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(54) POLISHING SHEET AND METHOD OF MANUFACTURING THE SHEET

(57) A polishing sheet which will not become deformed as time goes so as to remain capable of polishing a target surface evenly and smoothly is provided. Also, a method of producing such a polishing sheet is provided. A polishing sheet 10 of the invention comprises a woven cloth sheet 12 with single fibers 13, fiber bundles 13 obtained by tying a plurality of fibers together, or bundle groups 13 obtained by tying together said fiber bundles, and a resin 14 fixing said fibers or said fiber bundles together. The woven cloth sheet 10 is affixed on a backing sheet 15. The woven cloth sheet has a sateen number in the range of 3-15.

Fig.1(a)

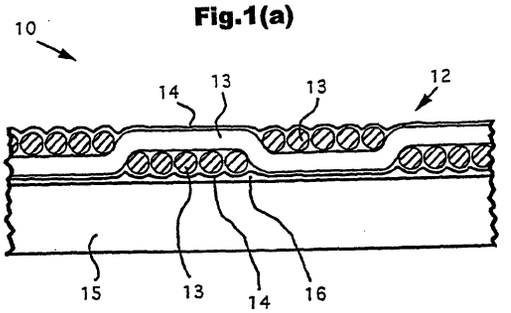
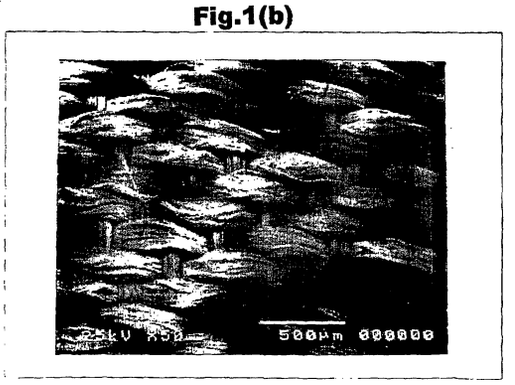


Fig.1(b)



EP 1 306 162 A1

Description

Technical Field

[0001] This invention relates to a polishing sheet for polishing a target object requiring a high degree of smoothness for its surface such as semiconductor wafers, liquid crystal glass substrates, magnetic hard disk substrates and magnetic head substrates and a method of producing such a polishing sheet. In particular, this invention relates to such a sheet adapted for chemical mechanical polishing.

Background of the Art

[0002] A chemical mechanical polishing (CMP) method is commonly carried out for polishing a target object requiring a high degree of smoothness for its surface such as semiconductor wafers, liquid crystal glass substrates, magnetic hard disk substrates and magnetic head substrates.

[0003] The CMP method is carried out by use of a polishing liquid containing a component which reacts chemically with the target surface to be polished. While the target surface is chemically etched or while complexes and oxides are being formed on the target surface, the surface is abraded mechanically by free polishing particles contained in the polishing liquid. The CMP method is known to have the advantage of being able to accomplish a very fine polishing work and to make a surface smooth to a very high degree.

[0004] In the field of semiconductor devices, for example, the so-called multi-layer wiring technology is becoming important for increasing the device capacity. In this multi-layer wiring technology, the base layer must be made extremely flat. If the base layer is uneven with protrusions and indentations, the result in step differences and the wires formed over a step difference are likely to be broken easily. Thus, the desired functions cannot be expected, and the CMP method is relied upon in order to make smooth a wafer having a wiring pattern and an insulating film formed thereon.

[0005] As disclosed in Japanese Patent Publication Nos. Heisei 8-3540 and Heisei 10-88111, for example, a CMP method may be used to make a semiconductor wafer flat by supplying an alkaline polishing liquid with a component (such as a water solution of potassium hydroxide) which reacts chemically with the film formed on the wafer surface onto a polishing pad attached to a rotary lapping plate and pressing the wafer onto this pad.

[0006] Prior art examples of a polishing pad used for such a purpose include a pad having a foamed base having many very small holes on the surface (such as a commercially available formed polyurethane pad IC-1000 produced by Rodel, Inc.) and a pad having a sheet of woven cloth comprising plastic fibers affixed to an elastic sheet such as a rubber sheet (as disclosed in Japanese Patent Publication No. Showa 55-90263). These polishing pads were used because the free polishing particles held in the very small surface holes of a foamed material or in spaces between the fibers of the woven cloth were believed to elastically act on the target surface such that the target surface can be polished to a high degree of smoothness.

[0007] Prior art polishing pads using a foamed material were produced by foaming a mixture of at least two resin materials to form a foamed block and slicing such a foamed block to a desired thickness but it was difficult to control the degree of foaming to be uniform throughout the body of the foamed block. Thus, the produced pads were different in the number of holes per unit area of surface and elasticity and local variations were also present even on each produced pad.

[0008] If such a prior art polishing pad using a foamed material is used, furthermore, the polishing surface becomes worn out locally or as a whole, becoming deformed as time passes such that it becomes incapable of polishing the target surface uniformly. Besides, the small holes on the polishing surface become clogged with abrading particles and debris such that the polishing rate (the amount polished per unit time) becomes lower. Thus, the common practice is to carry out the so-called dressing process by use of a sand plate or the like with hard particles such as diamond particles imbedded to recondition the pad surface. The dressing process is not only time-consuming but also troublesome in that hard particles such as diamond particles removed from the dressing tool become attached to the pad surface, causing unwanted scratches on the target surface to be made smooth.

[0009] If a prior art polishing pad with a woven cloth is used, the fibers on the woven cloth on the pad surface become displaced as time passes and the pad becomes deformed such that it becomes impossible to polish the target surface uniformly. At the same time, it becomes difficult to keep the free abrading particles on the pad surface and the polishing rate is adversely affected.

[0010] In view of the above, it is an object of this invention to provide a polishing sheet which will not become deformed as time goes so as to remain capable of polishing a target surface evenly and smoothly. It is also an object of this invention to provide a method of producing such a polishing sheet.

Summary of the Invention

[0011] A polishing sheet embodying this invention, with which the above and other objects can be accomplished, may be characterized as comprising a woven cloth sheet of a fiber, a fiber bundle with a plurality of fibers bundles up together or a fiber bundle assembly with a plurality of such fiber bundles of the cloth sheet. Such a polishing sheet of the present invention may preferably attached to the surface of a backing sheet of a plastic, woven or non-woven cloth or foamed material by using a resin adhesive of a known kind such as urethane, polyester or acryl resins.

[0012] Sateen woven cloths may be used as examples of woven sheets. If the sateen number is increased, the surface roughness of the target object can be made smaller and the polishing rate can also be increased. The sateen number is preferably in the range of 1-15 and more preferably in the range of 3-15.

[0013] Woven sheets of this invention may comprises fibers of known kinds not only for the purpose of polishing but also for general use. Fibers with thickness equal to or less than 0.1 deniers are used for reducing the surface roughness of the target object and to increase the rate of polishing. Polyester fibers of thickness equal to 0.1 deniers or smaller are preferably used.

[0014] Examples of resin for fixing the fibers or fiber bundles of a woven sheet include urethane resins, polyester resins and acryl resins. Urethane resins may preferably be used. The density of resin in the resin solution is preferably in the range of 0.1%-30%. The resin solution of this invention is obtained by dissolving such a resin material in water, alcohol or water-based solvent such as an organic solvent.

[0015] Polishing sheets of this invention as described above may be produced by impregnating such a woven cloth as described above with a resin solution and then drying the woven cloth impregnated with the resin solution.

[0016] A target object is polished by causing a polishing liquid to be present between a polishing pad or a polishing tape made of a polishing sheet of this invention and the surface of the target object to be polished and causing a relative motion between the target object and the polishing pad or the polishing tape. A polishing liquid with a component which chemically interacts appropriately with the surface of the target object is preferably selected for carrying out a chemical mechanical polishing process. The invention does not require whether the polishing liquid should or should not contain abrading particles.

Brief Description of the Drawings

[0017]

Fig.1(a) is a sectional view of a polishing sheet embodying this invention and Fig.1(b) is a surface photograph by a scanning electron microscope taken of another polishing sheet embodying this invention.
Fig.2 is a side view of a polishing machine for rotary lapping tape of polishing.
Fig.3 is a side view of a polishing machine for rotary head type of polishing.
Fig.4 is a side view of a polishing machine for belt type of polishing.
Fig.5 is a side view of a polishing machine for drum type of polishing.
Fig.6 is a side view of a polishing machine for tape type of polishing.

Best Mode for carrying out the Invention

[0018] <POLISHING SHEET> As shown in Figs.1(a) and 1(b), a polishing sheet 10 embodying this invention is characterized as comprising a sheet 12 having single fibers 13, fiber bundles 13 with a plurality of fibers tied together or assembles 13 of a plurality of fiber bundles each with a plurality of fibers and a resin material 14 fixing these fibers 13 and these fiber bundles 13 together. In order to prevent displacement in a transverse direction while being used in a polishing process, the polishing sheet 10 is affixed to the surface of a backing sheet 15 by using an adhesive agent 16 of a known kind such as a urethane resin, a polyester resin or an acryl resin. Examples of material to be used for the backing sheet 15 includes plastic sheets such as polyester, polypropylene or polyethylene terephthalate sheets, woven cloth sheets, non-woven cloth sheets and foamed sheets made of a foamed material such as foamed urethane.

[0019] As the woven cloth sheet 12, sateen woven fibers and fiber bundles 13 may be used. If the sateen number in this case is too small, the polishing rate becomes too small and the surface roughness of the target object after the polishing process becomes large. If the sateen number is increased, the polishing rate becomes larger and the surface roughness of the polished target object becomes small but if the sateen number is made too large, the polishing sheet becomes too easily deformed. It is therefore preferred that the sateen number be equal to 15 or less and more preferably in the range of 3-15. Fig,1(a) shows an example where the sateen number is 5.

[0020] Examples of fibers 13 forming the woven cloth sheet 12 of this invention include one or more selected from synthetic fibers such as nylon, polyester, acryl, vinylon, vinyl polychloride, polyethylene, vinyliden, polyurethane, polychlal, rayon, polynosic, cupra, acetate, triacetate and promix and natural fibers such as carbon fibers, silk, wool, cotton

and hemp. Fibers with thickness equal to or less than 0.1 deniers are used in order to make the surface roughness of the target object small and the polishing rate high. Polyester fibers with thickness equal to or less than 0.1 deniers are preferred.

[0021] The resin solution to be impregnated in the woven cloth sheet 12 is obtained by dissolving a known kind of urethane or polyester resin in water. The density of resin in the resin solution is in the range of 0.1%-30%. A urethane resin solution may preferably bu used such that the fibers and fiber bundles of the woven cloth sheet 12 are fixed together by urethane resin 14.

<PRODUCING METHOD> The polishing sheet 10 as shown in Figs.1(a) and 1(b) is produced by impregnating the woven cloth sheet 12 with a resin solution and drying this woven cloth sheet 12 impregnated with the resin solution such that the fibers and fiber bundles 13 of the woven cloth sheet 12 become fixed together by a resin 14. Preferably it is then affixed to the surface of a backing sheet 15 by means of an adhesive agent 16. In this process, the resin solution may be impregnated in the woven cloth sheet 12 by using a spray or by submerging the woven cloth sheet 12 in a tank containing the resin solution. The woven cloth sheet 12 may be affixed to the backing sheet 15 without using the adhesive agent 16 but by pressing the woven cloth sheet 12 impregnated with the resin solution against the surface of the backing sheet 15 and drying the resin solution. Instead of using the adhesive agent 16, a double-faced adhesive tape of a known kind (not shown) may be used on the backing sheet 15.

<POLISHING METHOD> The polishing of the surface of a target object is accomplished by causing a polishing liquid to exist between a polishing pad or a polishing tape made of the polishing sheet 10 as shown in Figs.1(a) and 1(b) and causing the polishing pad or the polishing tape and the target object to move with respect to each other.

[0022] Some of representative polishing process using the polishing method of this invention will be explained next.

1. Rotary lapping method

[0023] This is done, as shown in Fig.2, by pasting a polishing pad 10 made of a polishing sheet of this invention on a lapping plate D. The target object 11 to be polished is adsorbed to a head H and while the lapping plate D and the head H are rotated as shown by arrows, a polishing liquid is supplied through a nozzle N onto the polishing pad 10 on the lapping plate D and the target object 11 is pressed on the polishing pad 10 on the lapping plate D.

2. Rotary head method

[0024] This is done, as shown in Fig.3, by causing a target object 11 such as a glass plate for liquid crystal to be held on a lapping plate D by means of a holder S such as a frame. While a polishing liquid is supplied to the surface of this target object 11 through a nozzle N, a head H to which the polishing pad 10 made of a polishing sheet of this invention is attached in pressed against it and caused to move horizontally on a serpentine path on the surface of the target object 11.

3. Belt polishing method

[0025] This is done, as shown in Fig.4, by causing a target object 11 such as a semiconductor wafer to be adsorbed onto a head H. As the head H is rotated, a belt-shaped polishing pad 10 made of a polishing sheet of this invention is run in the direction shown by an arrow. A polishing liquid is supplied onto the surface of the polishing pad 10 through a nozzle N, and the target object 11 adsorbed to the head H is pressed against the polishing pad 10 running over a platen P having an elastic material (not shown) affixed to its surface.

4. Drum polishing method

[0026] This is done, as shown in Fig.5, by causing a target object 11 such as a semiconductor wafer to be adsorbed onto a head H and rotating the head H as shown by an arrow while a drum C with the polishing pad 10 made of a polishing sheet of this invention pasted around it is caused to rotate as shown by another arrow. A polishing liquid is supplied onto the surface of the polishing pad 10 around the drum C and the target object 11 adsorbed to the head H is pressed against it.

5. Tape polishing method

[0027] This is done, as shown in Fig.6, by causing a target object 11 such as a semiconductor wafer to be adsorbed onto a head H and rotating the head H as shown by a an arrow while a polishing liquid is supplied through a nozzle N onto the polishing tape 10 made of a polishing sheet of this invention sent out from a supply roller R1 in the direction of another arrow. The target object adsorbed to the head H is pressed against the polishing tape 10 on a platen P

having an elastic material (not shown) affixed to its surface. The polishing tape 10 is sequentially rolled around by a take-up roller R2. The polishing tape 10 may be moved either continuously or intermittently such that the motion is stopped while the target object 11 is being pushed onto the surface of the polishing tape 10.

<POLISHING LIQUID> In the method according to this invention, a known kind of polishing liquid used for polishing with free abrading particles may be used but those containing a component which chemically react with the surface of the target object are preferred. This is because, as explained above, the chemical mechanical polishing has the advantage of being able to carry out a high degree of planarization. When a metal or glass is polished by the chemical mechanical polishing method, acidic solutions, solutions containing an oxidant, solution containing a chelating agent, or alkaline solutions such as those containing potassium hydroxide solution or sodium hydroxide solution may be used.

[0028] Examples of abrading particles dispersed in the polishing liquid include known kinds such as particles of silica, cerium oxide, alumina, zirconia and diamond.

[0029] When the chemical mechanical polishing method is used, it does not matter whether abrading particles are used or not. If a polishing liquid containing abrading particles is used, the rate of polishing becomes greater than if a polishing pad based on a foamed material is used. If a polishing liquid not containing abrading particles is used, the rate of polishing is about the same as if a polishing pad based on a foamed material is used.

<TEST EXAMPLE 1> A woven cloth sheet was prepared by using fiber bundles of 12 bundles each tying together 70 bundles of polyester fibers of thickness 0.06 deniers as weft and with sateen number of 8 and was impregnated with a resin solution prepared by dissolving urethane resin (concentration 10%) in water. The impregnated woven cloth sheet was dried and then attached to the surface of a polyethylene terephthalate (PET) sheet by using an acryl adhesive agent to produce a polishing sheet embodying this invention. This polishing sheet was cut to produce a polishing pad of Test Example 1.

<TEST EXAMPLE 2> A woven cloth sheet was prepared by using fiber bundles of 12 bundles each tying together 70 bundles of polyester fibers of thickness 0.06 deniers both as weft and warp and with sateen number of 5 and was impregnated with the same resin solution prepared in Test Example 1. The impregnated woven cloth sheet was dried and then attached to the surface of a PET sheet by using a double-sided acryl adhesive tape to produce a polishing sheet embodying this invention. This polishing sheet was cut to produce a polishing pad of Test Example 2.

<TEST EXAMPLE 3> A woven cloth sheet was prepared by using fiber bundles of 12 bundles each tying together 70 bundles of polyester fibers of thickness 0.06 deniers both as weft and warp and with sateen number of 1 (plain weave) and was impregnated with the same resin solution prepared in Test Example 1. The impregnated woven cloth sheet was dried and then attached to the surface of a PET sheet by using a double-sided acryl adhesive tape to produce a polishing sheet embodying this invention. This polishing sheet was cut to produce a polishing pad of Test Example 3.

<TEST EXAMPLE 4> A woven cloth sheet was prepared by using fiber bundles of 12 bundles each tying together 70 bundles of polyester fibers of thickness 0.06 deniers both as weft and warp and with sateen number of 3 and was impregnated with the same resin solution prepared in Test Example 1. The impregnated woven cloth sheet was dried and then attached to the surface of a PET sheet by using a double-sided acryl adhesive tape to produce a polishing sheet embodying this invention. This polishing sheet was cut to produce a polishing pad of Test Example 4.

<COMPARISON EXAMPLE 1> A woven cloth sheet was prepared by using fiber bundles of 12 bundles each tying together 70 bundles of polyester fibers of thickness 0.06 deniers both as weft and warp and with sateen number of 3 and was attached to the surface of a PET sheet by using a double-sided acryl adhesive tape to produce a polishing sheet embodying this invention. This polishing sheet was cut to produce a polishing pad of Comparison Example 1.

<COMPARISON EXAMPLE 2> This was a commercially available foamed polyurethane pad (IC-1000 produced by Rodel, Inc.).

<COMPARISON EXAMPLE 3> A woven cloth sheet was prepared by using fiber bundles of 34 bundles each tying polyester fibers of thickness 1.18 deniers both as weft and warp and with sateen number of 1 (plain weave) and was impregnated with the same resin solution prepared in Test Example 1. The impregnated woven cloth sheet was dried and then attached to the surface of a PET sheet by using a double-sided acryl adhesive tape to produce a polishing sheet embodying this invention. This polishing sheet was cut to produce a polishing pad of Comparison Example 3.

<POLISHING TEST 1> The effects of sateen number on the polishing rate and the surface roughness of a target object were examined.

[0030] This test was carried out by using polishing pads made of polishing sheets of Test Examples 1, 2 and 3 embodying this invention (with sateen numbers 8, 5 and 1) produced by preparing sateen-woven cloth sheets with fiber bundles fixed with a resin and affixing them onto a backing sheet.

[0031] In this test, target objects were 8-inch silicon wafers having a Cu film of thickness 8000Å formed thereon by spattering. They were polished by using Polishing Liquid A shown in Table 2 below, containing alumina particles with average particle diameter of 0.1μm, and a polishing machine of the rotary lapping type (Mechpol E550 produced by Presi Co., Ltd.) as shown in Fig.2, under the conditions shown in Table 1.

Table 1

POLISHING CONDITIONS	
Rate of rotation of head	40 rpm
Rate of rotation of lapping plate	40 rpm
Supply rate of polishing liquid	250 ml/minute
Pressure of compression	300 g/cm^2
Polishing time	60 seconds

Table 2

POLISHING LIQUID (for POLISHING TEST 1)	
Polishing Liquid A (containing abrading particles)	
Quinaldinic acid	0.67 weight %
Hydrogen peroxide water	4.67 weight %
Lactic acid	1.33 weight %
Alumina (average diameter 0.1μm)	4.99 weight %
Pure water	89.33 weight %

[0032] The rate of polishing (in units of Å/minute) was determined by using 4-probe contact type resistance sensor for measurement of film thickness to measure the abraded film thickness per unit time. Surface roughness (in units of Å) was measured by using a white color interference type surface roughness sensor (NEW VIEW produced by Zygo Co., Ltd.).

<RESULT 1> Results of Polishing Test 1 are shown in Table 3, showing that the rate of polishing increases and the surface roughness of the target object becomes smaller after the polishing as the sateen number in increased.

Table 3

RESULT 1 (POLISHING TEST 1)			
	Sateen number	Surface Roughness (Å)	Rate of polishing (Å/minute)
Test Example 1	8	4.23	4027.2
Test Example 2	5	5.80	2626.9
Test Example 3	1	80.2	1779.6

<POLISHING TEST 2> Polishing pads from Test Example 4 and Comparison Examples 1 and 2 were used to polish wafers of the same kind as used in Polishing Test 1. Polishing Liquid A as used in Polishing Test 1 and Polishing Liquid B not containing abrading particles as described in Table 4 were used. It is to be noted that Polishing Liquid B contains the same components that react chemically with the Cu film to form complexes on the surface as does Polishing Liquid A. The same sensors were used for the measurements of film thickness and rate of polishing and under the conditions described in Table 1 above.

Table 4

POLISHING LIQUID (for POLISHING TEST 2)	
Polishing Liquid B (without containing abrading particles)	
Quinaldinic acid	0.67 weight %
Hydrogen peroxide water	4.67 weight %
Lactic acid	1.33 weight %
Pure water	93.33 weight %

<RESULT 2> Results of the tests are shown in Table 5. It shows that if a polishing pad of Test Example 4 was used, the rate of polishing is greater than was a pad of Comparison Example 1 or 2 is used, whether or not Polishing Liquid A or B was used. The surface roughness was equally good (about 3.0Å- about 4.0Å) whether a pad of Test Example 4 was used or a pad of Comparison Example 1 or 2 was used but it was found that the surface of the wafer with Cu film as a whole was much more uniformly smooth if a pad of Test Example 4 was used than if a pad of Comparison Example 1 or 2 was used.

Table 5

RESULT (POLISHING TEST 2)			
Polishing Rate (nm/minute)			
	Test Example 4	Comparison Example 1	Comparison Example 2
Polishing Liquid A	2136	1950	1300
Polishing Liquid B	1606	986	1290

<POLISHING TEST 3> Polishing pads from Test Example 3 (with fibers of thickness o.o6 deniers) and Comparison Example 3 (with fibers of thickness 1.18 deniers) were used to polish wafers of the same kind as used in Polishing Test 1. Polishing Liquid A containing alumina particles with average diameter of 0.1μm shown in Table 2 was used, and the polishing was done by using the same polishing machine and under the same conditions as in Polishing Test 1. <RESULT 3> Results of the test are shown in Table 6. The results show that both the rate of polishing and the surface roughness improve if the thickness of the fibers are reduced such that a flatter surface can be obtained in a short time.

Table 6

RESULT (POLISHING TEST 3)				
	Sateen number	Fiber thickness (denier)	Surface roughness (Å)	Rate of polishing (Å/minute)
Test Example 3	1	0.06	80.2	1779.6
Comparison Example 3	1	1.18	513.4	1680.5

[0033] According to the present invention, the shape of the polishing sheet is stabilized and is not easily deformed. Thus, the target surface can be polished smoothly at a high rate of polishing even without the use of abrading particles.
[0034] Also, in the polishing utilizing the chemical mechanical polishing method, the target surface can be polished smoothly at a high rate of polishing even without the use of abrading particles.

Claims

1. A polishing sheet comprising:

a woven cloth sheet with single fibers, fiber bundles obtained by tying a plurality of fibers together, or bundle groups obtained by tying together said fiber bundles; and
a resin fixing said fibers or said fiber bundles together.

2. The polishing sheet of claim 1 wherein said woven cloth sheet has a sateen number in the range of 1-15.

3. The polishing sheet of claim 1 wherein said woven cloth sheet has a sateen number in the range of 3-15.

4. The polishing sheet of claim 1 wherein said fibers are of thickness 0.1 deniers or less.

5. The polishing sheet of claim 1 further comprising a backing sheet having a surface , on which said woven cloth sheet is affixed.

6. A method of producing a polishing sheet, said method comprising the steps of:

impregnating with a resin solution a woven cloth sheet with single fibers, fiber bundles obtained by tying a plurality of fibers together, or bundle groups obtained by tying together said fiber bundles; and
drying said woven cloth sheet impregnated with said resin solution and thereby fixing said fibers or said fiber bundles together.

7. The method of claim 6 further comprising the step of attaching said dried woven cloth sheet on a surface of a backing sheet.

8. A method of polishing a surface of a target object to be polished, said method comprising the steps of:

preparing a polishing pad or a polishing tape of any one of claims 1-5;
causing a polishing liquid to be present between said polishing pad or polishing tape and said surface, said polishing liquid containing a component which reacts chemically with said target surface; and
causing said polishing pad or polishing tape and said target object to move with respect to each other.

Amended claims under Art. 19.1 PCT

1. (amended) A polishing sheet comprising:

a woven cloth sheet with single fibers, fiber bundles obtained by tying a plurality of fibers together, or bundle groups obtained by tying together said fiber bundles; and
a resin fixing said fibers or said fiber bundles together.

wherein said fibers are of thickness less than 0.08 deniers, said woven cloth sheet is a sateen woven cloth sheet, and said woven cloth sheet has a sateen number in the range of 3-15.

2. (cancellation)

3. (cancellation)

4. (cancellation)

5. The polishing sheet of claim 1 further comprising a backing sheet having a surface, on which said woven cloth sheet is affixed.

6. (amended) A method of producing a polishing sheet, said method comprising the steps of:

impregnating with a resin solution a woven cloth sheet with single fibers, fiber bundles obtained by tying a plurality of fibers together, or bundle groups obtained by tying together said fiber bundles; and
drying said woven cloth sheet impregnated with said resin solution and thereby fixing said fibers or said fiber bundles together,

wherein said fibers are of thickness less than 0.08 deniers, said woven cloth sheet is a sateen woven cloth sheet, and said woven cloth sheet has a sateen number in the range of 3-15.

7. The method of claim 6 further comprising the step of attaching said dried woven cloth sheet on a surface of a backing sheet.

8. (amended) A method of polishing a surface of a target object to be polished, said method comprising the steps of:

preparing a polishing pad or a polishing tape of claim 1 or 5;
causing a polishing liquid to be present between said polishing pad or polishing tape and said surface, said polishing liquid containing a component which reacts chemically with said target surface; and
causing said polishing pad or polishing tape and said target object to move with respect to each other.

Fig.1(a)

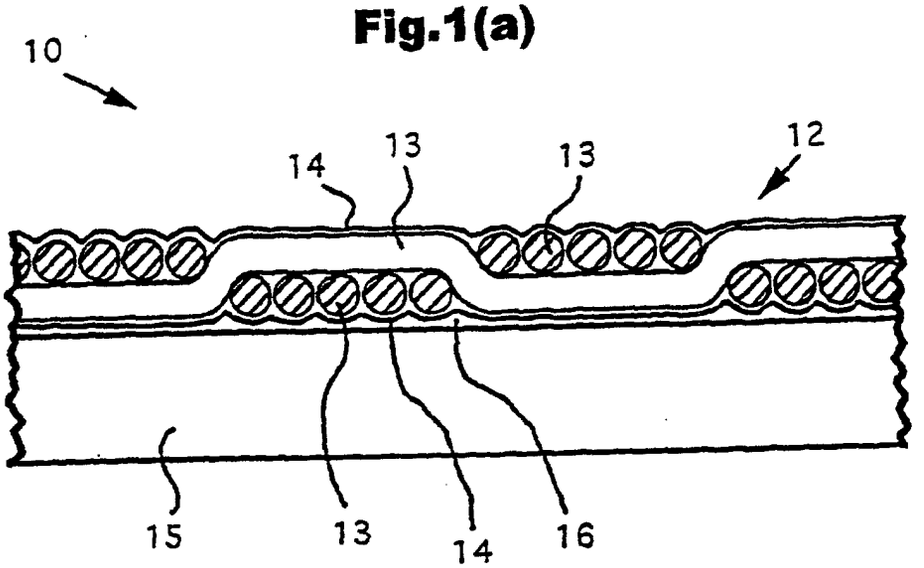


Fig.1(b)

Fig.2

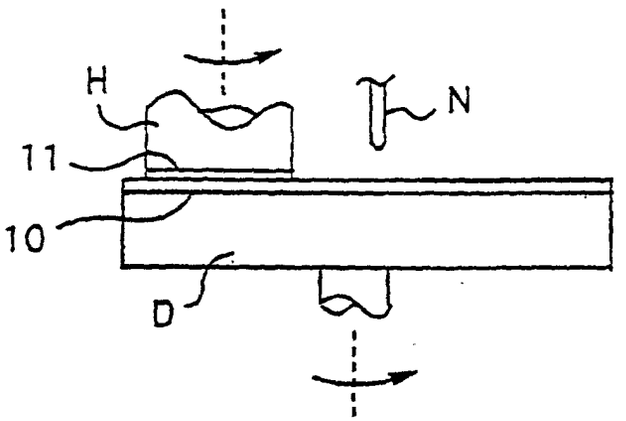


Fig.3

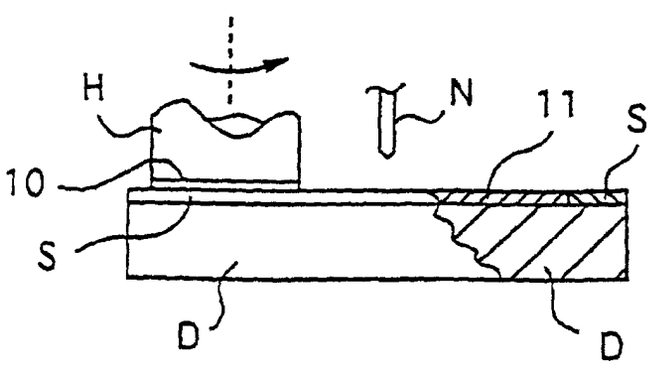


Fig.4

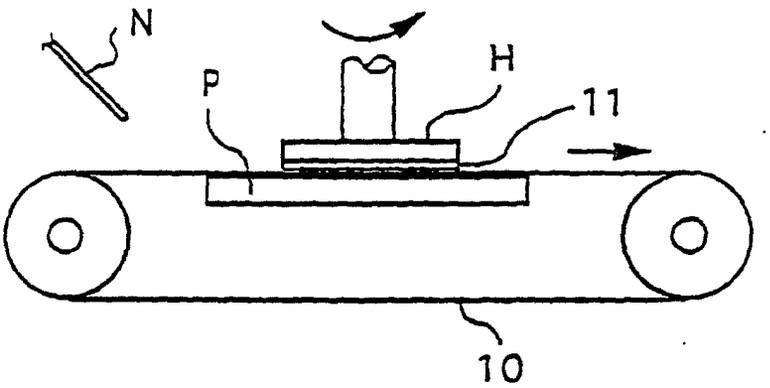


Fig.5

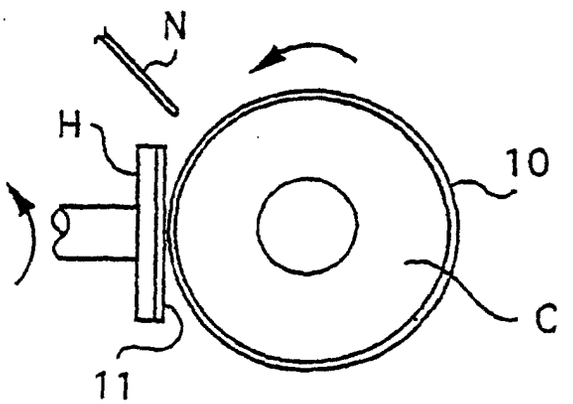
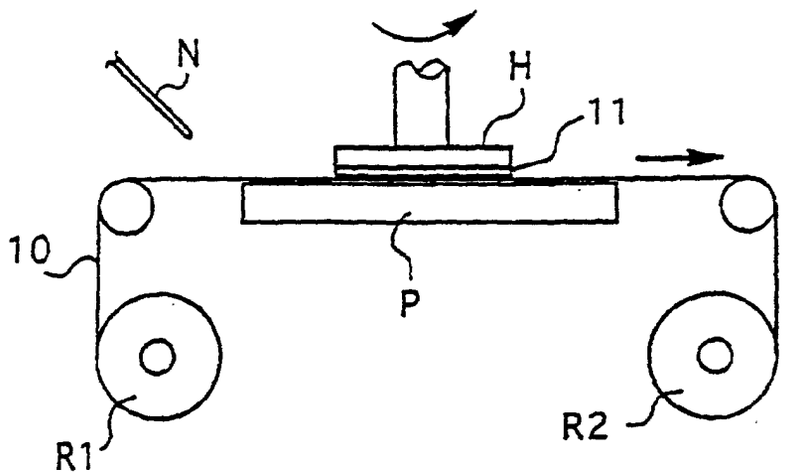


Fig.6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP01/06754

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B24B37/00

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] B24B37/00, B24D11/00, H01L21/304, D06M15/564

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926-2001 Toroku Jitsuyo Shinan Koho 1994-2001
Kokai Jitsuyo Shinan Koho 1971-2001 Jitsuyo Shinan Toroku Koho 1996-2001

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	JP 11-90810 A (Kuraray Co., Ltd.), 06 April, 1999 (06.04.99), Claims; Par. No. [0013] (Family: none)	1,2,4,6 8 3,5,7
Y	EP 451944 A2 (Minnesota Mining and Manufacturing Company), 16 October, 1991 (16.10.91), page 3, line 58 to page 4, line 2; page 4, lines 28 to 31; Figs. 1 to 4 & JP 5-229071 A	5,7
Y	JP 11-99479 A (Teijin Limited), 13 April, 1999 (13.04.99), Claims; Par. Nos. [0001], [0003] (Family: none)	8

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 October, 2001 (30.10.01)	13 November, 2001 (13.11.01)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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