

SLURRY USED IN POLISHING A SUBSTRATE

5 BACKGROUND OF THE INVENTION

Field of the Invention

[0001]

The present invention relates to a carrier plate that is used when disc-shaped substrates suitably used as magnetic recording media for a magnetic recorder and reproducing devices such as hard disk drives are polished or ground, a method of
10 manufacturing disc-shaped substrates using the carrier plates, and a double-sided machining device that includes the carrier plates and machines both surfaces of disc-shaped substrates.

15 Description of Related Art

[0002]

In recent years, disc-shaped disk substrates have been actively manufactured with the increase in demand of recording media. An aluminum substrate and a glass substrate have been widely used as a magnetic disc substrate that is one of disk substrates.
20 An aluminum substrate is excellent in machinability and inexpensive, and a glass substrate is excellent in strength.

[0003]

In the past, the polishing or grinding of a disc-shaped substrate has been performed in a step of manufacturing disc-shaped substrates. As a method of polishing
25 (grinding) the disc-shaped substrate, there is a method that holds disc-shaped substrates

in substrate holding holes of carrier plates, interposes the carrier plates between a pair of upper and lower surface plates disposed so as to face each other, and machines the surfaces and backs of the disc-shaped substrates by making the pair of upper and lower surface plates and the carrier plates move relative to each other.

5 [0004]

For example, Japanese Unexamined Patent Application, First Publication No. 2000-280167 discloses a technique that receives plate-like objects to be machined in receiving holes of carrier plates and rotates the carrier plates between upper and lower surface plates while supplying polishing liquid to polish both surfaces of the objects to be
10 machined so that both the surfaces of the objects are made flat.

Further, Japanese Unexamined Patent Application, First Publication No. 2000-198064 discloses a technique that positions workpieces in workpiece holding holes of a carrier for a polishing machine and polishes upper and lower surfaces of the workpieces by abrasive grains contained in an abrasive supplied between the workpieces
15 and an upper or lower surface plate moving relative to the workpieces.

[0006]

However, in the related art, the polishing (grinding) speed on the upper and lower surfaces of the disc-shaped substrate is changed with time when both surfaces of a plurality of disc-shaped substrates are continuously polished (ground) by a method of
20 polishing (grinding) both surfaces of the disc-shaped substrates by interposing the carrier plates, which hold the disc-shaped substrates, between the pair of surface plates. For this reason, since a difference in polishing (grinding) depth between the upper and lower surfaces of the polished (ground) disc-shaped substrate is gradually increased, there is a problem in that a deviation in the quality of the polished (ground) disc-shaped substrate
25 is increased.

SUMMARY OF THE INVENTION

[0007]

The invention has been made to solve the above-mentioned problem, and uses a
5 method of polishing (grinding) both surfaces of disc-shaped substrates by interposing a
carrier plate, which holds the disc-shaped substrates, between a pair of upper and lower
surface plates.

According to this method, the change of the polishing (grinding) speed on the
upper and lower surfaces of the disc-shaped substrate does not easily occur even when
10 both surfaces of a plurality of disc-shaped substrates are continuously polished (ground).

An object of the invention is to provide a carrier plate that can suppress the
increase of a difference in polishing (grinding) depth between upper and lower surfaces
of a polished (ground) disc-shaped substrate in this way.

[0008]

15 Further, another object of the invention is to provide a method of manufacturing
disc-shaped substrates that can continuously manufacture a plurality of disc-shaped
substrates having a small deviation in quality by using the carrier plate of the invention
and is excellent in productivity, and a double-sided machining device for machining both
surfaces of disc-shaped substrates.

20 [0009]

In order to solve the problem, the present inventor has repeatedly performed the
following examination while focusing attention on the discharge of polishing (grinding)
liquid supplied to polished (ground) surfaces of disc-shaped substrates when carrier
plates holding the disc-shaped substrates are interposed between a pair of upper and
25 lower surface plates and both surfaces of the disc-shaped substrates are polished

(ground).

That is, after being used in polishing (grinding), polishing (grinding) liquid is mainly discharged to the outer peripheral portion of the lower surface plate together with polishing (grinding) waste. However, when both surfaces of a plurality of disc-shaped
5 substrates are continuously polished (ground), polishing (grinding) waste and polishing (grinding) liquid to be discharged gradually remain between the polished (ground) surfaces of the disc-shaped substrates and the lower surface plate.

[0010]

Since the polishing (grinding) waste and polishing (grinding) liquid, which have
10 remained, are moved downward by gravity, the polishing (grinding) speed on the lower surface of the disc-shaped substrate is changed and the surface of lower abrasive cloth or the lower surface plate is particularly worn out. As a result, it is found that a difference in polishing (grinding) depth between the upper and lower surfaces of the polished (ground) disc-shaped substrate is increased.

15 Accordingly, the present inventor has repeatedly performed diligent examination so that polishing (grinding) liquid having been used in polishing (grinding) and to be discharged and polishing (grinding) waste are stably discharged when both surfaces of disc-shaped substrates are polished (ground).

[0011]

20 As a result, it is found that it is preferable that strip-shaped blades function as scrapers wiping polishing (grinding) waste and polishing (grinding) liquid present on the surface plate when carrier plates, which include strip-shaped blades formed on at least one surface so as to protrude, are used as carrier plates and disc-shaped substrates are polished (ground).

25 If the carrier plates and the pair of upper and lower surface plates are moved

relative to each other during polishing (grinding) when the carrier plates including the strip-shaped blades are used, upper and lower surfaces of the disc-shaped substrates are polished (ground) and polishing (grinding) waste and polishing (grinding) liquid to be discharged are moved on the surfaces of the pair of upper and lower surface plates, which face the strip-shaped blades, by the strip-shaped blades.

[0012]

Accordingly, the discharge of polishing (grinding) waste and polishing (grinding) liquid from the surfaces of the pair of upper and lower surface plates facing the strip-shaped blades is promoted. For this reason, even when both surfaces of a plurality of disc-shaped substrates are continuously polished (ground), the remaining of polishing (grinding) waste and polishing (grinding) liquid which should be discharged is prevented. Therefore, a change in the polishing (grinding) speed on the upper and lower surfaces of the disc-shaped substrate is suppressed.

The invention relates to the following:

[0013]

(1) A carrier plate that is provided in a double-sided machining device polishing or grinding both upper and lower surfaces of disc-shaped substrates, the carrier plate comprising:

substrate holding holes that hold the disc-shaped substrates; and strip-shaped blades that are formed on at least one surface of the carrier plate so as to protrude from the surface.

[0014]

(2) The carrier plate according to (1), wherein the strip-shaped blades are formed on both upper and lower surfaces of the carrier plate.

(3) The carrier plate according to (1) or (2),
 wherein the carrier plate has a circular shape in plan views seen from sides
 facing the upper and lower surfaces of the carrier plate, and
 the strip-shaped blades extend in directions crossing a circumferential direction
 5 of the carrier plate in the plan view.

(4) The carrier plate according to (3),
 wherein the strip-shaped blades are formed of a plurality of strip-shaped
 portions that have the same shape in the plan view and are arranged at regular intervals in
 the circumferential direction.

10 [0015]

(5) A method of manufacturing disc-shaped substrates, the method comprising:
 a step of polishing or grinding both upper and lower surfaces of the disc-shaped
 substrates,

wherein the step of polishing or grinding both the upper and lower surfaces
 15 includes
 a step of holding the disc-shaped substrates in substrate holding holes
 provided in a carrier plate,

a step of disposing the disc-shaped substrates, which are held by the
 carrier plate, between a pair of upper and lower surface plates, and

20 a surface machining step of polishing or grinding both the upper and
 lower surfaces of the disc-shaped substrates by making the carrier plates and the pair of
 upper and lower surface plates move relative to each other while supplying polishing
 liquid or grinding liquid to the disc-shaped substrates, and moving polishing waste or
 grinding waste and the polishing liquid or the grinding liquid present on surfaces of the
 25 pair of upper and lower surface plates, which face strip-shaped blades formed on at least

one surface of the carrier plate so as to protrude from the surface, by the strip-shaped blades.

[0016]

(6) The method according to (5),

5 wherein a carrier plate of which both upper and lower surfaces are provided with the strip-shaped blades is used as the carrier plate.

(7) The method according to (5) or (6),

 wherein grinding surface plates are used as the pair of upper and lower surface plates, and

10 both the upper and lower surfaces of the disc-shaped substrates are ground while a coolant is supplied as the grinding liquid in the surface machining step.

(8) The method according to (5) or (6),

 wherein polishing surface plates are used as the pair of upper and lower surface plates, and

15 both the upper and lower surfaces of the disc-shaped substrates are polished while slurry containing an abrasive is supplied as the polishing liquid in the surface machining step.

[0017]

(9) A double-sided machining device for polishing or grinding both upper and

20 lower surfaces of disc-shaped substrates, the double-sided machining device comprising:

 a carrier plate that includes substrate holding holes holding the disc-shaped substrates and strip-shaped blades formed on at least one surface of the carrier plate so as to protrude from the surface;

 a pair of upper and lower surface plates that are disposed so as to face each other
25 with the carrier plate interposed therebetween;

supply means for supplying polishing liquid or grinding liquid to the disc-shaped substrates; and

drive means for making the carrier plate and the pair of upper and lower surface plates move relative to each other.

5 [0018]

The carrier plate of the invention includes strip-shaped blades that are formed on at least one surface of the carrier plate so as to protrude. Accordingly, when the disc-shaped substrates held by the carrier plates of the invention are disposed between the pair of upper and lower surface plates and the pair of upper and lower surface plates and the carrier plates move relative to each other to polish or grind both the upper and lower surfaces of the disc-shaped substrates, both the upper and lower surfaces of the disc-shaped substrates are polished (ground) and polishing (grinding) waste and polishing (grinding) liquid to be discharged are moved on the surfaces of the pair of upper and lower surface plates, which face the strip-shaped blades, by the function of the strip-shaped blades as scrapers that wipe polishing (grinding) waste and polishing (grinding) liquid present on the surface plates.

[0019]

Accordingly, the discharge of polishing (grinding) waste and polishing (grinding) liquid from the surfaces of the pair of upper and lower surface plates facing the strip-shaped blades is facilitated. For this reason, even when both surfaces of a plurality of disc-shaped substrates are continuously polished (ground), it is possible to prevent the polishing (grinding) waste and the polishing (grinding) liquid to be discharged remaining. Therefore, a change in the polishing (grinding) speed on the upper and lower surfaces of the disc-shaped substrate is suppressed.

25 Accordingly, the method of manufacturing disc-shaped substrates of the

invention using the carrier plates of the invention is a method that can continuously manufacture a plurality of disc-shaped substrates having a small deviation in quality and is excellent in productivity.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

FIG. 1 is a schematic perspective view showing an example of a double-sided machining device for machining both surfaces of disc-shaped substrates of the invention.

FIG. 2 is a schematic enlarged perspective view of a carrier plate of the double-sided machining device for machining both surfaces of disc-shaped substrates shown in FIG. 1.

FIG. 3 is a schematic perspective view showing another example of the carrier plate of the invention.

FIG. 4 is a schematic perspective view showing another example of the carrier plate of the invention.

FIG. 5 is a schematic perspective view showing another example of the carrier plate of the invention.

DETAILED DESCRIPTION OF THE INVENTION

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[0021]

An embodiment of the invention will be described in detail below with reference to the drawings.

The invention relates to a carrier plate that is applied when disc-shaped substrates forming magnetic recording media or the like for hard disk drives are polished (ground), a method of manufacturing disc-shaped substrates using the carrier plates, and

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a double-sided machining device that includes the carrier plates and machines both surfaces of disc-shaped substrates.

[0022]

Double-sided machining device

5 FIG. 1 is a schematic perspective view showing an example of a double-sided machining device for machining both surfaces of disc-shaped substrates of the invention. FIG. 2 is a schematic enlarged perspective view of a carrier plate of the double-sided machining device for machining both surfaces of disc-shaped substrates shown in FIG. 1. The double-sided machining device 60 shown in FIG. 1 is a double-sided polishing
10 device that polishes both upper and lower surfaces of disc-shaped substrates 10 or a double-sided grinding device that grinds both upper and lower surfaces of disc-shaped substrates 10.

[0023]

As shown in FIG. 1, the double-sided machining device 60 of this embodiment
15 includes carrier plates 30, a pair of lower and upper surface plates 21a and 21b that are disposed so as to face each other with the carrier plates 30 interposed therebetween, supply means (not shown) for supplying polishing liquid or grinding liquid to the disc-shaped substrates 10, and drive means (not shown) for making the carrier plates 30 and the pair of lower and upper surface plates 21a and 21b move relative to each other.

20 [0024]

The disc-shaped substrate 10 is used as a substrate such as a magnetic recording medium for a hard disk drive by the polishing and/or grinding of both upper and lower surfaces thereof. Examples of the disc-shaped substrate 10 include an aluminum alloy substrate or a glass substrate that is formed of a disc-shaped thin plate having an opening
25 portion at the center thereof. The aluminum alloy substrate may include a Ni-P plating

film that is formed on the surface thereof.

After this disc-shaped substrate 10 is polished and/or ground to be described below, layers forming a magnetic recording medium, such as a magnetic layer, a protective layer, and a lubricating film, are formed on the upper surface of the disc-shaped substrate 10, so that a magnetic recording medium is formed.

[0025]

The double-sided machining device 60 shown in FIG. 1 is provided with the pair of upper and lower surface plates (hereinafter, simply referred to as surface plates), which include the lower surface plate 21a and the upper surface plate 21b, as the surface plates. The disc-shaped substrates 10 are placed on the lower surface plate 21a. The upper surface plate 21b presses the disc-shaped substrates 10, which are placed on the lower surface plate 21a, from above to apply working pressure to the disc-shaped substrates 10.

[0026]

The surface plates 21a and 21b shown in FIG. 1 have a circular shape in a plan view seen from the carrier plates 30, and rotating shafts (central shafts) 46a and 46b, which are used to rotate the surface plates 21a and 21b, are formed at the central portions of the lower and upper surface plates 21a and 21b, respectively. The surface plates 21a and 21b shown in FIG. 1 are rotatable about the central shafts 46a and 46b, respectively. The rotational directions of the surface plates 21a and 21b are opposite to each other as shown in FIG. 1 by arrows.

[0027]

When the double-sided machining device 60 of this embodiment is used as a double-sided polishing device, polishing surface plates of which surfaces facing each other function as polishing surfaces are used as the surface plates 21a and 21b. For

example, surface plates including polishing pads, which are provided on the surfaces of the surface plates 21a and 21b facing each other (that is, the polishing surfaces) and polish the surfaces of the disc-shaped substrates 10, or the like are used as the polishing surface plates.

5 [0028]

The polishing pad can be determined according to the material of the disc-shaped substrate 10, a kind of slurry containing an abrasive used in polishing, the purpose of polishing, or the like. For example, when the disc-shaped substrate 10 is an aluminum alloy substrate that includes a Ni-P plating film formed on the surface thereof, 10 it is preferable that hard abrasive cloth made of urethane or suede-like soft abrasive cloth be used as the polishing pad.

Further, when the disc-shaped substrate 10 is formed of a glass substrate, it is preferable that, for example, suede-like soft abrasive cloth be used as the polishing pad.

[0029]

15 Furthermore, when the double-sided machining device 60 of this embodiment is used as a double-sided grinding device, grinding surface plates of which surfaces facing each other function as grinding surfaces are used as the surface plates 21a and 21b. The grinding surface plate can be determined according to the material of the disc-shaped substrate 10, the purpose of grinding, or the like. For example, when the disc-shaped 20 substrate 10 is a glass substrate, it is preferable that a grinding stone using abrasive grains made of alumina or diamond be used as the grinding surface plate.

[0030]

Further, as shown in FIG. 1, a ring-shaped recess 22 along a circumferential direction is formed on the surface of the lower surface plate 21a facing the upper surface 25 plate 21b. The recess 22 is to receive the carrier plates 30.

As shown in FIG. 1, a tooth portion 42 is formed on an outer wall surface portion of the recess 22. Further, a sun gear 44 is formed along an inner wall surface portion of the recess 22. The width of the recess 22 in the radial direction of the lower surface plate 21a is a dimension corresponding to the diameter of the carrier plate 30 as shown in FIG. 1.

[0031]

The carrier plates 30 are placed on the lower surface plate 21a and are disposed between the surface plates 21a and 21b as shown in FIG. 1. As shown in FIG. 1, the carrier plates 30 are received in the ring-shaped recess 22 which is formed on the surface of the lower surface plate 21a facing the upper surface plate 21b. In the double-sided machining device 60 shown in FIG. 1, five carrier plates 30 are received in the recess 22. Five carrier plates 30 are disposed between the surface plates 21a and 21b in the double-sided machining device 60 shown in FIG. 1, but the number of the carrier plates 30 disposed between the surface plates 21a and 21b is not particularly limited.

[0032]

As shown in FIG. 2, the carrier plate 30 has a circular shape in a plan view seen from a position that faces the upper surface or the lower surface of the carrier plate, and includes holes for holding substrate 34 and strip-shaped(belt-shaped) blades 36 that are formed of strip-shaped portions 36a formed on the upper and lower surfaces of the carrier plate 30 so as to protrude. In the carrier plate 30 shown in FIG. 2, the strip-shaped blades 36 formed on the upper surface and the strip-shaped blades 36 formed on the lower surface are symmetrical with respect to the middle of the carrier plate 30 in a thickness direction. Additionally, the strip-shaped blades 36 formed on the lower surface of the carrier plate 30 are not shown in FIG. 2 so that the disposition and shapes of the strip-shaped blades 36 of FIG. 2 are easily understood.

[0033]

The substrate holding hole 34 is to hold the disc-shaped substrate 10. The substrate holding hole 34 has a circular shape in a plan view seen from a position that faces the upper surface or the lower surface of the carrier plate 30, and a plurality of
5 substrate holding holes 34 are formed so as to pass through the carrier plate 30. Since the disc-shaped substrate 10 is installed in the substrate holding hole 34 when the disc-shaped substrate 10 is polished (ground), it is possible to stably polish (grind) the disc-shaped substrate 10 with a high accuracy. The number of the substrate holding
10 holes 34 is not particularly limited, and can be appropriately determined according to the thickness or strength of the carrier plate 30, the thickness of the disc-shaped substrate 10 to be held, or the like.

[0034]

The inner diameter of the substrate holding hole 34 is determined according to the diameter of the disc-shaped substrate 10 and is larger than the diameter of the
15 disc-shaped substrate 10 within a range where the disc-shaped substrate 10 is held. If the inner diameter of the substrate holding hole 34 is larger than the diameter of the disc-shaped substrate 10, as described above, it is possible to prevent extra stress from being applied to a part of the outer peripheral end of the disc-shaped substrate 10 when the disc-shaped substrate 10 is polished (ground). Accordingly, it is preferable that the
20 inner diameter of the substrate holding hole 34 be larger than the diameter of the disc-shaped substrate 10.

[0035]

The strip-shaped blades 36 shown in FIG. 2 have the same shape in a plan view seen from a position that faces the upper surface or the lower surface of the carrier plate
25 30 and are formed of four strip-shaped portions 36a that are arranged at regular intervals

in the circumferential direction. The number of the strip-shaped portions 36a is not particularly limited and may be in the range of 1 to 3 or may be 5 or more. Further, four strip-shaped portions 36a of the strip-shaped blades 36 shown in FIG. 2 have the same shape, but part or all of the plurality of strip-shaped portions may have different shapes.

5 [0036]

As shown in FIG. 2, each of the strip-shaped portions 36a has the shape of a line extending in a direction crossing the circumferential direction of the carrier plate 30 in a plan view seen from a position that faces the upper surface or the lower surface of the carrier plate 30 and is disposed between the substrate holding holes 34 adjacent to each other. If the strip-shaped portions 36a extend in the directions crossing the circumferential direction of the carrier plate 30 in the plan view, the strip-shaped blades 36 effectively function as scrapers, which wipe polishing (grinding) waste and polishing (grinding) liquid present on the surface plates 21a and 21b, as compared to a case where the strip-shaped portions 36a extend in the circumferential direction of the carrier plate 30.

10 15

[0037]

The extending direction of each of the strip-shaped portions 36a is inclined with respect to the radial direction of the carrier plate 30 at a predetermined angle as shown in FIG. 2. The strip-shaped portions 36a extend in the directions crossing the circumferential direction of the carrier plate 30, and the strip-shaped blades 36 effectively function as scrapers, which wipe polishing (grinding) waste and polishing (grinding) liquid present on the surface plates, when the extending directions of the strip-shaped portions 36a are inclined with respect to the radial direction of the carrier plate 30.

20

[0038]

25 In order to make the strip-shaped blade 36 more effectively function as a scraper,

the inclination of the extending direction of the strip-shaped portion 36a with respect to the radial direction of the carrier plate 30, that is, an angle θ , which is close to the outer peripheral side of the carrier plate 30, of angles formed between the extending direction of the strip-shaped portion 36a and the radial direction of the carrier plate 30 is preferably
5 in the range of 0 to 80°, and more preferably in the range of 1 to 45°.

[0039]

As described below, the carrier plate 30 is rotatable about a central axis 37 of the carrier plate 30 in a direction that is shown by an arrow of FIG. 2. It is preferable that the inclination of the extending direction of the strip-shaped portion 36a with respect to
10 the radial direction of the carrier plate 30 be determined according to the rotational direction of the carrier plate 30.

In the carrier plate 30 shown in FIG. 2, an end portion 3a of the strip-shaped portion 36a, which is close to the center, is disposed on the front side of an end portion 3b of the strip-shaped portion 36a, which is close to the outer peripheral end, in the
15 rotational direction of the carrier plate 30 with respect to the radial direction of the carrier plate 30.

[0040]

According to this structure, when both the upper and lower surfaces of the disc-shaped substrates 10 are polished (ground) while the carrier plate 30 is rotated about
20 the central axis 37 of the carrier plate 30 by using drive means, the strip-shaped blades 36 effectively wipe polishing (grinding) waste and polishing (grinding) liquid, which are present on the surface plates 21a and 21b, toward the outer periphery of the carrier plate 30.

As a result, the carrier plate 30 shown in FIG. 2 can further facilitate the
25 discharge of polishing (grinding) waste and polishing (grinding) liquid from the surface

plates 21a and 21b as compared to, for example, a case where the rotational direction of the carrier plate 30 is opposite to the direction shown in FIG. 2.

[0041]

The width, thickness, length, planar shape, and the like of the strip-shaped portion 36a of the strip-shaped blade 36 can be appropriately determined according to the size or the like of the carrier plate 30.

It is preferable that the width of the strip-shaped blade 36 (strip-shaped portion 36a) be in the range of, for example, 2 to 10 mm. When the width of the strip-shaped blade 36 is 2 mm or more, the strip-shaped blade 36 has strength enough to function as a scraper. Further, when the width of the strip-shaped blade 36 is 10 mm or less, it is possible to easily dispose the strip-shaped blade 36 between the substrate holding holes 34 adjacent to each other even though a plurality of substrate holding holes 34 are densely disposed.

[0042]

Furthermore, the thickness of the strip-shaped blade 36 (strip-shaped portion 36a) (the height from the surface of the carrier plate 30) can be appropriately selected according to the thickness of the disc-shaped substrate 10 that is an object to be machined, the thickness of the carrier plate 30, or the like. The thickness of the strip-shaped blade 36 is not particularly limited, but it is preferable that the thickness of the strip-shaped blade 36 be in the range of 0.2 to 2 mm. When the thickness of the strip-shaped blade 36 is 0.2 mm or more, the strip-shaped blade 36 more effectively functions as a scraper. Accordingly, it is possible to further facilitate the discharge of polishing (grinding) waste and polishing (grinding) liquid from the surface plates. When the thickness of the strip-shaped blade 36 is 0.2 mm or more, polishing (grinding) liquid to be discharged, abrasive grains used in polishing (grinding), and polishing

(grinding) waste are not easily accumulated on a tooth portion 35 that is formed on the outer peripheral portion of the carrier plate 30.

Moreover, it is preferable that the thickness of the strip-shaped blade 36 be 2 mm or more in terms of the ease of mounting the strip-shaped blade 36 on the carrier plate 30.

[0043]

Further, the sum of the thickness of the carrier plate 30 and the thickness of the strip-shaped blade 36 (strip-shaped portion 36a) is equal to or smaller than the thickness of the polished (ground) disc-shaped substrate 10, and it is preferable that a difference between the sum and the thickness of the polished (ground) disc-shaped substrate 10 be in the range of 0.2 to 1 mm. When the difference in thickness is 0.2 mm or more, it is possible to prevent a problem that is caused in the polishing (grinding) of the disc-shaped substrate 10 by the contact between the strip-shaped blade 36 and the surface plates 21a and 21b during the polishing (grinding) of the disc-shaped substrate 10. Furthermore, when the difference in thickness is 1 mm or less, the difference in thickness is sufficiently small. Accordingly, the strip-shaped blade 36 can more effectively function as a scraper, so that it is possible to further facilitate the discharge of polishing (grinding) waste and polishing (grinding) liquid from the surface plates 21a and 21b.

[0044]

In the carrier plate 30 shown in FIG. 2, the strip-shaped blades 36 are formed on the upper and lower surfaces of the carrier plate 30. However, the strip-shaped blades 36 may be formed on at least one surface of the carrier plate 30, may be formed only on the upper surface of the carrier plate 30, and may be formed only on the lower surface of the carrier plate 30. When the strip-shaped blades 36 are formed on both the upper and lower surfaces of the carrier plate 30, the discharge of polishing (grinding) waste and

polishing (grinding) liquid from the surface plates 21a and 21b is facilitated.

Accordingly, it is possible to effectively prevent polishing (grinding) waste and polishing (grinding) liquid, which are to be discharged, from remaining.

[0045]

5 In addition, when the strip-shaped blades 36 are formed only on one surface of the carrier plate 30, it is preferable that the strip-shaped blades 36 be formed only on the lower surface of the carrier plate 30 since the discharge of polishing (grinding) waste and polishing (grinding) liquid from the lower surface plate 21a can be effectively facilitated. The reason for this is that polishing (grinding) liquid and polishing (grinding) waste used
10 in polishing (grinding) are apt to be accumulated on the lower surface plate 21a due to the effect of gravity.

The material of the carrier plate 30 is not particularly limited. However, an epoxy resin or the like, which is reinforced by the mixture of, for example, aramid fiber or glass fiber, may be used as the material of the carrier plate 30. Further, it is
15 preferable that the strip-shaped blades 36 and the carrier plate 30 be integrally formed with each other using the same material at the same time.

[0046]

As shown in FIGS. 1 and 2, the tooth portion 35 is formed on the outer peripheral portion of the carrier plate 30. As shown in FIG. 1, the tooth portions 35 of
20 the carrier plates 30 received in the ring-shaped recess 22 of the lower surface plate 21a mesh with the tooth portion 42 on the outer wall surface portion of the recess 22. Further, the tooth portions 35 mesh with the sun gear 44 on the inner wall surface portion of the recess 22.

Accordingly, when both surfaces of the disc-shaped substrates 10 are polished
25 (ground), the carrier plate 30 shown in FIG. 2 performs a planetary motion, that is,

revolves around the central shafts 46a and 46b of the lower and upper surface plates 21a and 21b while rotating about the central axis 37 of the carrier plate 30 by drive means. Furthermore, the rotational direction of the carrier plate 30 shown in FIG. 1 is the same as the rotational direction of the lower surface plate 21a and is opposite to the rotational direction of the upper surface plate 21b.

[0047]

The shape of the strip-shaped blade 36 can be appropriately determined according to the number and density of the substrate holding holes 34 formed in the carrier plate 30 and is not limited to the shape shown in FIG. 2. For example, the shape of the strip-shaped blade may be the shape shown in each of FIGS. 3 to 5.

FIGS. 3 to 5 are schematic perspective views showing other examples of the carrier plate of the invention. In addition, an arrow shown in each of FIGS. 3 to 5 represents a rotational direction when the carrier plate is rotated about the central axis 37 of the carrier plate.

[0048]

Strip-shaped blades of a carrier plate 31 shown in FIG. 3 have the same shape in a plan view seen from a position that faces the upper surface or the lower surface of the carrier plate 31 and are formed of three strip-shaped portions 36b that are arranged at regular intervals in the circumferential direction of the carrier plate 31. Each of the strip-shaped portions 36b has the shape of a line extending in the radial direction of the carrier plate 31 and is disposed between substrate holding holes 34 adjacent to each other.

In the invention, the extending direction of the strip-shaped portion 36a may be inclined with respect to the radial direction of the carrier plate 30 at a predetermined angle as in the carrier plate 30 shown in FIG. 2 and the extending direction of the

strip-shaped portion 36a may be the radial direction of the carrier plate 31 as in the carrier plate 31 shown in FIG. 3.

In the invention, polishing (grinding) waste and polishing (grinding) liquid, which are present on the surface plate and are to be discharged, are moved to the outer
5 peripheral side of the carrier plate by a centrifugal force that is caused by the rotation of the carrier plate. For this purpose, the extending direction of the strip-shaped portion may be the radial direction of the carrier plate 31 as shown in FIG. 3 (the angle θ close to the outer peripheral side of the carrier plate 30 in FIG. 2 may be 0°).

[0049]

10 Strip-shaped blades of a carrier plate 32 shown in FIG. 4 have the same shape in a plan view seen from a position that faces the upper surface or the lower surface of the carrier plate 32, and are formed of three strip-shaped portions 36c that are arranged at regular intervals in the circumferential direction of the carrier plate 32. Similar to the strip-shaped portion 36a shown in FIG. 2, each of the strip-shaped portions 36c extends
15 in a direction crossing the circumferential direction of the carrier plate 32 in a plan view, the extending direction of the strip-shaped portion 36c has the shape of a line inclined with respect to the radial direction of the carrier plate 32, and each of the strip-shaped portions 36c is disposed between substrate holding holes 34 adjacent to each other.

[0050]

20 A carrier plate 33 shown in FIG. 5 includes three strip-shaped portions 36d that have the same shape in a plan view seen from a position facing the upper surface or the lower surface of the carrier plate 33 and are arranged at regular intervals in the circumferential direction. Each of the strip-shaped portions 36d has the shape of a curve that is convex in the rotational direction of the carrier plate 33 and has a
25 substantially C shape in a plan view, extends in a direction crossing the circumferential

direction, and is disposed between substrate holding holes 34 adjacent to each other.

In the carrier plate 33 shown in FIG. 5, an end portion 3d of the strip-shaped portion 36d, which is close to the outer peripheral side, is disposed on the front side of an end portion 3c of the strip-shaped portion 36d, which is close to the center, in the rotational direction of the carrier plate 33 with respect to the radial direction of the carrier plate 33.

[0051]

In the carrier plate 33 shown in FIG. 5, the strip-shaped portions 36d has the shape of a curve that is convex in the rotational direction of the carrier plate 33 and has a substantially C shape in a plan view. For this reason, when both upper and lower surfaces of the disc-shaped substrates 10 are polished (ground) while the carrier plate 33 is rotated about the central axis 37 of the carrier plate 33 by drive means, polishing (grinding) waste and polishing (grinding) liquid present on the surface plates 21a and 21b can be effectively wiped toward the outer periphery of the carrier plate 33 without being accumulated at portions, which are curved in a C shape, of the strip-shaped blades 36d. Accordingly, the carrier plate 33 shown in FIG. 5 can facilitate the discharge of polishing (grinding) waste and polishing (grinding) liquid from the surface plates 21a and 21b as compared to, for example, a case where the rotational direction is opposite to the direction shown in FIG. 5.

20 [0052]

As long as supply means can supply polishing liquid or grinding liquid to the disc-shaped substrates 10, any kind of supply means may be used as supply means for supplying polishing liquid or grinding liquid. The supply means may be provided in, for example, the upper surface plate 21b and include supply ports through which polishing liquid or grinding liquid is supplied at a predetermined flow rate.

The polishing liquid or grinding liquid can be appropriately determined according to the material of the disc-shaped substrate 10, the purpose of polishing (grinding), or the like. For example, slurry containing an abrasive may be used as the polishing liquid.

5 Further, a coolant may be used as the grinding liquid.

[0053]

Furthermore, the drive means is to make the carrier plates 30 and the pair of lower and upper surface plates 21a and 21b move relative to each other. In the double-sided machining device 60 shown in FIG. 1, the drive means makes the carrier
10 plates 30 perform a planetary motion by rotating the surface plates 21a and 21b about the central shafts 46a and 46b of the surface plates 21a and 21b in opposite directions, respectively, and rotating carrier plates 30 about the central axes 37 of the carrier plates 30.

[0054]

15 Method of manufacturing disc-shaped substrate

Next, a method of manufacturing the disc-shaped substrates of the invention will be described using a case where both upper and lower surfaces of a plurality of disc-shaped substrates 10 for magnetic recording media are continuously polished or ground using the double-sided machining device 60 for machining both surfaces of
20 disc-shaped substrates that is shown in FIG. 1 and includes the carrier plates 30 of the invention shown in FIG. 2.

[0055]

When both surfaces of the disc-shaped substrates 10 are ground or polished using the double-sided machining device 60 that is shown in FIG. 1 and includes the
25 carrier plates 30 shown in FIG. 2, first of all, the carrier plates 30 are received in the

ring-shaped recess 22 of the lower surface plate 21a. Accordingly, as shown in FIG. 1, the tooth portions 35 of the carrier plates 30 mesh with the tooth portion 42 on the outer wall surface portion of the recess 22 and mesh with the sun gear 44 on the inner wall surface portion of the recess 22.

5 [0056]

After that, the disc-shaped substrates 10 are placed in the substrate holding holes 34 formed in the carrier plates 30 and the disc-shaped substrates 10 are held by the carrier plates 30. Subsequently, the upper surface plate 21b is placed on the lower surface plate 21a on which the carrier plates 30 holding the disc-shaped substrates 10 are received. Accordingly, the disc-shaped substrates 10, which are held by the carrier plates 30, are disposed between the pair of lower and upper surface plates 21a and 21b.

[0057]

After that, while polishing liquid or grinding liquid is supplied to the ground surfaces or the polished surfaces of the disc-shaped substrates 10 from the supply ports of the supply means provided in, for example, the upper surface plate 21b at a predetermined flow rate, the carrier plates 30 and the surface plates 21a and 21b are moved relative to each other by the drive means.

Accordingly, both the upper and lower surfaces of the disc-shaped substrates 10 are polished (ground) and polishing waste or grinding waste and polishing liquid or grinding liquid, which are present on the surfaces of the surface plates 21a and 21b facing the strip-shaped blades 36, are moved by the strip-shaped blades 36 that are formed on the upper and lower surfaces of the carrier plates 30 so as to protrude (surface machining step).

[0058]

25 In the surface machining step of this embodiment, the drive means makes the

carrier plates 30 perform a planetary motion by rotating the pair of lower and upper surface plates 21a and 21b about the central shafts 46a and 46b, respectively, and revolving the carrier plates 30 around the central shafts 46a and 46b of the pair of lower and upper surface plates 21a and 21b while rotating the carrier plates 30 about the central axes 37. Specifically, the drive means rotates the carrier plates 30 and the lower surface plate 21a in the same direction and rotates the upper surface plate 21b in the direction opposite to the rotational directions of the carrier plates 30 and the lower surface plate 21a.

According to the method of manufacturing the disc-shaped substrates of this embodiment, the drive means makes the carrier plates 30 perform a planetary motion in the surface machining step. Accordingly, the disc-shaped substrates 10 placed in the substrate holding holes 34 of the carrier plates 30 also perform a planetary motion, so that the disc-shaped substrates 10 can be rapidly polished or ground with a high accuracy.

[0059]

In the method of manufacturing the disc-shaped substrates of this embodiment, carrier plates including the strip-shaped blades 36 on both upper and lower surfaces thereof are used as the carrier plates 30. For this reason, in the surface machining step, both the upper and lower surfaces of the disc-shaped substrates 10 are polished (ground) and it is possible to move polishing (grinding) waste to be discharged, abrasive grains used in polishing (grinding), and polishing (grinding) liquid on the surfaces of the lower and upper surface plates 21a and 21b, which face the strip-shaped blades 36, by the function of the strip-shaped blades 36 as scrapers.

[0060]

Accordingly, in the surface machining step of this embodiment, polishing (grinding) liquid having been used in polishing (grinding) and to be discharged, abrasive

grains used in polishing (grinding), and polishing (grinding) waste are mainly and stably discharged to the outer peripheral portion of the lower surface plate 21a by the sweeping operation of the strip-shaped blades 36 as scrapers that is obtained from the rotation and revolution of the carrier plates 30, a centrifugal force that is generated by the rotation of the surface plates 21a and 21b, and gravity.

[0061]

In contrast, for example, when a surface machining step is continuously performed in the same manner as this embodiment by using carrier plates that do not include strip-shaped blades, polishing (grinding) waste and polishing (grinding) liquid to be discharged remain between the polished (ground) surfaces of the disc-shaped substrates 10 and the lower surface plate 21a as described below.

That is, when the carrier plates without strip-shaped blades are used, the sweeping operation for sweeping polishing (grinding) liquid, which is obtained from the rotation and revolution of the carrier plates in the surface machining step, is obtained by tooth portions formed on the outer peripheral portions of the carrier plates (which correspond to reference numeral 35 of the carrier plate 30 shown in FIG. 2).

[0062]

Since the tooth portions of the carrier plates have a complicated uneven shape, used polishing (grinding) liquid to be discharged, polishing (grinding) waste, and abrasive grains used in polishing (grinding) are gradually accumulated on the tooth portions when the surface machining step is continuously performed. Polishing (grinding) liquid, polishing (grinding) waste, and abrasive grains, which are accumulated on the tooth portions, inhibit the discharge of polishing (grinding) liquid, polishing (grinding) waste, and abrasive grains to the outer peripheral portion of the lower surface plate 21a. For this reason, when polishing (grinding) is continuously performed, the

sweeping operation of the carrier plates gradually deteriorates. As a result, polishing (grinding) liquid to be discharged, polishing (grinding) waste, and abrasive grains used in polishing (grinding) remain between the polished (ground) surfaces of the disc-shaped substrates 10 and the lower surface plate 21a. Polishing (grinding) liquid, polishing (grinding) waste, and abrasive grains used in polishing (grinding), which remain, cause a polishing (grinding) speed to change and cause the surface of the lower surface plate 21a to wear out. For this reason, when a surface machining step is continuously performed using carrier plates that do not include strip-shaped blades, a difference in polishing (grinding) speed is apt to occur between the upper and lower surfaces of the disc-shaped substrate 10. Accordingly, a difference in polishing (grinding) depth between the upper and lower surfaces of the polished (ground) disc-shaped substrate is apt to increase.

[0063]

In contrast, in the method of manufacturing the disc-shaped substrates of this embodiment, the discharge of polishing (grinding) liquid, abrasive grains used in polishing (grinding), and polishing (grinding) waste from the surfaces of the lower and upper surface plates 21a and 21b facing the strip-shaped blades 36 is facilitated in the surface machining step by the sweeping operation of the strip-shaped blades 36 as scrapers that is obtained from the rotation and revolution of the carrier plates 30.

[0064]

Further, since the strip-shaped blades 36 are formed on both the upper and lower surfaces of the carrier plates 30 so as to protrude, the tooth portions 35 of the carrier plates 30 do not come into contact with the lower and upper surface plates 21a and 21b. Accordingly, even though the carrier plates 30 rotate and revolve, polishing (grinding) liquid to be discharged, abrasive grains used in polishing (grinding), and polishing (grinding) waste are not easily accumulated on the tooth portions 35 that are formed on

the outer peripheral portions of the carrier plates 30. For this reason, it is also possible to prevent the discharge of polishing (grinding) liquid, abrasive grains used in polishing (grinding), and polishing (grinding) waste to the outer peripheral portion of the lower surface plate 21a from being inhibited by the polishing (grinding) liquid, the abrasive grains used in polishing (grinding), and the polishing (grinding) waste that are accumulated on the tooth portions 35.

[0065]

Therefore, according to the method of manufacturing the disc-shaped substrates of this embodiment, a change in the polishing (grinding) speed on the upper and lower surfaces of the disc-shaped substrate 10 is suppressed even when the both surfaces of the plurality of disc-shaped substrates 10 are continuously polished (ground). Accordingly, according to the method of manufacturing the disc-shaped substrates of this embodiment, it is possible to continuously manufacture a plurality of disc-shaped substrates 10 having a small deviation in quality, so that excellent productivity is obtained.

15 [0066]

Next, a method of manufacturing disc-shaped substrates, which includes a step of continuously polishing both upper and lower surfaces of the disc-shaped substrates 10 including Ni-P plating films formed on the surfaces of aluminum alloy substrates by using the double-sided machining device 60 including the carrier plates 30 of this embodiment as a double-sided polishing device, will be described in detail.

In the step of polishing both upper and lower surfaces of the disc-shaped substrates 10, it is preferable that both the upper and lower surfaces of the disc-shaped substrates 10 be polished by using polishing surface plates as the pair of lower and upper surface plates 21a and 21b while slurry containing an abrasive is supplied as polishing liquid in the surface machining step.

[0067]

It is preferable that surface plates where polishing pads made of hard abrasive cloth made of urethane or suede-like soft abrasive cloth are provided on the surfaces, which face each other, of the lower and upper surface plates 21a and 21b, that is, the
5 polishing surfaces be used as the polishing surface plates.

A material, in which abrasive grains made of alumina or colloidal silica and serving as an abrasive are dispersed in a well-known solvent, such as water, methanol, ethanol, propanol, isopropanol, or butanol, and which is made into slurry, may be used as the slurry that contains abrasive and is supplied to both the upper and lower surfaces of
10 the disc-shaped substrates 10. Well-known additives, such as an oxidizing agent, a surface-active agent, a dispersing agent, and a rust-preventive agent, may be added to the slurry containing an abrasive, as necessary.

[0068]

The concentration of the abrasive grains contained in the slurry containing an
15 abrasive (slurry concentration) is preferably in the range of 1 to 50 mass%, more preferably in the range of 3 to 40 mass%, and still more preferably in the range of 5 to 10 mass%. When the slurry concentration is lower than 1 mass%, it is difficult to obtain sufficient polishing performance. In addition, when the slurry concentration exceeds 50 mass%, the viscosity of the slurry containing an abrasive is increased and fluidity
20 deteriorates. For this reason, there is a concern that the surfaces of the polished disc-shaped substrates 10 are roughened, and economical efficiency is lowered due to the excessive use of abrasive grains.

[0069]

In this embodiment, it is preferable that two polishing steps using separate
25 polishing surface plates be performed as the step of polishing the disc-shaped substrate

10. In addition, the separate polishing surface plates mean that common polishing surface plates are not used in the two polishing steps, and polishing surface plates used in the two polishing steps may be the same polishing surface plates or may be different polishing surface plates.

5 When two or more polishing steps using separate polishing surface plates are performed as the step of polishing the disc-shaped substrates 10, it is possible to improve productivity and to obtain high-quality disc-shaped substrates 10 having much less damage and smooth surfaces after polishing as compared to a case where only one polishing step is performed as the step of polishing the disc-shaped substrates 10.

10 [0070]

In this embodiment, two polishing steps will be described using a case where a rough polishing step and a finish polishing step are performed.

Rough polishing step

15 The rough polishing step is performed using the method of manufacturing the disc-shaped substrates of this embodiment that uses the double-sided machining device 60 of this embodiment as a double-sided polishing device.

20 Specifically, it is preferable that the rough polishing step be a step of polishing both the upper and lower surfaces of the disc-shaped substrates 10 by a first polishing surface plate while supplying slurry containing alumina abrasive grains as an abrasive in the surface machining step.

After the rough polishing step, the polished disc-shaped substrates 10 are washed. After that, the finish polishing step is performed.

[0071]

Finish polishing step

25 The finish polishing step is performed by the method of manufacturing the

disc-shaped substrates of this embodiment that uses the double-sided machining device 60 of this embodiment as a double-sided polishing device.

Specifically, it is preferable that the finish polishing step be a step of polishing both the upper and lower surfaces of the disc-shaped substrates 10 by a second polishing surface plate while supplying slurry containing colloidal silica abrasive grains as an
5 abrasive in the surface machining step.

[0072]

In the finish polishing step, it is preferable that 50% cumulative average diameter (D50) in terms of volume of colloidal silica abrasive grains used as an abrasive
10 be in the range of 5 to 180 nm. It is possible to effectively remove damages to the surface of the disc-shaped substrate 10 in the finish polishing step by using this abrasive, so that the disc-shaped substrates 10 having higher smoothness are obtained.

[0073]

The rough polishing step and the finish polishing step are performed by the
15 method of manufacturing the disc-shaped substrates of this embodiment that uses the double-sided machining device 60 including the carrier plates 30 of this embodiment as a double-sided polishing device. For this reason, the change of the polishing speed on the upper and lower surfaces of the disc-shaped substrate 10 is suppressed by the function of the strip-shaped blades as scrapers that wipe polishing waste present on the surface plates
20 21a and 21b and slurry containing abrasive grains. Accordingly, according to the method of manufacturing the disc-shaped substrates of this embodiment, it is possible to continuously manufacture a plurality of disc-shaped substrates 10 that include Ni-P plating films formed on surfaces of aluminum alloy substrates and have a small deviation in quality, so that excellent productivity is obtained.

25

[0074]

Next, a method of manufacturing disc-shaped substrates, which includes a step of continuously grinding both upper and lower surfaces of the disc-shaped substrates 10 formed of glass substrates by using the double-sided machining device 60 including the carrier plates 30 of this embodiment as a double-sided grinding device and a step of
5 continuously polishing both the upper and lower surfaces of the disc-shaped substrates 10 formed of glass substrates by using the double-sided machining device 60 of this embodiment as a double-sided polishing device, will be described.

[0075]

In the step of grinding both the upper and lower surfaces of the disc-shaped
10 substrates 10, it is preferable that both the upper and lower surfaces of the disc-shaped substrates 10 be ground by using grinding surface plates as the pair of lower and upper surface plates 21a and 21b while a coolant is supplied as grinding liquid in the surface machining step.

In this embodiment, a primary grinding step, an inner-outer periphery grinding
15 step, an inner periphery polishing step, a secondary grinding step, an outer periphery polishing step, a primary polishing step, a secondary polishing step, and a final washing/inspecting step are performed on the disc-shaped substrates 10, which are formed of glass substrates, in this order.

[0076]

20 Primary grinding step

The primary grinding step is performed by the method of manufacturing the disc-shaped substrates of this embodiment that uses the double-sided machining device 60 of this embodiment as a double-sided grinding device.

The primary grinding step is a step of grinding the surfaces of the disc-shaped
25 substrates 10 formed of glass substrates so as to make the surfaces of the disc-shaped

substrates 10 smooth. In the primary grinding step, it is preferable that a grinding stone containing abrasive grains made of alumina or diamond be used as the grinding surface plate and water be used as the coolant.

[0077]

5 Inner-outer periphery grinding step

The inner-outer periphery grinding step is a step of roughly grinding the inner and outer peripheral end surfaces of the disc-shaped substrates 10 formed of glass substrates.

A device, which includes inner and outer peripheral grinding stones and grinds
10 the inner and outer peripheral end surfaces of the disc-shaped substrates 10 by rotating a laminated body in which a plurality of disc-shaped substrates 10 are laminated with spacers interposed therebetween so that central holes correspond to each other about an axis, is used in the inner-outer periphery grinding step. Grinding stones, which are formed by fixing, for example, diamond abrasive grains by a binder, may be used as the
15 inner and outer peripheral grinding stones.

[0078]

Inner periphery polishing step

The inner periphery polishing step is a step of polishing the inner peripheral end surfaces of the disc-shaped substrates 10, which have been subjected to the inner-outer
20 periphery grinding step, so as to make the inner peripheral end surfaces of the disc-shaped substrates 10 smooth. Examples of the inner periphery polishing step include a step of rotating a brush in an opening portion of the disc-shaped substrate 10 at a high speed while making polishing liquid flow into the opening portion. It is preferable that a material in which, for example, cerium oxide abrasive grains are
25 dispersed in water and which is made into slurry be used as the polishing liquid.

[0079]

Secondary grinding step

The secondary grinding step is performed by the method of manufacturing the disc-shaped substrates of this embodiment that uses the double-sided machining device
5 60 of this embodiment as a double-sided grinding device.

The secondary grinding step is a step of grinding the surfaces of the disc-shaped substrates 10, which have been subjected to the primary grinding step, so as to make the surfaces of the disc-shaped substrates 10 smooth. In the secondary grinding step, as in the primary grinding step, it is preferable that grinding stones containing abrasive grains
10 made of alumina or diamond be used as grinding surface plates and the particle size of the abrasive grain be smaller than that of the abrasive grain used in the primary grinding step. Further, in the secondary grinding step, it is preferable that water be used as the coolant.

[0080]

15 Outer periphery polishing step

The outer periphery polishing step is a step of polishing the outer peripheral end surfaces of the disc-shaped substrates 10, which have been subjected to the inner-outer periphery grinding step, so as to make the outer peripheral end surfaces of the disc-shaped substrates 10 smooth. Examples of the outer periphery polishing step
20 include a step of making a rotating brush come into contact with the disc-shaped substrate 10 while making polishing liquid flow to the outer peripheral portion of the disc-shaped substrate 10. A material in which, for example, cerium oxide abrasive grains are dispersed in water and which is made into slurry may be used as the polishing liquid.

25 [0081]

Primary polishing step

The primary polishing step is performed by the method of manufacturing the disc-shaped substrates of this embodiment that uses the double-sided machining device 60 of this embodiment as a double-sided polishing device.

- 5 The primary polishing step is a step of polishing the surfaces of the disc-shaped substrates 10, which have been subjected to the secondary grinding step, so as to make the surfaces of the disc-shaped substrates 10 more smooth. In the primary polishing step, surface plates including polishing pads, which are provided on the surfaces of the surface plates 21a and 21b facing each other (that is, the polishing surfaces) and are made
10 of hard abrasive cloth made of urethane, are used as the polishing surface plates. It is preferable that a material in which cerium oxide abrasive grains as an abrasive are dispersed in water and which is made into slurry be used as the slurry that is supplied to both the upper and lower surfaces of the disc-shaped substrates 10 and contains an abrasive.

15 [0082]

Secondary polishing step

The secondary polishing step is performed by the method of manufacturing the disc-shaped substrates of this embodiment that uses the double-sided machining device 60 of this embodiment as a double-sided polishing device.

- 20 The secondary polishing step is a step of polishing the surfaces of the disc-shaped substrates 10, which have been subjected to the primary polishing step, so as to make the surfaces of the disc-shaped substrates 10 more smooth as final finishing. In the secondary polishing step, it is preferable that surface plates 21a and 21b including polishing pads, which are provided on the polishing surfaces facing each other and are
25 made of suede-like soft abrasive cloth, be used as the polishing surface plates. It is

preferable that a material in which cerium oxide abrasive grains or colloidal silica is dispersed in a solvent such as water and which is made into slurry be used as the slurry that is supplied to both the upper and lower surfaces of the disc-shaped substrates 10 and contains an abrasive.

5 [0083]

Final washing/inspecting step

The final washing is performed, so that the abrasive and the like used in the above-mentioned series of steps are removed from the surfaces of the disc-shaped substrates 10. For example, a chemical washing method or the like using a detergent
10 (chemicals) together with ultrasonic waves may be used as a final washing method.

Further, a method of inspecting the presence or absence of damages, warps, or the like on the surfaces of the disc-shaped substrates 10 by an optical inspecting unit using, for example, laser may be used as the inspecting step.

[0084]

15 The primary grinding step and the secondary grinding step are performed by the method of manufacturing the disc-shaped substrates of this embodiment that uses the double-sided machining device 60 including the carrier plates 30 of this embodiment as a double-sided grinding device. For this reason, the change of the polishing speed on the upper and lower surfaces of the disc-shaped substrate 10 is suppressed by the function of
20 the strip-shaped blades as scrapers that wipe grinding waste present on the surface plates 21a and 21b, abrasive grains used in machining, and a coolant.

[0085]

Moreover, the primary polishing step and the secondary polishing step are performed by the method of manufacturing the disc-shaped substrates of this
25 embodiment that uses the double-sided machining device 60 including the carrier plates

30 of this embodiment as a double-sided polishing device. For this reason, the change of the polishing speed on the upper and lower surfaces of the disc-shaped substrate 10 is suppressed by the function of the strip-shaped blades as scrapers that wipe polishing waste present on the surface plates 21a and 21b and slurry containing abrasive grains.

5 Therefore, according to the method of manufacturing the disc-shaped substrates of this embodiment, it is possible to continuously manufacture a plurality of disc-shaped substrates 10 that are formed of glass substrates and have a small deviation in quality, so that excellent productivity is obtained.

[Example]

10 [0086]

Hereinafter, the effect of the invention becomes more apparent by an example.

In addition, the invention is not limited to the following example, and may be appropriately modified without departing from the scope of the invention.

[0087]

15 (Example)

Both upper and lower surfaces of a plurality of disc-shaped substrates 10 for magnetic recording media were continuously polished using the following method by the double-sided machining device including the carrier plates 30 shown in FIG. 2.

20 A substrate, which was made of an disc-shaped aluminum alloy (corresponding to material symbol A5086) having an outer diameter of 65 mm, an inner diameter of 20 mm, and a thickness of 1.3 mm, of which the inner and outer peripheral end surfaces and the data surface were subjected to turning, and on which a Ni-P plating film having a thickness of about 10 μm was formed by performing an electroless Ni-P plating treatment on the entire surface thereof, was used as the disc-shaped substrate 10.

25 [0088]

As described below, a rough polishing step and a finish polishing step were performed as the step of polishing both the upper and lower surfaces of the disc-shaped substrate 10.

In the rough polishing step and the finish polishing step, a carrier plate including
5 the strip-shaped blades 36 formed of four strip-shaped portions 36a as shown in FIG. 2 was used as the carrier plate 30. Each of the strip-shaped portions had a width of 5 mm and a height of 0.3 mm. In addition, an angle θ , which is close to the outer peripheral side of the carrier plate 30, of angles formed between the extending direction of the strip-shaped portion 36a and the radial direction of the carrier plate 30 was 2° .

10 [0089]

In each of the rough polishing step and the finish polishing step, a three-way type double-sided polishing machine (11B type manufactured by System Seiko Co., Ltd.) was used as a double-sided machining device.

This double-sided machining device includes the carrier plates 30 shown in FIG.
15 2, polishing surface plates that are formed of lower and upper surface plates of which polishing surfaces facing each other are provided with polishing pads made of suede-like soft abrasive cloth, supply means for supplying polishing liquid at a predetermined flow rate through supply ports formed in the upper surface plate, and drive means for making the carrier plates 30 perform a planetary motion by rotating the pair of upper and lower
20 surface plates, respectively, and revolving the carrier plates 30 around the central shafts of the pair of upper and lower surface plates while rotating the carrier plates 30 about the central axes 37.

[0090]

In the rough polishing step and the finish polishing step, first of all, disc-shaped
25 substrates 10 were placed in the substrate holding holes 34 formed in the carrier plates 30

and thirty disc-shaped substrates 10 were held by the carrier plates 30. Subsequently, the upper surface plate was placed on the lower surface plate in which the carrier plates 30 holding the disc-shaped substrates 10 were received so that the disc-shaped substrates 10 held by the carrier plates 30 were disposed between the pair of upper and lower surface plates. Working pressure between the lower and upper surface plates was 110 g/cm².

[0091]

After that, in the rough polishing step and the finish polishing step, the carrier plates 30 and the surface plates were moved relative to each other by the drive means while polishing liquid was supplied to the polished surfaces of the disc-shaped substrates 10 from the supply ports of the supply means (surface machining step).

In the surface machining step that includes the rough polishing step and the finish polishing step, the carrier plates 30 was rotated in the same direction as the rotational direction of the lower surface plate and the upper surface plate was rotated in the direction opposite to the rotational directions of the carrier plates 30 and the lower surface plate by the drive means. The rotational speed of each of the lower and upper surface plates was 20 rpm.

[0092]

In addition, in the rough polishing step, slurry in which alumina abrasive grains as an abrasive having a value of D50 of 0.3 μm were dispersed at a concentration of 5 mass% in a solvent made of an aqueous solution to which a chelating agent and an oxidizing agent were added so that a hydrogen ion exponent was adjusted to an acid range of pH 1.5 was used as the polishing liquid. Further, the rough polishing step was performed while the polishing liquid was supplied to the polished surfaces of the disc-shaped substrates 10 at a flow rate of 500 ml/min.

In the rough polishing step, the carrier plates 30 and the surface plates were moved relative to each other for six minutes while the polishing liquid was supplied. After that, the carrier plates 30 and the surface plates were moved relative to each other for two minutes while water was supplied instead of the slurry.

- 5 In the rough polishing step, a polishing depth per surface of the disc-shaped substrate 10 was about 1.5 μm .

[0093]

The polished disc-shaped substrates 10 were washed with water after the rough polishing step.

- 10 After that, the finish polishing step was performed. In the finish polishing step, slurry in which colloidal silica abrasive grains as an abrasive having a value of D50 of 10 nm were dispersed at a concentration of 7 mass% in a solvent made of an aqueous solution to which a chelating agent and an oxidizing agent were added so that a hydrogen ion exponent was adjusted to an acid range of pH 1.5 was used as the polishing liquid.
- 15 Further, the finish polishing step was performed while the polishing liquid was supplied to the polished surfaces of the disc-shaped substrates 10 at a flow rate of 500 ml/min.

In the finish polishing step, the carrier plates 30 and the surface plates were moved relative to each other for ten minutes while the polishing liquid was supplied.

- 20 In the finish polishing step, a polishing depth per surface of the disc-shaped substrate 10 was about 0.5 μm .

[0094]

The polished disc-shaped substrates 10 were washed with water after the finish polishing step, and the step of polishing the disc-shaped substrates 10 was ended.

- 25 After that, the polished disc-shaped substrates 10 held by the carrier plates 30 were exchanged for unpolished disc-shaped substrates 10, and the polishing of the

disc-shaped substrates 10 was repeated in the same manner as described above so that a total of 40000 disc-shaped substrates 10 were continuously polished.

[0095]

(Comparative Example)

- 5 40000 disc-shaped substrates 10 were continuously polished in the same manner as the example except that carrier plates without the strip-shaped blades 36 were used as carrier plates.

(Evaluation)

- 10 In the example and the comparative example, polishing depths of the upper and lower surfaces of the polished disc-shaped substrate were measured every 600 disc-shaped substrates, differences in a polishing depth between the upper and lower surfaces of the disc-shaped substrates were calculated, and an average value of the differences was obtained.

- 15 As a result, in the example, the average value of the differences in the polishing depth between the upper and lower surfaces of the disc-shaped substrates was 0.005 μm .

In contrast, in the comparative example, the average value of the differences in the polishing depth between the upper and lower surfaces of the disc-shaped substrates was 0.048 μm .

- 20 While preferred embodiments of the invention have been described and illustrated above, it should be understood that these are exemplary of the invention and are not to be considered as limiting. Additions, omissions, substitutions, and other modifications can be made without departing from the spirit or scope of the present invention. Accordingly, the invention is not to be considered as being limited by the foregoing description, and is only limited by the scope of the appended claims.

CLAIMS

1. A carrier plate that is provided in a double-sided machining device polishing or grinding both upper and lower surfaces of disc-shaped substrates, the carrier plate
5 comprising:
 - substrate holding holes that hold the disc-shaped substrates; and
 - strip-shaped blades that are formed on at least one surface of the carrier plate so as to protrude from the surface.
- 10 2. The carrier plate according to claim 1,
 - wherein the strip-shaped blades are formed on both upper and lower surfaces of the carrier plate.
3. The carrier plate according to claim 1 or 2,
15 wherein the carrier plate has a circular shape in plan views seen from sides facing the upper and lower surfaces of the carrier plate, and
 - the strip-shaped blades extend in directions crossing a circumferential direction of the carrier plate in the plan view.
- 20 4. The carrier plate according to claim 3,
 - wherein the strip-shaped blades are formed of a plurality of strip-shaped portions that have the same shape in the plan view and are arranged at regular intervals in the circumferential direction.
- 25 5. A method of manufacturing disc-shaped substrates, the method comprising:

a step of polishing or grinding both upper and lower surfaces of the disc-shaped substrates,

wherein the step of polishing or grinding both the upper and lower surfaces includes

5 a step of holding the disc-shaped substrates in substrate holding holes provided in a carrier plate,

a step of disposing the disc-shaped substrates, which are held by the carrier plate, between a pair of upper and lower surface plates, and

a surface machining step of polishing or grinding both the upper and
10 lower surfaces of the disc-shaped substrates by making the carrier plates and the pair of upper and lower surface plates move relative to each other while supplying polishing liquid or grinding liquid to the disc-shaped substrates, and moving polishing waste or grinding waste and the polishing liquid or the grinding liquid present on surfaces of the pair of upper and lower surface plates, which face strip-shaped blades formed on at least
15 one surface of the carrier plate so as to protrude from the surface, by the strip-shaped blades.

6. The method according to claim 5,

wherein a carrier plate of which both upper and lower surfaces are provided with
20 the strip-shaped blades is used as the carrier plate.

7. The method according to claim 5 or 6,

wherein grinding surface plates are used as the pair of upper and lower surface plates, and

25 both the upper and lower surfaces of the disc-shaped substrates are ground while

a coolant is supplied as the grinding liquid in the surface machining step.

8. The method according to claim 5 or 6,

wherein polishing surface plates are used as the pair of upper and lower surface

5 plates, and

both the upper and lower surfaces of the disc-shaped substrates are polished

while slurry containing an abrasive is supplied as the polishing liquid in the surface machining step.

10 9. A double-sided machining device for polishing or grinding both upper and lower surfaces of disc-shaped substrates, the double-sided machining device comprising:

a carrier plate that includes substrate holding holes holding the disc-shaped substrates and strip-shaped blades formed on at least one surface of the carrier plate so as to protrude from the surface;

15 a pair of upper and lower surface plates that are disposed so as to face each other with the carrier plate interposed therebetween;

supply means for supplying polishing liquid or grinding liquid to the disc-shaped substrates; and

drive means for making the carrier plate and the pair of upper and lower surface

20 plates move relative to each other.