DESCRIPTION

Title of Invention: METHOD OF MANUFACTURING DISK-SHAPED SUBSTRATE AND APPARATUS FOR MANUFACTURING DISK-SHAPED SUBSTRATE

Technical Field

[0001] The present disclosure relates to a method of manufacturing a disk-shaped substrate and an apparatus for manufacturing a disk-shaped substrate.

Background Art

[0002] Conventionally, in a process of manufacturing a disk-shaped substrate used as a substrate for a magnetic recording medium, polishing a surface of the disk-shaped substrate using a polishing apparatus in order to improve flatness of the surface of the disk-shaped substrate has been known. For example, in the polishing apparatus disclosed in Japanese Patent Application Laid-Open (JP-A) No. 2005-230978, a lower surface plate and an upper surface plate are disposed to face each other, and a disk-shaped substrate is disposed between the lower surface plate and the upper surface plate in a state in which the disk-shaped substrate is accommodated inside a carrier.

[0003] In JP-A No. 2005-230978, a surface of the disk-shaped substrate is polished by rotating the disk-shaped substrate while supplying a polishing liquid between the lower surface plate and the upper surface plate in a state in which the lower surface plate and the upper surface plate are in contact with the disk-shaped substrate. However, in the polishing apparatus, after the disk-shaped substrate is polished, the polished disk-shaped substrate and the carrier may adhere to the upper surface plate via the polishing liquid, as a result of which there are cases in which the disk-shaped substrate is not separated from the upper surface plate even in a case in which the upper surface plate is raised.

[0004] To solve the above problem, in JP-A No. 2005-230978, a separation gas as a separation fluid is supplied from the outside via nozzle holes provided in the upper surface plate to a space between the upper surface plate and the disk-shaped substrate and to a space between the upper surface plate and the carrier, respectively, thereby separating the disk-shaped substrate from the upper surface plate. In JP-A No. 2005-230978, discharging the polishing liquid from between the upper surface plate and the disk-shaped substrate and from between the upper surface plate and the carrier by supplying the separation gas is disclosed. After the disk-shaped substrate and the carrier are separated from the upper surface plate, the disk-shaped substrate is transferred

from the polishing apparatus to an apparatus for performing the next step.

[0005] Patent Literature 1: JP-A No. 2005-230978

SUMMARY OF INVENTION

Technical Problem

[0006] Here, usually, the thickness of the carrier located around the disk-shaped substrate is thinner than the thickness of the disk-shaped substrate. For this reason, in a case in which the carrier accommodating the disk-shaped substrate is disposed on the lower surface plate, the height of the disk-shaped substrate becomes higher than the height of the carrier. That is, between the lower surface plate and the upper surface plate, the volume of space per unit area of the carrier in a portion above the carrier is larger than the volume of space per unit area of the disk-shaped substrate in a portion above the disk-shaped substrate.

[0007] In JP-A No. 2005-230978, regarding a supply system for the separation gas as the separation fluid supplied to the upper side of the disk-shaped substrate and a supply system for the separation gas as the separation fluid supplied to the upper side of the carrier, the respective supply sources are common, and one common pipe extending from the common supply source is used as a part of a supply path. In JP-A No. 2005-230978, one supply system is commonly used as the supply system for the separation gas on the disk-shaped substrate side and the supply system for the separation gas on the carrier side.

[0008] For this reason, in a case in which the separation fluid is supplied to the upper side of the disk-shaped substrate, the separation fluid tends to flow away toward the upper side of the carrier, where the space volume per unit area is large. In other words, the separation fluid flows to the upper side of the carrier, where the pressure loss is smaller than on the upper side of the disk-shaped substrate. As a result, the pressure of the separation fluid supplied to the upper side of the disk-shaped substrate decreases. For this reason, the polishing liquid accumulated in the portion above the disk-shaped substrate is not sufficiently discharged, as a result of which there are cases in which the disk-shaped substrate is not separated from the upper surface plate.

[0009] The disclosure has been made in view of the above-described problem, and provides a method of manufacturing a disk-shaped substrate and an apparatus for manufacturing a disk-shaped substrate with which a polished disk-shaped substrate is easily separated from the upper surface plate.

Solution to Problem

[0010] Specific means for achieving the above purpose are as follows.

<1>

A method of manufacturing a disk-shaped substrate, including: a step of disposing a carrier, which accommodates a disk-shaped substrate, between a lower surface plate and an upper surface plate; a step of sandwiching the disk-shaped substrate between the lower surface plate and the upper surface plate and subjecting the disk-shaped substrate to a grinding treatment or a polishing treatment while supplying a treatment liquid between the lower surface plate and the upper surface plate; a step of supplying a first separation fluid, which separates the disk-shaped substrate from the upper surface plate, between the upper surface plate and the disk-shaped substrate, using a first supply system; and a step of supplying a second separation fluid, which separates the carrier from the upper surface plate, between the upper surface plate and the carrier, using a second supply system independent of the first supply system.

[0011] <2>

The method of manufacturing a disk-shaped substrate according to <1>, in which the step of supplying at least one of the first separation fluid or the second separation fluid includes: a treatment of feeding a liquid to bring the liquid into contact with the treatment liquid; and a treatment of feeding a gas after the liquid to apply pressure to the liquid in a state in which the liquid is in contact with the treatment liquid.

[0012] <3>

An apparatus for manufacturing a disk-shaped substrate, including: a lower surface plate, a carrier accommodating a disk-shaped substrate being placed on an upper side of the lower surface plate; an upper surface plate disposed above the lower surface plate so as to be capable of moving toward or moving away from the lower surface plate, the upper surface plate having a first nozzle hole formed in a portion facing the disk-shaped substrate and a second nozzle hole formed in a portion facing the carrier; a treatment liquid supply unit that supplies a treatment liquid between the lower surface plate and the upper surface plate; a first supply system having a first supply source in which a first separation fluid for separating the disk-shaped substrate from the upper surface plate is stored, and a first pipe connected between the first supply source and the first nozzle hole; and a second supply system having a second supply source in which a second separation fluid for separating the carrier from the upper surface plate is stored, and a second pipe connected between the second supply source and the second nozzle hole, the second supply system being provided independently of the first supply system.

[0013] <4>

The apparatus for manufacturing a disk-shaped substrate according to <3>, further

including a control device that executes a treatment of supplying the first separation fluid between the upper surface plate and the disk-shaped substrate by the first supply system, and a treatment of supplying the second separation fluid between the upper surface plate and the carrier by the second supply system.

[0014] <5>

The apparatus for manufacturing a disk-shaped substrate according to <4>, in which the control device controls at least one of the first supply system or the second supply system so as to, as a treatment of supplying at least one of the first separation fluid or the second separation fluid, feed a liquid to bring the liquid into contact with the treatment liquid, and feed a gas after the liquid to apply pressure to the liquid in a state in which the liquid is in contact with the treatment liquid.

Advantageous Effects of Invention

[0015] According to the disclosure, it is possible to provide a method of manufacturing a disk-shaped substrate and an apparatus for manufacturing a disk-shaped substrate with which a polished disk-shaped substrate is easily separated from the upper surface plate.

BRIEF DESCRIPTION OF DRAWINGS

[0016] Fig. 1 is a plan view illustrating an apparatus for manufacturing a disk-shaped substrate according to an embodiment of the disclosure.

Fig. 2 is a sectional view taken along line 2-2 in Fig. 1.

Fig. 3 is a sectional view illustrating a method of manufacturing a disk-shaped substrate according to the present embodiment (part 1).

Fig. 4 is a sectional view illustrating the method of manufacturing a disk-shaped substrate according to the present embodiment (part 2).

Fig. 5 is a sectional view illustrating a method of manufacturing a disk-shaped substrate according to a comparative example.

DESCRIPTION OF EMBODIMENTS

[0017] Embodiments of the disclosure will be described below. However, the disclosure is not limited to the following embodiments. In a case in which embodiments are described with reference to drawings in the disclosure, the configuration of the embodiment is not limited to the configurations shown in the drawings. The sizes of members in each drawing are conceptual, and the relative relationship in size between the members is not limited to the relationship

shown in the drawings.

[0018] In the following description of the drawings, similar parts are denoted by similar reference signs. However, the drawings are schematic, and the relationship between a thickness and a planar dimension, and the ratio of the thicknesses of each apparatus and each member, differ from actual relationships and ratios. Therefore, specific thicknesses and dimensions should be determined with reference to the following description. The drawings also include portions in which dimensional relationships and ratios differ from each other. Unless otherwise specified in the specification, the number of each component of the disclosure is not limited to one, and plural components may be present.

[0019] In the following embodiments, constituent elements thereof (including element steps and the like) are not essential unless particularly specified. The same applies to numerical values and ranges thereof, and the numerical values and ranges do not limit the disclosure.

In the disclosure, numerical ranges indicated using "to" include the numerical values described before and after "to" as the minimum value and the maximum value, respectively.

In numerical ranges described stepwise in the disclosure, an upper limit value or a lower limit value described in one numerical range may be replaced with an upper limit value or a lower limit value of another numerical range described stepwise. In numerical ranges described in the disclosure, an upper limit value or a lower limit value of the numerical range may be replaced with a value shown in Examples.

[0020] In the disclosure, in a case in which components are included, each component may include plural kinds of corresponding substances. In a case in which plural kinds of substances corresponding to each component are present in a composition, the content ratio or content amount of each component means the total content ratio or content amount of the plural kinds of substances present in the composition, unless otherwise specified.

In the disclosure, particles corresponding to each component may include plural kinds of particles. In a case in which plural kinds of particles corresponding to each component are present in a composition, the particle diameter of each component means a value for a mixture of the plural kinds of particles present in the composition, unless otherwise specified.

In the disclosure, the term "layer" or "film" includes not only a case in which the layer or film is formed over the entire region in which the layer or film is present when the region is observed, but also a case in which the layer or film is formed only in part of the region.

[0021] <Apparatus for Manufacturing Disk-Shaped Substrate>

First, an apparatus for manufacturing a disk-shaped substrate 10 according to the

present embodiment will be described with reference to Figs. 1 and 2. As shown in Figs. 1 and 2, the apparatus for manufacturing a disk-shaped substrate 10 includes a lower surface plate 12, an upper surface plate 14, a polishing liquid supply unit 30, a first supply system 41, and a second supply system 42.

[0022] In the present embodiment, the apparatus for manufacturing a disk-shaped substrate 10 is a polishing apparatus. In the disclosure, the apparatus for manufacturing a disk-shaped substrate 10 may be configured to include one or more other apparatuses necessary for manufacturing a disk-shaped substrate.

[0023] Specifically, a grinding apparatus that grinds a disk-shaped substrate 50 at a stage preceding the polishing apparatus, a batch transfer apparatus for an unprocessed or processed disk-shaped substrate 50, a standby apparatus that causes an unprocessed or processed disk-shaped substrate 50 to stand by, and the like may be included. Independently of these apparatuses, or in combination with these apparatuses, an accommodation rack which accommodates an unprocessed or processed disk-shaped substrate, a cleaning apparatus that cleans the disk-shaped substrate 50, a drying apparatus that dries the disk-shaped substrate 50, and the like may be included.

[0024] (Disk-Shaped Substrate)

The disk-shaped substrate 50 is accommodated inside an accommodation hole 52A of a carrier 52. The disk-shaped substrate 50 of the present embodiment is, for example, an aluminum substrate or an aluminum alloy substrate, and in the disclosure, the disk-shaped substrate 50 is not limited thereto, and a glass substrate or the like may be adopted. Hereinafter, an aluminum substrate, an aluminum alloy substrate, and a glass substrate are also collectively referred to as a “substrate”. An aluminum substrate and an aluminum alloy substrate are also collectively referred to as an “aluminum substrate”. A plating layer may be formed on a surface of the aluminum substrate. In this case, a surface to be polished can be the plating layer. The aluminum substrate is advantageous in that the aluminum substrate has excellent workability and can reduce manufacturing cost.

[0025] A glass strengthening layer may be formed on a surface of a glass substrate. In this case, a surface to be polished can be the glass strengthening layer. Formation of the glass strengthening layer is not essential in the glass substrate. The disclosure is also applicable to a case in which a surface of a solid glass substrate on which the glass strengthening layer is not formed is polished. Because the glass substrate is excellent in strength, surface flatness, heat resistance, and the like as compared with the aluminum substrate, it is easy to achieve size

reduction and high density of the disk-shaped substrate.

[0026] As shown in Fig. 1, in the present embodiment, a case in which the number of the disk-shaped substrates 50 accommodated in one carrier 52 is three is illustrated, but the disclosure is not limited to this configuration, and the number of the accommodated disk-shaped substrates may be one or may be any number of two or more. Similarly, in the present embodiment, a case in which the number of the carriers 52 placed on the lower surface plate 12 is four is illustrated, but the disclosure is not limited to this configuration, and the number of the placed carriers may be one or may be any number of two or more.

[0027] The disk-shaped substrate 50 of the present embodiment is for a magnetic recording medium, but in the disclosure, the disk-shaped substrate 50 is not limited to a disk-shaped substrate for a magnetic recording medium. The disk-shaped substrate according to the disclosure may be, for example, another information recording disk such as an optical disk.

[0028] In the polishing apparatus, the disk-shaped substrate 50 rotates, namely, undergoes self-rotation, about an axis of the disk-shaped substrate 50 via the carrier 52, and also rotates, namely, revolves, around a sun gear 16 about an axis of the sun gear 16.

[0029] (Lower Surface Plate)

As shown in Fig. 2, the lower surface plate 12 has a disk-shaped lower base 12A and a disk-shaped lower polishing pad 12B provided on the lower base 12A in Fig. 2. For the lower polishing pad 12B, a known polishing material such as polishing cloth can be adopted. In the disclosure, the term “lower surface plate” may be used as a generic term including a lower polishing pad.

The carrier 52 which accommodates the disk-shaped substrate 50 is placed on an upper side of the lower polishing pad 12B of the lower surface plate 12. As shown in Fig. 1, one sun gear 16 that meshes with gears at peripheral edges of the four carriers 52 is disposed at the center of the lower surface plate 12. One external gear 18 that meshes with the gears at the peripheral edges of the four carriers 52 is disposed around the lower surface plate 12. As shown in Fig. 2, a discharge path D for discharging a polishing liquid 60 is formed between the lower surface plate 12 and the external gear 18.

(Upper Surface Plate)

As shown in Fig. 2, the upper surface plate 14 has a disk-shaped upper base 14A and a disk-shaped upper polishing pad 14B provided under the upper base 14A in Fig. 2. For the upper polishing pad 14B, a known polishing material such as polishing cloth can be adopted, similarly to the lower polishing pad 12B. In the disclosure, the term “upper surface plate” may

be used as a generic term including an upper polishing pad.

The upper surface plate 14 is disposed above the lower surface plate 12 in a state of facing the lower surface plate 12. In the present embodiment, both the lower surface plate 12 and the upper surface plate 14 are provided so as to be vertically movable by being connected to a hydraulic driving device, an electric driving device, or the like. For this reason, the upper surface plate 14 is capable of moving toward or moving away from the lower surface plate 12. In the disclosure, the upper surface plate 14 may be disposed so as to be capable of moving toward or moving away from the lower surface plate 12 by at least one of the lower surface plate 12 or the upper surface plate 14 being vertically movable.

[0030] The upper surface plate 14 has a first nozzle hole 21 and a second nozzle hole 22. The first nozzle hole 21 is formed in a portion facing the disk-shaped substrate 50 so as to pass through the upper base 14A and the upper polishing pad 14B. The second nozzle hole 22 is formed in a portion facing the carrier 52 so as to pass through the upper base 14A and the upper polishing pad 14B.

In the present embodiment, Fig. 1 illustrates a state in which two first nozzle holes 21 are formed in a portion facing one disk-shaped substrate 50, and six second nozzle holes 22 are formed in a portion facing the carrier 52, but the disclosure is not limited thereto. In the disclosure, the respective numbers of the first nozzle holes 21 and the second nozzle holes 22 can be changed if appropriate.

In the present embodiment, as can be seen from line 2-2 in Fig. 1, a state in which two first nozzle holes 21 and two second nozzle holes 22 are disposed on one straight line in plan view is illustrated, but the disclosure is not limited thereto. The arrangement pattern of the first nozzle holes 21 and the second nozzle holes 22 can be changed if appropriate.

[0031] (Polishing Liquid Supply Unit)

The polishing liquid supply unit 30 has a polishing liquid tank 30A in which the polishing liquid 60 is stored, and a polishing liquid pipe 30B connected between the polishing liquid tank 30A and the upper surface plate 14. The polishing liquid supply unit 30 supplies the polishing liquid 60 between the lower surface plate 12 and the upper surface plate 14. Specifically, for example, the polishing liquid 60 may be supplied between the lower surface plate 12 and the upper surface plate 14 by being dropped onto an upper surface of the upper base 14A of the upper surface plate 14 in Fig. 2 and moving on the surface from the upper surface side toward the lower side of the upper surface plate 14. A through hole penetrating the upper base 14A and the upper polishing pad 14B may be formed as a path through which the

polishing liquid 60 flows. The polishing liquid 60 of the present embodiment corresponds to the treatment liquid of the disclosure. The polishing liquid supply unit 30 of the present embodiment corresponds to the treatment liquid supply unit of the disclosure.

[0032] (First Supply System)

As shown in Fig. 2, the first supply system 41 has a first supply source 41A and a first pipe 41B. A first separation fluid (see a first separation fluid 71 in Fig. 4) which separates the disk-shaped substrate 50 from the upper surface plate 14 is stored in the first supply source 41A. The first pipe 41B is connected between the first supply source 41A and the first nozzle hole 21. The first supply source 41A includes a storage device such as a tank capable of storing the first separation fluid. In a case in which the first separation fluid is a combination of plural kinds of separation fluids whose respective supply start timings are different from each other, each separation fluid is stored in the storage device so as to be selectively usable without being mixed with the other separation fluids.

(Second Supply System)

The second supply system 42 has a second supply source 42A and a second pipe 42B. A second separation fluid (see a second separation fluid 72 in Fig. 4) which separates the carrier 52 from the upper surface plate 14 is stored in the second supply source 42A. The second pipe 42B is connected between the second supply source 42A and the second nozzle hole 22. Other configurations of the second supply source 42A are similar to those of the first supply source 41A, and thus redundant description will be omitted. The second supply system 42 is provided independently of the first supply system 41.

[0033] (Separation Fluid)

As the first separation fluid or the second separation fluid, a known liquid such as pure water or a known gas such as air can be adopted if appropriate. In the present embodiment, the type of the first separation fluid and the type of the second separation fluid are common, but the disclosure is not limited thereto, and the type of the first separation fluid and the type of the second separation fluid may be different from each other.

[0034] (Independent Arrangement of Supply Systems)

The first supply system 41 and the second supply system 42 of the present embodiment are supply systems independent of each other. Specifically, the first supply source 41A of the first supply system 41 and the second supply source 42A of the second supply system 42 are different, separate supply sources from each other. The first pipe 41B of the first supply system 41 and the second pipe 42B of the second supply system 42 are not connected to each other.

[0035] Here, that the respective supply systems are independent of each other includes both that the respective supply paths are not connected and that the respective supply sources are different from each other. In other words, that the respective supply systems in supply systems for plural separation fluids are not independent of each other includes at least one of the supply sources of the respective separation fluids being common or the supply paths of the respective separation fluids being connected to each other.

[0036] (Control Device)

In the present embodiment, as shown in Fig. 2, a control device 44 that causes the polishing apparatus to execute one or more treatments included in the polishing step is connected to the first supply system 41 and the second supply system 42. In the disclosure, one or more treatments included in the polishing step may be provided to the control device 44, for example, in the form of a program.

[0037] In the present embodiment, a case in which one control device 44 is connected to both the first supply system 41 and the second supply system 42 has been illustrated, but in the disclosure, the number of the control devices can be arbitrarily set to one or more, and, for example, one control device may be connected for each of the first supply system 41 and the second supply system 42. Regardless of the number of control devices provided in the apparatus for manufacturing a disk-shaped substrate 10, the first supply system 41 and the second supply system 42 can be configured independently of each other.

[0038] <Method of Manufacturing Disk-Shaped Substrate>

Next, a method of manufacturing a disk-shaped substrate using the apparatus for manufacturing a disk-shaped substrate 10 according to the present embodiment will be described with reference to Figs. 3 and 4. The method of manufacturing a disk-shaped substrate according to the present embodiment includes:

(A) a step of disposing the carrier 52 which accommodates the disk-shaped substrate 50 between the lower surface plate 12 and the upper surface plate 14;

(B) a step of sandwiching the disk-shaped substrate 50 between the lower surface plate 12 and the upper surface plate 14 and subjecting the disk-shaped substrate 50 to a polishing treatment while supplying the polishing liquid 60 between the lower surface plate 12 and the upper surface plate 14;

(C) a step of supplying a first separation fluid which separates the disk-shaped substrate 50 from the upper surface plate 14, between the upper surface plate 14 and the disk-shaped substrate 50, using the first supply system 41; and

(D) a step of supplying a second separation fluid which separates the carrier 52 from the upper surface plate 14, between the upper surface plate 14 and the carrier 52, using the second supply system 42 independent of the first supply system 41.

In the present embodiment, a case in which the method of manufacturing a disk-shaped substrate including the steps (A) to (D) is carried out by operating the control device 44 using a program for carrying out the method of manufacturing a disk-shaped substrate will be exemplarily described. In the disclosure, the method of manufacturing a disk-shaped substrate may be executed by an operator of the apparatus for manufacturing a disk-shaped substrate 10 operating the control device 44.

[0039] In the present embodiment, the method of manufacturing a disk-shaped substrate includes separation treatment for separating the disk-shaped substrate 50 from the upper surface plate 14 in the polishing step. In the disclosure, the method of manufacturing a disk-shaped substrate may be configured to include one or more other ordinarily known treatments necessary for manufacturing the disk-shaped substrate 50, according to the type of disk-shaped substrate.

[0040] For example, in the case of an aluminum substrate, the method of manufacturing a disk-shaped substrate includes the following steps.

Blank substrate preparation step: an aluminum alloy plate material having a thickness of about 2 mm or less is obtained by rolling an aluminum alloy ingot. An aluminum alloy substrate having desired dimensions is prepared by punching the obtained aluminum alloy plate material into a disk shape.

Cutting step: The prepared aluminum alloy substrate is subjected to chamfering of inner and outer diameters and cutting of both main surfaces.

Grinding step: In order to reduce surface roughness, waviness, and the like of the aluminum alloy substrate after cutting, both main surfaces of the aluminum alloy substrate are subjected to grinding using a grindstone.

Plating step: For the purpose of imparting surface hardness and suppressing surface defects to the substrate subjected to grinding, plating such as electroless nickel plating (NiP) is applied to the surface of the aluminum alloy substrate.

Polishing step: Both main surfaces of the aluminum alloy substrate on which a plating film has been formed are subjected to polishing.

[0041] In the case of a glass substrate, the method of manufacturing a disk-shaped substrate includes, for example, the following steps.

Blank substrate preparation step: A glass blank serving as a material for a plate-shaped glass substrate for a magnetic recording medium having a pair of main surfaces is produced by press molding. The glass blank is formed into an annular shape by forming a circular hole in a central portion of the produced glass blank. Next, a glass substrate having a chamfered surface is obtained by performing shape processing. A grinding step and a polishing step are performed on inner and outer peripheral end surfaces of the glass substrate subjected to shape processing.

Grinding step: A main surface of the glass substrate after end-surface polishing is subjected to grinding using fixed abrasive grains.

Polishing step: A main surface of the glass substrate after the grinding step is polished using a predetermined polishing agent. During the polishing step, chemical strengthening treatment may be performed on the glass substrate.

[0042] Details of the polishing step according to the present embodiment will be described below.

[Polishing Step]

In the polishing step, in a state in which the lower surface plate 12 and the upper surface plate 14 are in contact with the disk-shaped substrate 50, a surface of the disk-shaped substrate 50 is polished by the lower surface plate 12 and the upper surface plate 14 by rotating the disk-shaped substrate 50 while supplying the polishing liquid 60 between the lower surface plate 12 and the upper surface plate 14.

The polishing liquid used for polishing an aluminum substrate is not particularly limited as long as the polishing liquid is one that is ordinarily used, and examples of the polishing liquid include a slurry including, for example, aluminum oxide, colloidal silica, or the like. The polishing liquid used for polishing a glass substrate is not particularly limited as long as the polishing liquid is one that is ordinarily used, and examples of the polishing liquid include a slurry including, for example, cerium oxide, zirconia, colloidal silica, or the like.

[0043] Here, as shown in Fig. 3, after the disk-shaped substrate 50 is polished, the polished disk-shaped substrate 50 and the carrier 52 may adhere to the upper surface plate 14 via the polishing liquid 60, as a result of which there are cases in which the disk-shaped substrate 50 is not separated from the upper surface plate 14 even in a case in which the upper surface plate 14 is raised and a gap G is formed between the lower surface plate 12 and the upper surface plate 14. For this reason, the first separation fluid 71 is supplied between the upper surface plate 14 and the disk-shaped substrate 50 by the first supply system 41, from the outside via the first nozzle hole 21 provided in the upper surface plate 14, independently of the second supply

system 42. The second separation fluid 72 is supplied between the upper surface plate 14 and the carrier 52 by the second supply system 42, from the outside via the second nozzle hole 22 provided in the upper surface plate 14, independently of the first supply system 41.

[0044] In the disclosure, "supply" means that a supplied object reaches a target place as a result. For example, supply of the first separation fluid 71 means that the first separation fluid 71 reaches between the upper surface plate 14 and the disk-shaped substrate 50. Supply of the second separation fluid 72 means that the second separation fluid 72 reaches between the upper surface plate 14 and the carrier 52.

[0045] The timing at which the first supply system 41 starts applying a driving force to the first separation fluid 71 in order to supply the first separation fluid 71 may be before the start of raising of the upper surface plate 14 or after the start of the raising. The timing at which application of the driving force to the first separation fluid 71 is stopped may be before completion of the raising, in which the upper surface plate 14 reaches a preset height, or after completion of the raising.

[0046] The timing at which the second supply system 42 starts applying a driving force to the second separation fluid 72 in order to supply the second separation fluid 72 may be before the start of raising of the upper surface plate 14 or after the start of the raising. The timing at which application of the driving force to the second separation fluid 72 is stopped may be before completion of the raising, in which the upper surface plate 14 reaches a predetermined height, or after completion of the raising. In the disclosure, a case in which supply of the first separation fluid 71 and the second separation fluid 72 is performed without being accompanied by a treatment of raising the upper surface plate 14 is also not excluded.

[0047] (Combination of Two-Phase Separation Fluids)

In the present embodiment, each of the first separation fluid 71 and the second separation fluid 72 includes both a liquid that is fed first and a gas that is fed after the liquid. In the disclosure, both the first separation fluid 71 and the second separation fluid 72 need not include both a liquid that is fed first and a gas that is fed after the liquid, and at least one of the first separation fluid 71 or the second separation fluid 72 may include both a liquid that is fed first and a gas that is fed after the liquid.

In the disclosure, the "liquid that is fed first" means, in a combination of two-phase separation fluids including a liquid in a state in which the liquid is in contact with the polishing liquid 60 and a gas that applies pressure to the liquid, a liquid that is fed before the timing at which the gas that applies pressure to the liquid is fed. For this reason, the "liquid that is fed

first" is not limited to a liquid that is fed first after the start of treatment in a certain polishing treatment. For example, even in a case in which, after the start of a certain polishing treatment, after feeding of a separation fluid is performed one or more times, feeding of a liquid for bringing the liquid into contact with the polishing liquid 60 and feeding of a gas that follows the liquid and applies pressure to the liquid are performed, the fed liquid is the "liquid that is fed first" in the disclosure.

[0048] The step of supplying the first separation fluid 71 includes a treatment of feeding a liquid to bring the liquid into contact with the polishing liquid 60, and a treatment of feeding a gas after the liquid to apply pressure to the liquid in a state in which the liquid is in contact with the polishing liquid 60. That is, two-phase fluids forming the first separation fluid 71 are supplied in two stages in the order of liquid and gas.

Similarly, as the second separation fluid 72, two-phase fluids of a liquid and a gas are used in combination. The step of supplying the second separation fluid 72 includes a treatment of feeding a liquid to bring the liquid into contact with the polishing liquid 60, and a treatment of feeding a gas after the liquid to apply pressure to the liquid in a state in which the liquid is in contact with the polishing liquid 60. Two-phase fluids forming the second separation fluid 72 are also supplied in two stages in the order of liquid and gas.

In the disclosure, the step of supplying at least one of the first separation fluid 71 or the second separation fluid 72 need only include a treatment of feeding a liquid to bring the liquid into contact with the polishing liquid 60, and a treatment of feeding a gas after the liquid to apply pressure to the liquid in a state in which the liquid is in contact with the polishing liquid 60.

[0049] The liquid of the present embodiment can be selected if appropriate according to the contents of preceding and subsequent treatments, recycling of a treatment liquid used, and the like, and examples of the liquid include pure water, coolant, and the like. The gas of the present embodiment is, for example, air, but in the disclosure, the gas is not limited thereto, and another gas can be adopted if appropriate.

[0050] In a case in which the control device 44 is used, the control device 44 executes a treatment of supplying the first separation fluid 71 between the upper surface plate 14 and the disk-shaped substrate 50 by the first supply system 41, and a treatment of supplying the second separation fluid 72 between the upper surface plate 14 and the carrier 52 by the second supply system 42. The control device 44 controls at least one of the first supply system 41 or the second supply system 42 so that a treatment of feeding a liquid to bring the liquid into contact

with the polishing liquid 60, and a treatment of feeding a gas after the liquid to apply pressure to the liquid in a state in which the liquid is in contact with the polishing liquid 60 are executed.

[0051] In the present embodiment, in a case in which the disk-shaped substrate 50 and the carrier 52 are separated from the upper surface plate 14, the first separation fluid 71 and the second separation fluid 72 reach the corresponding first nozzle hole 21 and second nozzle hole 22, respectively, with a reduced time difference. In the disclosure, formation of a temporal gap between the timing at which the first separation fluid 71 reaches the first nozzle hole 21 and the timing at which the second separation fluid 72 reaches the second nozzle hole 22 is not excluded.

[0052] As shown in Fig. 4, by supplying the first separation fluid 71 and the second separation fluid 72 independently of each other, the polishing liquid 60 that causes the polished disk-shaped substrate 50 and the carrier 52 to adhere to the upper surface plate 14 is discharged through the discharge path D between the lower surface plate 12 and the external gear 18. As a result, both the disk-shaped substrate 50 and the carrier 52 are separated from the upper surface plate 14. Thereafter, the disk-shaped substrate 50 is taken out from inside the carrier 52 by a batch transfer apparatus not shown, and is transferred to a subsequent step.

[0053] In the disclosure, the polishing treatment may be performed plural times. In a case in which the polishing treatment is performed plural times, the types of the polishing liquid 60 used in the respective polishing treatments may be different from each other. For example, chemical strengthening treatment for the disk-shaped substrate 50 may be included between plural polishing treatments in order to improve impact resistance performance of the disk-shaped substrate 50. Then, a magnetic recording medium having desired specifications can be manufactured by performing predetermined steps such as cleaning, formation of a magnetic film, and cooling on the transferred disk-shaped substrate 50.

[0054] (Comparative Example)

Fig. 5 shows an apparatus for manufacturing a disk-shaped substrate 10Z according to a comparative example. In the manufacturing apparatus 10Z, members similar to those of the apparatus for manufacturing a disk-shaped substrate 10 according to the present embodiment are denoted by the same reference signs, and description thereof will be omitted.

The manufacturing apparatus 10Z includes a common supply system 43 that includes a common supply source 43A and a common pipe 43B and that supplies a separation fluid 73 to each of the first nozzle hole 21 facing the disk-shaped substrate 50 and the second nozzle hole 22 facing the carrier 52. As described above, in the manufacturing apparatus 10Z, the supply system for separation gas on the disk-shaped substrate 50 side and the supply system for

separation gas on the carrier 52 side are commonly used as one supply system, and are not independent of each other.

For this reason, in the comparative example, after polishing of the disk-shaped substrate 50, even in a case in which the separation fluid is supplied in a case in which the disk-shaped substrate 50 is not separated from the upper surface plate 14, the separation fluid supplied to the upper side of the disk-shaped substrate 50 tends to flow away toward the upper side of the carrier 52, where the space volume per unit area is large. As a result, the pressure of the separation fluid supplied to the upper side of the disk-shaped substrate 50 decreases. For this reason, the polishing liquid 60 accumulated in the portion above the disk-shaped substrate 50 is not sufficiently discharged, as a result of which there are cases in which the disk-shaped substrate 50 is not separated from the upper surface plate 14.

[0055] In contrast, in the present embodiment, the second separation fluid 72 which separates the carrier 52 is supplied between the upper surface plate 14 and the carrier 52 using the second supply system 42 independent of the first supply system 41 that supplies the first separation fluid 71 which separates the disk-shaped substrate 50. For this reason, flow of the separation fluid which separates the disk-shaped substrate 50 away toward the side of the portion above the carrier 52, that is, flow of the first separation fluid 71 to the upper side of the carrier 52, where the pressure loss is smaller than on the upper side of the disk-shaped substrate 50, can be suppressed. As a result, the separation fluid for discharging the polishing liquid 60 accumulated between the upper surface plate 14 and the disk-shaped substrate 50 can be supplied while suppressing a decrease in pressure. For this reason, in the present embodiment, the disk-shaped substrate 50 is easily separated from the upper surface plate 14.

In addition, in the present embodiment, since the first separation fluid 71 and the second separation fluid 72 are supplied independently of each other, in a case in which the upper surface plate 14 is raised, backflow of the first separation fluid 71 toward the first pipe 41B and the first supply source 41A via the first nozzle hole 21 is more easily suppressed than in the comparative example. Similarly, backflow of the second separation fluid 72 toward the second pipe 42B and the second supply source 42A via the second nozzle hole 22 is more easily suppressed than in the comparative example.

[0056] In addition, in the present embodiment, the disk-shaped substrate 50 can be separated using only the apparatus for manufacturing a disk-shaped substrate 10. For this reason, the present embodiment is particularly effective in an automated manufacturing line that does not use human labor.

[0057] In the present embodiment, since at least one of the first separation fluid 71 or the second separation fluid 72 includes both a liquid and a gas, drying of the polishing liquid 60 around the surface of the disk-shaped substrate 50 can be suppressed by the liquid. For this reason, dried polishing liquid 60 can be prevented from adhering to the surface and reducing flatness of the surface. However, this effect of the present embodiment is not limited to this reason. The disclosure is not limited to the present embodiment, and the first separation fluid and the second separation fluid may both be liquids or may both be gases within a range that does not impair the effects of the present embodiment.

[0058] In addition, in the present embodiment, discharge of the polishing liquid 60 together with the liquid is further promoted. The reason can be considered to be that, after the liquid is supplied, pressure is further applied by the gas to the liquid that has come into contact with the polishing liquid 60.

[0059] <Other Embodiments>

The disclosure has been described by the above-disclosed embodiments, but the discussions and drawings forming part of the disclosure should not be understood as limiting the disclosure.

[0060] For example, in the present embodiment, a case has been illustrated in which the carrier 52 is caused to undergo self-rotation and revolution using the external gear 18 and the sun gear 16, thereby collectively polishing plural disk-shaped substrates 50, but the disclosure is not limited thereto. In the disclosure, for example, while plural disk-shaped substrates are held in a state of protruding upward, a polishing plate may be brought into contact with surfaces of the disk-shaped substrates from above. Then, collective polishing of plural disk-shaped substrates may be performed by rotating the upper polishing plate. The polishing plate may undergo self-rotation and revolution without rotating the disk-shaped substrates.

[0061] (Grinding Apparatus)

In the present embodiment, the apparatus for manufacturing a disk-shaped substrate 10 has been described as a polishing apparatus, but in the disclosure, the apparatus is not limited thereto, and the manufacturing apparatus 10 may be a grinding apparatus. In the present embodiment, as the method of manufacturing a disk-shaped substrate, a method of manufacturing a polished disk-shaped substrate using a polishing apparatus as the manufacturing apparatus 10 has been illustrated, but in the disclosure, the method of manufacturing a disk-shaped substrate may be a method of manufacturing a ground disk-shaped substrate using a grinding apparatus as the manufacturing apparatus.

[0062] In a case in which the apparatus for manufacturing a disk-shaped substrate is a grinding apparatus, grindstones are applied to the lower polishing pad 12B in the lower surface plate 12 and the upper polishing pad 14B in the upper surface plate 14 of the manufacturing apparatus 10 in Fig. 2, respectively. At this time, the term "upper surface plate" and the term "lower surface plate" may each be used as a generic term including a grindstone.

In a grinding treatment in the grinding apparatus, the grinding treatment is performed by supplying, for example, a coolant as a treatment liquid instead of the polishing liquid 60. For this reason, the polishing liquid tank 30A, the polishing liquid pipe 30B, and the like in the present embodiment are read as a coolant tank, a coolant pipe, and the like, respectively, if appropriate. The treatment liquid in the grinding treatment is not limited to a coolant, and may be another liquid as long as the liquid is supplied between the upper surface plate and the lower surface plate.

[0063] In a case in which the manufacturing apparatus is a grinding apparatus, similarly to the present embodiment described above, the second separation fluid which separates the carrier is supplied between the upper surface plate and the carrier using the second supply system independent of the first supply system that supplies the first separation fluid which separates the disk-shaped substrate. For this reason, flow of the separation fluid which separates the disk-shaped substrate away toward the side of the portion above the carrier can be suppressed. As a result, the separation fluid for discharging the treatment liquid accumulated between the upper surface plate and the disk-shaped substrate can be supplied while suppressing a decrease in pressure. For this reason, similarly to the present embodiment described above, an advantage such as easy separation of the disk-shaped substrate from the upper surface plate is provided.

In addition, in a case in which the manufacturing apparatus is a grinding apparatus, similarly to the present embodiment described above, since the first separation fluid and the second separation fluid are supplied independently of each other, in a case in which the upper surface plate is raised, backflow of the first separation fluid toward the first pipe and the first supply source via the first nozzle hole is easily suppressed. Similarly, backflow of the second separation fluid toward the second pipe and the second supply source via the second nozzle hole is easily suppressed.

[0064] (Manufacturing Method)

The method of manufacturing a ground disk-shaped substrate according to the disclosure may include steps similar to the steps (A), (C), and (D) in the method of manufacturing a polished disk-shaped substrate according to the present embodiment, and a

step corresponding to (B) of the method of manufacturing a disk-shaped substrate according to the present embodiment, and specifically, may include the following steps in a grinding apparatus:

(A1) a step of disposing a carrier which accommodates a disk-shaped substrate between a lower surface plate and an upper surface plate;

(B1) a step of sandwiching the disk-shaped substrate between the lower surface plate and the upper surface plate and subjecting the disk-shaped substrate 50 to grinding treatment while supplying a treatment liquid between the lower surface plate and the upper surface plate;

(C1) a step of supplying a first separation fluid which separates the disk-shaped substrate from the upper surface plate, between the upper surface plate and the disk-shaped substrate, using a first supply system; and

(D1) a step of supplying a second separation fluid which separates the carrier from the upper surface plate, between the upper surface plate and the carrier, using a second supply system independent of the first supply system.

[0065] The method of manufacturing a polished disk-shaped substrate according to the present embodiment may include, as treatment steps in a grinding apparatus, the steps (A1), (B1), (C1), and (D1) in the method of manufacturing a ground disk-shaped substrate described above, and, as treatment steps in a polishing apparatus, as respective steps in the polishing apparatus, the steps (A), (B), (C), and (D) in the present embodiment.

As a result, a ground and polished disk-shaped substrate can be efficiently obtained while sequentially obtaining both the advantages of the method of manufacturing a ground disk-shaped substrate and the advantages of the method of manufacturing a polished disk-shaped substrate.

[0066] The disclosure includes various embodiments not described above, and the technical scope of the disclosure is defined by invention-specifying matters of the claims that are reasonable from the above description.

[0067] The disclosure of Japanese Patent Application No. 2024-050265 filed on March 26, 2024 is incorporated herein by reference in its entirety.

[0068] All publications, patent applications, and technical standards described in the present specification are incorporated herein by reference to the same extent as if each individual publication, patent application, and technical standard were specifically and individually indicated to be incorporated by reference.

Reference Signs List

[0069] 10, 10Z Apparatus for manufacturing disk-shaped substrate

12 Lower surface plate

12A Lower base

12B Lower polishing pad

14 Upper surface plate

14A Upper base

14B Upper polishing pad

16 Sun gear

18 External gear

21 First nozzle hole

22 Second nozzle hole

30 Polishing liquid supply unit

30A Polishing liquid tank

30B Polishing liquid pipe

41 First supply system

41A First supply source

41B First pipe

42 Second supply system

42A Second supply source

42B Second pipe

43 Common supply system

43A Common supply source

43B Common pipe

44 Control device

50 Disk-shaped substrate

52 Carrier

52A Accommodation hole

60 Polishing liquid

71 First separation fluid

72 Second separation fluid

73 Separation fluid

D Discharge path

G Gap