

DESCRIPTION

Title of Invention: WET CLEANING SHEET

Technical Field

[0001]

The present invention relates to a wet cleaning sheet.

Background Art

[0002]

Various cleaning sheets having surface unevenness formed by hydroentanglement have been proposed. Patent Literature 1 below discloses nonwoven fabric having recessed regions and raised regions in a specific pattern formed by using a patterning plate in hydroentanglement.

The assignee of the present invention previously proposed a wet cleaning sheet using nonwoven fabric, which includes a cleaning sheet impregnated with a composition containing a cleaning agent. The cleaning sheet includes a mesh sheet and a nonwoven fiber aggregate integrated with one or both sides of the mesh sheet. The fiber aggregate is formed by entangling the fibers of a loose fiber web among themselves and also with the mesh sheet. The fiber aggregate has the fibers raised and oriented in a wavy form to provide a large number of raised and depressed portions (see Patent Literature 2 below).

Citation List

Patent Literature

[0003]

Patent Literature 1: JP 4369089

Patent Literature 2: JP 3313786

Summary of Invention

[0004]

A wet cleaning sheet is capable of capturing a broad range of dust particles from fine to relatively large (e.g., bread crumbs).

However, a wet cleaning sheet containing a cleaning fluid has poor hair pick up

as compared with dry cleaning sheet. For example, the wet cleaning sheet described in Patent Literature 1 above does not achieve a hair trapping ratio of 100% and has been waiting for improvement in hair trapping capabilities.

[0005]

The invention provides a wet cleaning sheet including a substrate sheet impregnated with a cleaning fluid. The substrate sheet has a working surface, and includes: a mesh sheet; and a fiber aggregate joined to one or both sides of the mesh sheet in such a manner that the fibers of the fiber aggregate are entangled among themselves and with the mesh sheet. The substrate sheet has, on the working surface thereof, raised portions and depressed portions, the raised portions and the depressed portions being arranged so as to form a texturing pattern having macroscopically curved portions. The texturing pattern contains a borderline which is located between the raised portion and the depressed portion and which has length of at least 10 mm per cm^2 , and the raised portions each being surrounded by the depressed portions and having an area of at least 300 mm^2 . The substrate sheet has: a first direction corresponding to the machine direction or the main orientation direction of the constituent fibers; and a second direction perpendicular to the first direction. On drawing imaginary straight lines extending in the second direction within a rectangular region 280 mm long in the first direction and 200 mm wide in the second direction to determine a first straight line having a maximum total length of its segments that cross over any depressed portion and a second straight line having a minimum total length of its segments that cross over any depressed portion, the difference between the maximum and minimum total lengths divided by a shortest distance between the first and second straight lines in the first direction is 10 or greater.

[0006]

The invention also provides a method for making the wet cleaning sheet, comprising the step of hydroentanglement, in which

a continuous length layered structure composed of a mesh sheet and a fiber aggregate arranged on one or both sides of the mesh sheet is introduced onto a water permeable support member having thereon a patterning net having openings and curved ribs in plan view, and a waterjet is applied to the layered structure moving with the water permeable support member to make the substrate sheet having depressed portions corresponding to the ribs and raised portions corresponding to the openings.

Brief Description of Drawings

[0007]

[Fig. 1] Fig. 1 is a plan view of the working side of a first embodiment of the wet cleaning sheet according to the invention.

[Fig. 2] Fig. 2 is an enlarged fragmentary plan view of the texturing pattern of the substrate sheet used in the wet cleaning sheet of Fig. 1.

[Fig. 3] Fig. 3 is a plan view of the working side of a second embodiment of the wet cleaning sheet according to the invention (equivalent to Fig. 1).

[Fig. 4] Fig. 4(a), Fig. 4(b), and Fig. 4(c) illustrate a method for evaluating a variation in degree of fiber entanglement.

[Fig. 5] Fig. 5 is a plan view of a mesh sheet useful as a member forming a substrate sheet.

[Fig. 6] Fig. 6 is a perspective view of a handled cleaning implement.

[Fig. 7] Fig. 7 schematically illustrates a preferred method for producing the wet cleaning sheet of the invention.

[Fig. 8] Fig. 8 schematically illustrates the rotary drum set in the water needling device and its surroundings shown in Fig. 7.

[Fig. 9] Fig. 9 is a perspective view of an exemplary patterning net for use in the production of the wet cleaning sheet of the first embodiment.

[Fig. 10] Fig. 10 is a plan view of the working side of the wet cleaning sheet of Comparative example 1 (equivalent to Fig. 1).

Description of Embodiments

[0008]

The invention relates to a wet cleaning sheet having improved hair capturing capabilities.

[0009]

The invention will be described on the basis of its preferred embodiments with reference to the accompanying drawings.

A wet cleaning sheet 1 according to the first embodiment includes a substrate sheet 2 impregnated with an unshown cleaning fluid. Fig. 1 shows the working side of the wet cleaning sheet 1, i.e., the side to be contacted with an object to be cleaned in a cleaning operation.

As illustrated in Fig. 1, the substrate sheet 2 of the wet cleaning sheet 1 has, on its working side, a three-dimensional texture which has a pattern having a macroscopically curved portion. That is, the substrate sheet 2 has depressed portions 4 and raised portions 3 on its working side, and the borderline between the raised portion 3 and the depressed portion 4 includes a macroscopically curved line. As used herein, the phrase “having a macroscopically curved line” means that a part of the sides of figures composing the texturing pattern are curved lines, the term “curved line” excluding curved lines defining micro-to-nano scale pores and curved lines defining drain apertures with a diameter of about 1.5 to 2 mm.

[0010]

The texturing pattern of the substrate sheet 2 of the wet cleaning sheet 1 according to the first embodiment will be illustrated in detail. The texturing pattern of the substrate sheet 2 is made up of a plurality of discrete raised portions 3 that are separated from one another by depressed portions 4 in plan view. The individual raised portions 3 are surrounded by the depressed portion 4. The plurality of raised portions 3 include raised portions 31 and 32 different in plan view shape. In more detail, as illustrated in Fig. 2, the texturing pattern contains first raised portions 31 and second raised portions 32. The first raised portions 31 each have a generally triangular shape defined by three first arcs “a” of a circle centered at point P1 and three second arcs “b” each positioned intermediate between adjacent first arcs a and having opposite convexity to the arcs a. The second raised portions 32 are each defined by one arc “c” of a circle centered at point P2, two arcs “d” each facing the arc c, and a generally pentagonal figure “e” projecting between the two arcs d toward point P2. Three second raised portions 32 are regularly spaced circumferentially around one point P2. In between any adjacent two out of the three regularly spaced second raised portions 32 is located a part of the first raised portion 31 containing one of the three first arcs a.

[0011]

The distance from point P1 to the first arc a of the first raised portion 31 (i.e., the radius of a circle centered at point P1 and having the three first arcs a) and the distance from point P2 to the arc c of the second raised portion 32 (i.e., the radius of a circle centered at point P2 and having the arc c) are equal. Point P1 is positioned outside of the circle centered at point P2 and having the arc c. Point P2 is positioned outside of the

circle centered at point P1 and having the three first arcs a.

[0012]

The texturing pattern of Fig. 1 used in the first embodiment satisfies conditions 1 to 3 described below.

The substrate sheet used in the invention has a first direction X coincident with the web running direction (the direction in which a web material runs during production of the substrate sheet) and a second direction Y perpendicular to the first direction X. The web running direction as referred to above has the same meaning as the machine direction MD (see Fig. 7). The web running direction is usually coincident with the main orientation direction of fibers making up the web. Therefore, whether or not the web running direction is known, the main orientation direction of the constituent fibers shall define the first direction X. When the substrate sheet 2 has a rectangular plan view shape, the main orientation direction of constituent fibers is one of the two directions, the longitudinal direction parallel to the long side and transverse direction parallel to the short side, that shows a higher degree of fiber orientation than the other.

The second direction Y is a direction perpendicular to the first direction X. When the first direction X is the web running direction in the production of the substrate sheet (the same as the MD), the second direction Y is the direction perpendicular to the web running direction, namely the cross-machine direction (CD). When the first direction X is the main orientation direction of the constituent fibers, the second direction is the direction perpendicular to the first direction.

[0013]

Condition 1:

The texturing pattern includes a raised/depressed borderline having a length of at least 10 mm per cm².

As used herein, the term "raised/depressed borderline" refers to the borderline between the individual raised portions 3 and the individual depressed portions 4. The raised/depressed borderline is defined to be at the base of the raised portion 3 from which the thickness of the substrate sheet 2 starts to increase.

The length of the raised/depressed borderline per unit area (cm²) (hereinafter referred to as a specific borderline length) is measured by the method below.

Method for measuring specific borderline length:

The total length of the raised/depressed borderlines in a rectangular region 280 mm long in the first direction X and 200 mm wide in the second direction Y (hereinafter referred to as a measurement region) divided by the area of the measurement region is defined to be a specific borderline length. The measurement region is decided in such a manner that the center thereof in both the first and the second direction may be coincident with the center of the wet cleaning sheet under examination in both the first and the second direction.

[0014]

The specific borderline length is relatively short when the raised/depressed borderlines depict a relatively simple pattern in plan view. The specific borderline length is relatively long when the raised/depressed borderlines have many flexion points in plan view. Accordingly, the specific borderline length serves as a measure indicative of geometric complexity of the raised/depressed borderlines in plan view. With a specific borderline length of 10 mm or longer, the wet cleaning sheet has a sufficient number of sites on which hairs get caught and exhibits markedly improved hair capturing capabilities in wet mode cleaning operations.

The specific borderline length is at least 10 mm, preferably 11 mm or greater and 50 mm or smaller, more preferably 30 mm or smaller, preferably 10 to 50 mm, more preferably 11 to 30 mm.

[0015]

Condition 2:

The discrete raised portions 3 each surrounded by the depressed portions 4 each have an area of at least 300 mm^2 . In examining the substrate sheet, only the raised portions 3 each completely surrounded by the depressed portions 4 are chosen to be examined. Those raised portions 3 that are cut along any side edge of the measurement region are excluded from the area measurement. In other words, those raised portions 3 that are completely surrounded by the depressed portions 4 should each have an area of at least 300 mm^2 .

All or most of the raised portions 3 surrounded by the depressed portions 4 have an area of 300 mm^2 or more. As used herein, the phrase "most of" is intended to mean that 80% or more, in number, of the raised portions 3 completely surrounded by the

depressed portions 4 present in the measurement region have an area of 300 mm^2 or more. It is preferred that all of the raised portions 3 surrounded by the depressions 4 have an area of 300 mm^2 . The upper limit of the area of the individual raised portions 3 surrounded by the depressed portions 4 is preferably 3000 mm^2 , more preferably 2000 mm^2 .

To form raised portions with a large area is advantageous for the wet cleaning sheet in improving hair capturing capabilities during wet mode cleaning operations as compared when small raised portions are formed all over nonwoven fabric.

The area of the individual raised portions 3 surrounded by the depressed portions 4 (hereinafter simply referred to as the area of the individual raised portions) is measured as follows.

[0016]

Method for measuring area of individual raised portions:

The raised portions 3 each completely surrounded by the depressed portions 4 are chosen. The raised portions 3 that are cut along any side edge of the measurement region are excluded from the area measurement. Those raised portions 3 that are completely surrounded by the depressed portions 4, i.e., those raised portions 3 the outline of each of which is wholly within the rectangular measurement region 280 mm long in the first direction X and 200 mm wide in the second direction Y are chosen in the measurement region, and the area of each of the chosen raised portions 3 is measured.

With respect to condition 2, it is preferable for all of the chosen raised portions 3 to have an area of 300 mm^2 or more.

In the case when the hydroentanglement step is carried out using a patterning net 42 having drain apertures 45a (see Fig. 9), the depressed portions 4 corresponding to the opening-forming ribs 45 of the patterning net 42 may have tiny projections corresponding to the drain apertures 45a. Such tiny projections are not included in the term “raised portions” that provide together with the depressed portions the three-dimensionally textured surface according to the invention.

[0017]

Condition 3:

When imaginary straight lines L extending in the second direction Y are drawn in a rectangular region 280 mm long in the first direction X and 200 mm wide in the second

direction Y (measurement region) to determine a first straight line L1 having a maximum total length $L_{\max}$ of its segments m that cross over any depressed portion 4 of the texturing pattern and a second straight line L2 having a minimum total length $L_{\min}$ of its segments m that cross over any depressed portion 4, the difference between the maximum total length $L_{\max}$ and the minimum total length $L_{\min}$ ($L_{\max} - L_{\min}$) divided by a shortest distance L_3 between the first straight line L1 and the second straight line L2 in the first direction X ($(L_{\max} - L_{\min})/L_3$) is 10 or greater. For the sake of convenience, the value $((L_{\max} - L_{\min})/L_3)$ will hereinafter be called an unevenness change index. When a straight line L extending in the second direction Y is continuously moved in the first direction X, the more drastic the change is in the length m of the segments crossing over the depressed portions, the greater the unevenness change index is.

When two or more first straight lines L1 with the maximum total length of segments m crossing over the depressed portions of the texturing pattern are present in the first direction X and/or when two or more second straight lines L2 with the minimum total length of segments m crossing over the depressed portions of the texturing pattern are present in the first direction X, one of the first straight lines L1 and/or one of the second straight lines L2 is/are selected in such a manner that the distance between the first and second straight lines L1 and L2 is the shortest. The shortest distance between the selected two straight lines shall define the shortest distance L_3 in the first direction X.

[0018]

The hair capturing capabilities increase with the unevenness change index.

The unevenness change index is preferably 10 or greater, more preferably 15 or greater, even more preferably 20 or greater. The unevenness change index is preferably 50 or smaller, more preferably 45 or smaller, preferably 10 to 50, more preferably 15 to 45, even more preferably 20 to 40.

The reason why the hair capturing capabilities increase with the unevenness change index seems to be that, when the length of the segments m crossing over the depressed portions 4 of the texturing pattern, which corresponds to the length of the ribs of the patterning net over which a waterjet in the step of hydroentanglement is obstructed, changes more drastically, namely when the unevenness change index is greater, the degree of fiber entanglement of the fiber aggregate varies to a greater degree.

[0019]

The segments *m* of a straight line *L* extending in the second direction *Y* that cross over the depressed portions 4 of the texturing pattern are shown in Fig. 2. In Fig. 2, the segments *m* of the straight line *L* that cross over the depressed portions 4 of the texturing pattern are indicated by heavy lines. The total length of the segments *m* crossing over the depressed portions 4 of the texturing pattern is the total length of the segments *m* confined in the width of the measurement region in the second direction *Y*, i.e., 200 mm.

[0020]

According to the first embodiment of the wet cleaning sheet, since the pattern of the raised and depressed portions formed on the working side satisfies conditions 1 to 3, the wet cleaning sheet 1 is not only capable of removing fine dust, such as earthy and sandy dust, but also excellent in hair capturing capabilities.

[0021]

Fig. 3 is a plan view of the working side of a substrate sheet 2 of the wet cleaning sheet 1A according to the second embodiment, showing the texturing pattern of that side.

The texturing pattern of the second embodiment has macroscopically curved portions. The texturing pattern has a plurality of discrete raised portions separated from one another by the depressed portions 4. The individual raised portions 3 are surrounded by the depressed portions 4. The plurality of raised portions 3 include raised portions 33 to 36 different in plan view shape. In more detail, as illustrated in Fig. 3, the raised portions 3 include circular raised portion groups 30 that are arranged in a line in both the first direction *X* and the second direction *Y*. Each circular raised portion group 30 consists of one circular third raised portion 33 centered at point P3, four arcuate fourth raised portions 34 arranged to circumferentially surround the third raised portion 33, and four arcuate fifth raised portions 35 arranged to circumferentially surround the fourth raised portions 34. There are formed sixth raised portions 36 each encircled by four circular raised portion groups 30. The sixth raised portion 36 has a deformed square shape with its four sides concave inward.

[0022]

The wet cleaning sheet 1A of the second embodiment also has the working side of the substrate sheet 2 textured in a texturing pattern satisfying conditions 1 to 3.

Therefore, the wet cleaning sheet 1A is capable of not only removing fine dust, such as earthy and sandy dust, but also excellent in hair capturing capabilities. In Fig. 3 are shown the first straight line L1 having a maximum total length of its segments m that cross over depressed portions 4, the second straight line L2 having a minimum total length of its segments m that cross over depressed portions 4, and the shortest distance L3 between the first and second straight lines L1 and L2.

[0023]

It is preferred that the wet cleaning sheets 1 and 1A of the first and second embodiments have a non-uniform degree of fiber entanglement in planar direction on their working side in the interests of improving hair capturing capabilities. The variation in degree of fiber entanglement is preferably such that, when, as illustrated in Figs. 4(a), 4(b), and 4(c), a 120 mm-side square region of the surface (working side) of the cleaning sheet is divided into 12 mm-side square, small regions, and a tape stripping test is carried out on each small region, the standard deviation of the amount of fibers pulled out of the individual small regions is 0.6 mg or greater, more preferably 0.65 mg or greater. The standard deviation is preferably 0.8 mg or smaller, more preferably 0.7 mg or smaller, preferably 0.6 to 0.8 mg, more preferably 0.65 to 0.7 mg. The total amount of fibers pulled out of the 120 mm-side square regions is preferably 100 to 200 mg, more preferably 120 to 170 mg.

[0024]

In the invention, the tape stripping test was carried out on substrate sheets before being impregnated with a cleaning fluid in accordance with the procedures below.

Teptra® 12 mm wide standard tape (an adhesive tape available from King Jim) is cut into 12 mm lengths to prepare 12 mm-side square pieces of the adhesive tape, which are stuck one on each of a total of 100 small regions of a 120 mm-side square region of a substrate sheet using a pair of tweezers with no space between adjacent pieces as illustrated in Fig. 4(b). A load of 10 g is put on the 100 pieces of the adhesive tape to apply a 10 g load per piece. After the test specimen is allowed to stand at 20°C for 24 hours, each piece of the adhesive tape is stripped off and weighed to obtain the weight of the fibers adhering thereto in one tenth of milligram. In stripping off the piece, the piece is peeled diagonally from one of its lower corners with tweezers as illustrated in Fig. 4(c).

A standard deviation of the amount (mass) of fibers adhering to each of the 100

pieces is calculated.

[0025]

The substrate sheet 2 of the wet cleaning sheets 1 and 1A of the first and second embodiments is composed of a net 11 as a mesh sheet and a fiber aggregate on both sides of the net 11. The fiber aggregate has its fibers entangled among themselves and also with the mesh sheet to be united with the mesh sheet.

[0026]

The mesh sheet as a member composing the substrate sheet 2 is selected from a broad range of mesh sheet material including a perforated film. Examples of the mesh sheet include a net-like web formed of an aggregate of self-crimping fibers having developed crimps and being apertured as illustrated in Fig. 7 of Patent Literature 1 and an apertured film with a large number of apertures as illustrated in Fig. 8 of Patent Literature 1 as well as the net 11 shown in Fig. 5. The net 11 used as a mesh sheet has a lattice network. The shape of the openings of the net 11 may be altered variously.

[0027]

The fiber aggregate constituting one or both sides of the substrate sheet 2 is formed of entangled fibers. Examples of the fibers constituting the fiber aggregate include thermoplastic fibers, such as polyester fiber, polyamide fiber, and polyolefin fiber, and their conjugate fibers; microfibers manufactured from splittable fiber or by the melt-blowing process; semi-synthetic fibers, such as acetate fiber; regenerated fibers, such as cupra and rayon; natural fibers, such as cotton; and blends of the fibers recited above. A heat shrinkable net is preferred as a mesh sheet because a heat shrinkable net shrinks on heating in the production of the cleaning sheets 1 and 1A to form microscopic unevenness on the surface of the fiber aggregate. The heat shrinkable net may be made of thermoplastic polymers, including polyolefins, such as polyethylene, polypropylene, and polybutene; polyesters, such as polyethylene terephthalate and polybutylene terephthalate; polyamides, such as nylon 6 and nylon 66; acrylonitrile polymer; vinyl or vinylidene polymers, such as polyvinyl chloride and polyvinylidene chloride; and modified products, polyalloys, and polyblends of these thermoplastic polymers. Preferred are heat shrinkable nets designed to shrink either uniaxially or biaxially

according to the desired three-dimensional profile of the working side of the cleaning sheet or heat shrinkable nets made by weaving or knitting using heat shrinkable filaments made of the above recited thermoplastic fibers as at least one of the warp and weft, from which an appropriate selection is made in accordance with the desired profile of the working side of the cleaning sheet.

[0028]

In using the net 11 as a mesh sheet, the monofilament diameter is preferably 20 to 500 μm , more preferably 100 to 200 μm , and the aperture width is preferably 2 to 30 mm, more preferably 4 to 20 mm. In the case where the substrate sheet 2 has a fiber aggregate on both sides of a mesh sheet, the fiber aggregates on the two sides may be the same or different. When the two fiber aggregates on opposite sides are different, for example, in material, the wet cleaning sheet may be designed so that the two sides thereof may be used differently according to the task or the two sides may be different in hand.

The substrate sheet 2 may be composed of a mesh sheet and the fiber aggregate on only one side of the mesh sheet.

[0029]

The wet cleaning sheet of the invention is the substrate sheet 2 having been impregnated with a cleaning fluid.

The cleaning fluid is preferably an aqueous solution containing at least one of a surfactant, a solvent, and an alkali agent.

[0030]

The surfactant may be of various types, including nonionic, cationic, anionic, and amphoteric. Anionic surfactants include common sulfonates and sulfates. Examples of sulfonate surfactants include straight or branched chain alkyl (C8-C22) benzenesulfonates, long chain alkyl (C8-C22) sulfonates, and long chain olefin (C8-C22) sulfonates. Examples of sulfate surfactants include long chain monoalkyl (C8-C22) sulfate salts, polyoxyethylene (1-6 moles) long chain alkyl (C8-C22) ether sulfate salts, and polyoxyethylene (1-6 moles) alkyl (C8-C18) phenyl ether sulfate salts. The counter ion of the anionic surfactants can be cations of alkali metals, e.g., sodium and potassium, and alkanolamines, e.g., monoethanolamine, diethanolamine, and triethanolamine. Sulfonate

surfactants are preferred for their high resistance to hydrolysis, and long chain or branched chain alkyl benzenesulfonates are preferred in terms of cleansing power. Amphoteric surfactants include carbobetaines, sulfobetaines, and hydroxysulfobetaines each having a C8-C22 alkyl group. Nonionic surfactants include polyethylene glycol ethers, such as polyoxyethylene (6-35 moles) long chain alkyl or alkenyl (primary or secondary, C8-C22) ethers and polyoxyethylene (6-35 moles) alkyl (C8-C18) phenyl ethers; polyoxyethylene polyoxypropylene block copolymers; and polyhydric alcohol type, such as glycerol fatty acid esters, sorbitol fatty acid esters, and alkyl glycosides. Examples of the cationic surfactants include mono-long chain alkyl trimethylammonium salts, long chain alkyl dimethylammonium salts, and mono-long chain alkyl dimethylbenzylammonium salts each having a C10-C22 alkyl or alkenyl group.

[0031]

Examples of suitable solvents include alcohols, such as ethanol and isopropyl alcohol; glycols, such as ethylene glycol and propylene glycol; and glycol ethers, such as ethylene glycol monoethyl ether and propylene glycol monomethyl ether. Examples of suitable alkali agents include alkanolamines, such as monoethanolamine. If necessary, the cleaning fluid can contain additives, such as disinfectants, deodorants, and fragrances. The substrate sheet is preferably impregnated with 300% or more, more preferably 400% or more, preferably 800% or less, more preferably 500% or less, preferably 300% to 800%, more preferably 400% to 500%, of the cleaning fluid relative to the total mass of the fiber aggregate or aggregates.

[0032]

The wet cleaning sheets 1 and 1A of the foregoing embodiments can be used for cleaning either by hand or as attached to a handled cleaning implement. Use as attached to a handled cleaning implement is preferred for easy cleaning operations. Such a handled cleaning implement is exemplified by the one illustrated in Fig. 6, which includes a head 51 to which the wet cleaning sheet is attachable and a rod-like handle 53 connected to the head 51 via a universal joint 52. The lower side (the working side to be covered with the cleaning sheet) of the head 51 is oblong rectangular in plan view. The handled cleaning implement 5 with the wet cleaning sheet attached thereto is used, in a usual mode of usage, by moving the head 51 in the direction along the short side of the head 51 commonly in a forward and backward motion to achieve a cleaning operation.

That is, the direction parallel to the short side of the head 51 is the main moving direction M of the handled cleaning implement 5 in cleaning operations. In order to provide improved hair capturing performance, the wet cleaning sheet of the invention is preferably used with its second direction Y (which is perpendicular to the first direction X, i.e., the web running direction or the main orientation direction of the constituent fibers) coincident with the main moving direction M.

[0033]

Hence, it is preferred for providing excellent hair capturing capabilities that the wet cleaning sheet be used as attached to a handled cleaning implement having an oblong-rectangular plan-view shape on the working side of its head with its second direction Y coincident with the direction M parallel to the short side of the head 51 and with its first direction X coincident with the direction parallel to the long side of the head 51.

[0034]

A preferred method for making the wet cleaning sheet of the invention will then be described.

As illustrated in Fig. 7, fiber aggregates 12 are made using carding machines 21A and 21B and joined to the upper and lower side of a mesh sheet 11 fed from a stock roll 23 to make a continuous length layered structure 20 composed of the mesh sheet 11 and the fiber aggregate 12 on each side of the mesh sheet 11. The layered structure 20 is introduced into a water needling device 40. The fiber aggregates 12 are preferably formed from fiber webs.

As illustrated in Fig. 8, the water needling device 40 includes a rotary drum 41 which has its peripheral portion 41a formed of a large number of spring coils 41b extending in the axis of rotation and which serves as a water permeable support member. The water needling device 40 further includes: a patterning net 42 disposed on the peripheral portion 41a of the rotary drum 41; and a water injector 43 that jets a water stream from the outside toward the inside of the rotary drum 41. The patterning net 42 illustrated in Fig. 9 is designed to provide the texturing pattern shown in Fig. 1. The patterning net 42 has openings 31' and 32' the plan-view shapes of which are the same as those of the first and second raised portions 31 and 32, respectively, and opening-forming ribs 45 the plan-view shapes of which are the same as those of the depressed portions 4.

The patterning net 42 is made of a water resistant material, such as metals or plastics. As illustrated in Fig. 9, the opening-forming ribs 45 of the patterning net 42 have a large number of drain apertures 45a smaller than the width of the ribs 45 so that waterjet splattering on striking the ribs 45 may be prevented or reduced. The openings 31' and 32' of the patterning net 42 may be formed by punching or, preferably, laser cutting, which is less liable to cause distortion of the resulting patterning net 42 than punching. The drain apertures 45a are preferably formed by punching in order to prevent burr formation on the rim of the apertures.

A waterjet is directed to the continuous length layered structure 20 moving with the rotation of the rotary drum 41, whereupon the layered structure 20 is shaped to have depressed portions 4 corresponding to the ribs 45 of the patterning net 42 and raised portions 31 and 32 corresponding to the openings 31' and 32' of the net 42.

The patterning net 42 consists of ribs having in plan view macroscopically curved lines of the texturing pattern shown in Fig. 1.

[0035]

The waterjet of the water needling device applied to the layered structure 20 entangles the fibers of the fiber aggregate (fiber web) 12 on each side of the mesh sheet 11 not only among themselves but also with the mesh sheet 11 and with the fibers of their respectively opposite side fiber aggregate 12, thereby providing the substrate sheet 2 having the three layers united together and having its surface textured according to the texturing pattern shown in Fig. 1.

[0036]

The resulting substrate sheet 2 is forwarded to a heater 28 where it is heat treated to dry. When the mesh sheet 11 is heat-shrinkable, the mesh sheet 11 of the substrate sheet 2 is caused to shrink by the heat treatment, whereby fine unevenness are formed on the surface of the individual raised portions formed in the hydroentanglement step. The heat treated substrate sheet 2 is then impregnated with a cleaning fluid. Impregnation with a cleaning fluid may be carried out by any methods, for example, by spraying a cleaning fluid onto the substrate sheet 2 using a sprayer 27 intermediate between a pair of nip rollers 26 and a winder 29 as illustrated in Fig. 7. Alternatively, a cleaning fluid may be applied before the heat treatment. The resulting cleaning fluid-impregnated cleaning sheet may be wound into roll as illustrated in Fig. 7 or cut to lengths and, if needed,

folded, and packaged.

The wet cleaning sheet of the invention is thus produced efficiently. According to the above described embodiment of the method of production, since drastic changes occurs in the length of the ribs of the patterning net over which a waterjet is obstructed in the hydroentanglement step, which corresponds to the length of the segments *m* crossing over the depressed portions 4 of the texturing pattern, the resulting substrate sheet and wet cleaning sheet exhibit a large variation in the degree of fiber entanglement of the fiber aggregates in a planar direction. The first direction X of the wet cleaning sheet is coincident with the running direction (MD) of the layered structure 20 to which a waterjet is applied in the hydroentanglement step.

[0037]

The wet cleaning sheet of the invention preferably has a profiled working surface in such a manner that the difference in height between the top of the raised portion 3 and the bottom of the depressed portion 4 is 0.5 mm or more, more preferably 1.2 mm or more, preferably 0.5 to 5 mm, more preferably 1 to 2.5 mm. The difference in height is measured through observation of a cross-section of the sheet with no load applied thereon. The fiber aggregate of the wet cleaning sheet of the invention preferably has a basis weight of 50 g/m² or more, more preferably 65 g/m² or more, preferably 100 g/m² or less, more preferably 80 g/m² or less, preferably 50 to 100 g/m², more preferably 65 to 80 g/m².

While the invention has been described on the basis of its preferred embodiments, it should be understood that the invention is not limited to the embodiments.

[0038]

The following clauses are disclosed with respect to the foregoing embodiments of the wet cleaning sheet according to the invention.

(1) A wet cleaning sheet comprising a substrate sheet impregnated with a cleaning fluid,

the substrate sheet having a working surface and comprising: a mesh sheet; and a fiber aggregate joined to one or both sides of the mesh sheet in such a manner that the fibers of the fiber aggregate are entangled among themselves and with the mesh sheet,

the substrate sheet having, on the working surface thereof, raised portions and depressed portions, the raised portions and the depressed portions being arranged so as to form a texturing pattern having macroscopically curved portions,

the texturing pattern containing a borderline which is located between the raised portion and the depressed portion and which has length of at least 10 mm per cm², and the raised portions each being surrounded by the depressed portions and having an area of at least 300 mm²,

the substrate sheet having: a first direction corresponding to the machine direction or the main orientation direction of the constituent fibers; and a second direction perpendicular to the first direction, and

on drawing imaginary straight lines extending in the second direction within a rectangular region 280 mm long in the first direction and 200 mm wide in the second direction to determine a first straight line having a maximum total length of its segments that cross over any depressed portion and a second straight line having a minimum total length of its segments that cross over any depressed portion, the difference between the maximum and minimum total lengths divided by a shortest distance between the first and second straight lines in the first direction being 10 or greater.

[0039]

(2) The wet cleaning sheet as set forth in clause (1), wherein the raised portions are discrete in a planar direction of the texturing pattern, being separated from each other by the depressed portions and each being surrounded by the depressed portions.

(3) The wet cleaning sheet as set forth in clause (1) or (2), wherein the texturing pattern contains the raised portions having a plurality of plan-view shapes.

(4) The wet cleaning sheet as set forth in any one of clauses (1) to (3), wherein the texturing pattern comprises, as the raised portions, a first raised portion and a second raised portion, the first raised portion having a generally triangular shape defined by three first arcs a of a circle centered at point P1 and three second arcs b each positioned intermediate between adjacent first arcs a and having opposite convexity to the arcs a, and the second raised portion being defined by one arc c of a circle centered at point P2 which is different from P1, two arcs d each facing the arc c, and a generally pentagonal figure e projecting between the two arcs d toward point P2.

(5) The wet cleaning sheet as set forth in clause (4), wherein the circle centered at point P1 and the circle centered at point P2 have the same radius.

[0040]

(6) The wet cleaning sheet as set forth in clause (4) or (5), wherein point P1 is

positioned outside of the circle centered at point P2 and having the arc c, and point P2 is positioned outside of the circle centered at point P1 and having the three first arcs a.

(7) The wet cleaning sheet as set forth in any one of clauses (4) to (6), wherein the three second raised portions are regularly spaced circumferentially around point P2, and a part of the first raised portion containing one of the three first arcs a is located in between any adjacent two out of the three regularly spaced second raised portions.

(8) The wet cleaning sheet as set forth in any one of clauses (1) to (3), wherein the texturing pattern comprises circular raised portion groups arranged in a line in both the first direction and second directions, and

each circular raised portion group comprises, as the raised portions, one circular third raised portion centered at point P3, four arcuate fourth raised portions circumferentially surrounding the third raised portion, and four arcuate fifth raised portions circumferentially surrounding the fourth raised portions.

(9) The wet cleaning sheet as set forth in clause (8), wherein the texturing pattern further contains sixth raised portions each encircled by four of the circular raised portion groups.

(10) The wet cleaning sheet as set forth in clause (9), wherein the sixth raised portions each have a deformed square shape with its four sides concave inward.

[0041]

(11) The wet cleaning sheet as set forth in any one of clauses (1) to (10), wherein the texturing pattern has a specific borderline length of at least 10 mm, preferably 11 mm or greater and 50 mm or smaller, more preferably 30 mm or smaller, preferably 10 to 50 mm, more preferably 11 to 30 mm.

(12) The wet cleaning sheet as set forth in any one of clauses (1) to (11), wherein the depressed portions have tiny projections corresponding to drain apertures.

(13) The wet cleaning sheet as set forth in any one of clauses (1) to (12), wherein the difference between the maximum total length of segments of the first straight line that cross over any depressed portion and the minimum total length of segments of the second straight line that cross over any depressed portion divided by a shortest distance between the first straight line and the second straight line in the first direction X is preferably 15 or greater, more preferably 20 or greater.

(14) The wet cleaning sheet as set forth in any one of clauses (1) to (13), wherein the difference between the maximum total length of segments of the first straight line that

cross over any depressed portion and the minimum total length of segments of the second straight line that cross over any depressed portion divided by a shortest distance between the first straight line and the second straight line in the first direction X is preferably 50 or smaller, more preferably 45 or smaller.

(15) The wet cleaning sheet as set forth in clause (13) or (14), wherein the difference between the maximum total length and the minimum total length divided by a shortest distance between the first and the second straight line in the first direction X is preferably 10 to 50, more preferably 15 to 45, even more preferably 20 to 40.

[0042]

(16) The wet cleaning sheet as set forth in any one of clauses (1) to (15), wherein the mesh sheet includes a net-like web formed of an aggregate of self-crimping fibers having developed crimps and being apertured.

(17) The wet cleaning sheet as set forth in any one of clauses (1) to (15), wherein the mesh sheet is an apertured film having a large number of apertures.

(18) The wet cleaning sheet as set forth in any one of clauses (1) to (17), wherein the substrate sheet has the fiber aggregate on each side of the mesh sheet, the fiber aggregates on the two sides being the same.

(19) The wet cleaning sheet as set forth in any one of clauses (1) to (17), wherein the substrate sheet has the fiber aggregate on each side of the mesh sheet, the fiber aggregates on the two sides being different.

(20) The wet cleaning sheet as set forth in any one of clauses (1) to (17), wherein the substrate sheet has the fiber aggregate on one side of the mesh sheet.

[0043]

(21) The wet cleaning sheet as set forth in any one of clauses (1) to (20), wherein the substrate sheet has a non-uniform degree of fiber entanglement in a planar direction in such a manner that, when a 120 mm-side square region of the substrate sheet is divided into 12 mm-side square, small regions, and a tape stripping test is carried out on each small region, the standard deviation of the amount of fibers pulled out of the individual small regions is 0.6 mg or greater.

(22) The wet cleaning sheet as set forth in any one of clauses (1) to (19), being used as attached to a handled cleaning implement.

(23) The wet cleaning sheet as set forth in clause (22), wherein the handled cleaning

implement includes a head to which the wet cleaning sheet is attachable and a rod-like handle connected to the head.

(24) The wet cleaning sheet as set forth in clause (23), wherein the working side of the head to which the wet cleaning sheet is to be attached is oblong-rectangular in plan view.

(25) The wet cleaning sheet as set forth in any one of clauses (1) to (24), being used as attached to a handled cleaning implement having a head the working side of which is oblong-rectangular in plan view,

the wet cleaning sheet being adapted to be attached to the working side of the head with its second direction Y coincident with the direction parallel to the short side of the working side of the head and its first direction coincident with the direction parallel to the long side of the working side of the head.

[0044]

(26) The wet cleaning sheet as set forth in any one of clauses (1) to (25), wherein all or most of the raised portions surrounded by the depressed portions have an area of 300 mm^2 or more.

(27) A method for making a wet cleaning sheet comprising the step of hydroentanglement, in which a continuous length layered structure composed of a mesh sheet and a fiber aggregate arranged on one or both sides of the mesh sheet is introduced onto a water permeable support member having thereon a patterning net having openings and curved ribs in plan view, and a waterjet is applied to the layered structure moving with the water permeable support member to make a substrate sheet having depressed portions corresponding to the ribs and raised portions corresponding to the openings.

Examples

[0045]

The invention will now be illustrated in greater detail with reference to Examples, but it should be understood that the invention is not construed as being limited thereto.

Example 1

A substrate sheet with a textured surface on its working side in the pattern illustrated in Fig. 1 was prepared using the materials described below and the patterning

net illustrated in Fig. 9. The resulting substrate sheet was impregnated with 350 mass% of a cleaning fluid described below relative to the total mass of the fiber aggregates of the substrate sheet to obtain a wet cleaning sheet of Example 1.

Materials of substrate sheet:

Mesh sheet: a polypropylene net illustrated in Fig. 5 having a monofilament diameter of 200 μm and an aperture width of 10 mm.

Fiber aggregate: a carded web made of mixed staple fibers composed of PET fibers (thickness: 11.5 μm), acrylic fibers (thickness: 10.5 μm), and rayon fibers (thickness: 12 μm).

Formulation of cleaning fluid:

A cleaning fluid containing at least 0.1% of a cleansing base, at least 1% of an alcohol, and 50% or more of purified water.

[0046]

Example 2

A wet cleaning sheet of Example 2 was made in the same manner as in Example 1, except for changing the patterning net so as to result in the formation of the textured surface in the pattern illustrated in Fig. 3.

Comparative Example 1

A wet cleaning sheet of Comparative Example 1 was made in the same manner as in Example 1, except for changing the patterning net so as to result in the formation of the textured surface in the pattern illustrated in Fig. 10.

Comparative Example 2

A wet cleaning sheet of Comparative Example 2 was made in the same manner as in Example 1, except for using no patterning net on the rotary drum.

[0047]

The specific borderline length defined above, the smallest area of the raised portions surrounded by the depressed portions, and the unevenness change index of the

wet cleaning sheets obtained in Examples and Comparative Examples were determined. The results are shown in Table 1 below.

The first and second raised portions 31 and 32 of the wet cleaning sheet of Example 1 had an area of 1192 mm^2 and 712 mm^2 , respectively. The second raised portions 32 had the smallest area.

The third to sixth raised portions 33, 34, 35, and 36 of the wet cleaning sheet of Example 2 had an area of 707 mm^2 , 348 mm^2 , 600 mm^2 , and 1457 mm^2 , respectively. The fourth raised portions 34 had the smallest area.

In order to examine the variation in degree of fiber entanglement, the tape stripping test was conducted to determine the total amount of fibers pulled out of a 120 mm-side square region of each cleaning sheet and the standard deviation of the amount of fibers pulled out of individual small regions. The results obtained are also shown in Table 1.

For reference, the black portions in Fig. 9 of Patent Literature 1 and the cross-shaped openings of the apertured film 14 shown in Fig. 8(a) of Patent Literature 2 were taken as raised portions, and the specific borderline length, area of the individual raised portions, and unevenness change index were determined. The results are shown in Table 1 as Reference Examples 1 and 2.

[0048]

Evaluation:

The wet cleaning sheets of Examples and Comparative Examples were evaluated for capabilities of capturing fine dust and hairs. The results are shown in Table 1.

[0049]

1. Fine dust capturing capabilities

One gram of test powder class 7 (specified in JIS Z8901) having a composition near to that of fine earthy and sandy dust was evenly spread over a 90 cm by 30 cm area of a wooden floor. The wet cleaning sheet was attached to the head 51 of the handled cleaning implement 5 illustrated in Fig. 6. The class 7 test powder-dusted area of the floor was cleaned by giving ten, two-way (forward-and-backward) mopping motions of the cleaning sheet in the direction parallel to the short side of the head (direction M in Fig. 6), and the total mass of the dust collected by the cleaning sheet was measured. The ratio of the mass of the collected dust to 1 g was calculated to give fine dust capturing

ratio (%), which is shown in Table 1.

[0050]

2. Hair capturing capabilities:

Ten human hairs of 10 cm in length were placed on a 30 cm by 15 cm area of a wooden floor in regularly spaced, aligned and parallel relation with their longitudinal direction coincident with the direction parallel to the short side of the area. The wet cleaning sheet was attached to the head 51 of the handled cleaning implement 5 shown in Fig. 6. The area with the hairs was cleaned by giving two, two-way mopping motions of the wet cleaning sheet along the direction parallel to the short side, and the number of hairs caught on the sheet was counted. The ratio of the number of the captured hairs to the total number of hairs initially placed on the floor was calculated to give a hair capturing ratio (%), which is shown in Table 1.

[0051]

Table 1

	unit	Example 1	Example 2	Compara. Example 1	Compara. Example 2	Ref. Example 1	Ref. Example 2	Remarks
Specific Borderline Length	mm/cm ²	11.5	11	8	-	46	15	Condition 1
Smallest Area of Raised Portions	mm ²	712	348	763	-	24	144	Condition 2
Lmax	mm	108	104	60	-	161	150	
Lmin	mm	24	52	52	-	52.5	95	
Lmax - Lmin	mm	84	52	8	-	108.5	55	
L1/L2 Minimum Distance (L3)	mm	2.5	5	3.5	-	2.5	6	Condition 3
Unevenness Change Index (Lmax-Lmin/L3)		33.6	10.4	2.3	-	43.4	9.2	
Standard Deviation of Amount of Fibers Pulled out	mg	0.88	0.69	0.58	0.67	-	-	
Total Amount of Fibers Pulled out	mg	152.5	156.9	124.7	237.7	-	-	
Fine Dust Capturing Ratio	%	76.8	78.4	74.7	79	-	-	
Hair Capturing Ratio	%	73	53	50	20	-	-	

[0052]

As is apparent from Table 1, the wet cleaning sheets of Examples 1 and 2 exhibit good fine dust capturing capabilities equal to those of Comparative Examples 1 and 2. With respect to hair capturing capabilities, the wet cleaning sheets of Examples 1 and 2 show obvious improvement compared with those of Comparative Examples 1 and 2. The substrate sheets of the wet cleaning sheets of Examples 1 and 2 have a larger standard deviation, which is indicative of a larger variation in degree of fiber entanglement, than that of Comparative Example 1.

Industrial Applicability

[0053]

The wet cleaning sheet of the invention is not only capable of removing fine dust, such as earthy and sandy dust, but also excellent in hair capturing capabilities. The method of the invention enables efficient production of such a wet cleaning sheet.

CLAIMS

1. A wet cleaning sheet comprising a substrate sheet impregnated with a cleaning fluid,

the substrate sheet having a working surface and comprising: a mesh sheet; and a fiber aggregate joined to one or both sides of the mesh sheet in such a manner that the fibers of the fiber aggregate are entangled among themselves and with the mesh sheet,

the substrate sheet having, on the working surface thereof, raised portions and depressed portions, the raised portions and the depressed portions being arranged so as to form a texturing pattern having macroscopically curved portions,

the texturing pattern containing a borderline which is located between the raised portion and the depressed portion and which has length of at least 10 mm per cm², and the raised portions each being surrounded by the depressed portions and having an area of at least 300 mm²,

the substrate sheet having: a first direction corresponding to the machine direction or the main orientation direction of the constituent fibers; and a second direction perpendicular to the first direction, and

on drawing imaginary straight lines extending in the second direction within a rectangular region 280 mm long in the first direction and 200 mm wide in the second direction to determine a first straight line having a maximum total length of its segments that cross over any depressed portion and a second straight line having a minimum total length of its segments that cross over any depressed portion, the difference between the maximum and minimum total lengths divided by a shortest distance between the first and second straight lines in the first direction being 10 or greater.

2. The wet cleaning sheet according to claim 1, wherein the raised portions are discrete in planar directions of the texturing pattern, being separated from each other by the depressed portions and each being surrounded by the depressed portions.

3. The wet cleaning sheet according to claim 1 or 2, wherein the texturing pattern contains the raised portions having a plurality of plan-view shapes.

4. The wet cleaning sheet according to any one of claims 1 to 3, wherein the

texturing pattern comprises, as the raised portions, a first raised portion and a second raised portion, the first raised portion having a generally triangular shape defined by three first arcs a of a circle centered at point P1 and three second arcs b each positioned intermediate between adjacent first arcs a and having opposite convexity to the arcs a, and the second raised portion being defined by one arc c of a circle centered at point P2 which is different from P1, two arcs d each facing the arc c, and a generally pentagonal figure e projecting between the two arcs d toward point P2.

5. The wet cleaning sheet according to claim 4, wherein the circle centered at point P1 and the circle centered at point P2 have the same radius.

6. The wet cleaning sheet according to claim 4 or 5, wherein point P1 is positioned outside of the circle centered at point P2 and having the arc c, and point P2 is positioned outside of the circle centered at point P1 and having the three first arcs a.

7. The wet cleaning sheet according to any one of claims 4 to 6, wherein the three second raised portions are regularly spaced circumferentially around point P2, and a part of the first raised portion containing one of the three first arcs a is located in between any adjacent two out of the three regularly spaced second raised portions.

8. The wet cleaning sheet according to any one of claims 1 to 3, wherein the texturing pattern comprises circular raised portion groups arranged in a line in both the first direction and second directions, and

each circular raised portion group comprises, as the raised portions, one circular third raised portion centered at point P3, four arcuate fourth raised portions circumferentially surrounding the third raised portion, and four arcuate fifth raised portions circumferentially surrounding the fourth raised portions.

9. The wet cleaning sheet according to claim 8, wherein the texturing pattern further comprises sixth raised portions each encircled by four of the circular raised portion groups.

10. The wet cleaning sheet according to claim 9, wherein the sixth raised portions

each have a deformed square shape with its four sides concave inward.

11. The wet cleaning sheet according to any one of claims 1 to 10, wherein the texturing pattern has a specific borderline length of 10 to 50 mm.

12. The wet cleaning sheet according to any one of claims 1 to 11, wherein the depressed portions have tiny projections corresponding to drain apertures.

13. The wet cleaning sheet according to any one of claims 1 to 12, wherein the texturing pattern has imaginary straight lines including a first straight line having a maximum total length of its segments that cross over any depressed portion and a second straight line having a minimum total length of its segments that cross over any depressed portion,

the difference between the maximum and minimum total lengths divided by a shortest distance between the first and the second straight line in the first direction X is 15 or greater.

14. The wet cleaning sheet according to any one of claims 1 to 13, wherein the texturing pattern has imaginary straight lines including a first straight line having a maximum total length of its segments that cross over any depressed portion and a second straight line having a minimum total length of its segments that cross over any depressed portion,

the difference between the maximum and minimum total lengths divided by a shortest distance between the first and second straight lines in the first direction X is 50 or smaller.

15. The wet cleaning sheet according to claim 13 or 14, wherein the difference between the maximum and minimum total lengths divided by the shortest distance between the first and second straight lines in the first direction X is 10 to 50.

16. The wet cleaning sheet according to any one of claims 1 to 15, wherein the mesh sheet is a net-like web formed of an aggregate of self-crimping fibers having developed crimps and being apertured.

17. The wet cleaning sheet according to any one of claims 1 to 15, wherein the mesh sheet is an apertured film having a large number of apertures.

18. The wet cleaning sheet according to any one of claims 1 to 17, wherein the substrate sheet has the fiber aggregate on each side of the mesh sheet, the fiber aggregates on the two sides being the same.

19. The wet cleaning sheet according to any one of claims 1 to 17, wherein the substrate sheet has the fiber aggregate on each side of the mesh sheet, the fiber aggregates on the two sides being different.

20. The wet cleaning sheet according to any one of claims 1 to 17, wherein the substrate sheet has the fiber aggregate on one side of the mesh sheet.

21. The wet cleaning sheet according to any one of claims 1 to 20, wherein the substrate sheet has a non-uniform degree of fiber entanglement in planar directions in such a manner that, when a 120 mm-side square region of the substrate sheet is divided into 12 mm-side square, small regions, and a tape stripping test is carried out on each small region, the standard deviation of the amount of fibers pulled out of the individual small regions is 0.6 mg or greater.

22. The wet cleaning sheet according to any one of claims 1 to 19, being used as attached to a handled cleaning implement.

23. The wet cleaning sheet according to claim 22, wherein the handled cleaning implement comprises a head to which the wet cleaning sheet is attachable and a rod-like handle connected to the head.

24. The wet cleaning sheet according to claim 23, wherein the working side of the head to which the wet cleaning sheet is to be attached is oblong-rectangular in plan view.

25. The wet cleaning sheet according to any one of claims 1 to 24, being used as

attached to a handled cleaning implement having a head the working side of which is oblong-rectangular in plan view,

the wet cleaning sheet being adapted to be attached to the working side of the head with its second direction Y coincident with the direction parallel to the short side of the working side of the head and its first direction coincident with the direction parallel to the long side of the working side of the head.

26. A method for making the wet cleaning sheet according to any one of claims 1 to 25, comprising the step of hydroentanglement, in which

a continuous length layered structure composed of a mesh sheet and a fiber aggregate arranged on one or both sides of the mesh sheet is introduced onto a water permeable support member having thereon a patterning net having openings and curved ribs in plan view, and a waterjet is applied to the layered structure moving with the water permeable support member to make a substrate sheet having depressed portions corresponding to the ribs and raised portions corresponding to the openings.