** conditioning unit
[0091] **850** second conditioner
[0092] **852** conditioning member
[0093] **854** movement mechanism
[0094] **856** swing mechanism
[0095] **900** control unit
[0096] **1000** partial polishing device
[0097] **1100** substrate processing system
[0098] Wf substrate

1. A polishing device for partially polishing a substrate, comprising:
- a polishing member having a processing surface which comes into contact with the substrate and which is smaller than the substrate;
- a conditioning member for performing conditioning on the polishing member,
- a first pressing mechanism for pressing the conditioning member against the polishing member in polishing the substrate; and
- a control unit for controlling an operation of the polishing device, wherein the control unit is configured to control the first pressing mechanism when the substrate is partially polished by the polishing member.

2. The polishing device according to claim **1**, further comprising:
- a pressing mechanism for pressing the polishing member against the substrate; and
- a first drive mechanism for imparting a motion to the polishing member in a first motion direction parallel to a surface of the substrate.

3. The polishing device according to claim **2**, further comprising
- a second drive mechanism for imparting a motion to the conditioning member to have a component contained in a second motion direction perpendicular to the first motion direction, and parallel to the surface of the substrate.

4. The polishing device according to claim **3**, wherein
the second drive mechanism is configured to impart a linear motion and/or a rotating motion to the conditioning member.

5. The polishing device according to claim **1**, wherein
the control unit is configured to control the first pressing mechanism so that the conditioning is performed at a predetermined cycle in polishing the substrate.

6. The polishing device according to claim **1**, wherein
the polishing member and the conditioning member are held with a holding arm.

7. The polishing device according to claim **1**, further comprising
a collection unit for collecting waste generated from the polishing member in performing the conditioning.

8. The polishing device according to claim **7**, wherein
the collection unit includes a suction unit for removing the waste generated from the polishing member through suction in performing the conditioning.

9. The polishing device according to claim **7**, wherein
the collection unit includes a scraper or a wiper for collecting the waste generated from the polishing member in performing the conditioning.

10. The polishing device according to claim **7**, wherein the collection unit includes
a liquid supply mechanism for cleaning the conditioned polishing member, and
a liquid collection mechanism for collecting the liquid which has been used for cleaning the polishing member.

11. The polishing device according to claim **1**, wherein the polishing member is formed into any one of structures including:
(1) a disc shaped or a cylindrically shaped structure, having a center axis parallel to the surface of the substrate;
(2) a disc shaped structure, having a center axis tilting from a direction perpendicular to the surface of the substrate;
(3) a conically shaped or a truncated conically shaped structure, having a center axis parallel to the surface of the substrate;
(4) a spherically shaped or a partially spherically shaped structure; and
(5) a structure as a belt member.

12. A method for polishing a substrate, comprising:
pressing a polishing member against the substrate, the polishing member having a processing surface which comes into contact with the substrate and which is smaller than the substrate;
polishing the substrate by imparting relative motions to the polishing member and the substrate while pressing the polishing member against the substrate; and
conditioning the polishing member while bringing a conditioning member into contact with the polishing member in polishing the substrate.

13. The method according to claim **12**, further comprising
imparting a linear motion and/or a rotating motion to the conditioning member.

14. The method according to claim **12**, further comprising
collecting waste generated from the polishing member while the polishing member is conditioned.

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