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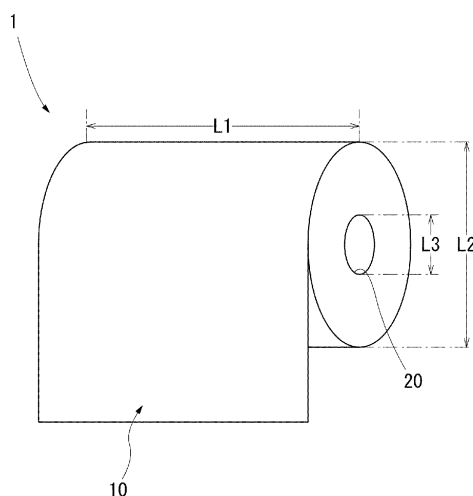
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(54) **TOILET PAPER**

(57) To provide toilet paper which is hardly torn in wiping other than the human body and is excellent in texture at the time of wiping humans.

To solve such problem, in three or four-ply toilet paper, a basis weight per ply of the toilet paper is 14.9 g/m² or more and 16.2 g/m² or less, an overall paper thickness is 297 μ m or more and 435 μ m or less, a dry tensile strength in a longitudinal direction is 451 cN/25 mm or more and 1001 cN/25 mm or less, and a ratio of a wet tensile strength in a horizontal direction to a dry tensile strength in a horizontal direction is 0.09 or more.

FIG. 1



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Description

Technical Field

5 **[0001]** The present invention relates to toilet paper. In particular, the present invention relates to toilet paper used for wiping the human body after excretion and wiping other than the human body.

Background Art

10 **[0002]** Toilet paper is mainly used for cleaning after excretion, but other uses vary by region, area, and country. Some toilet paper products are specially designed for cleaning after excretion, and some products are also used as substitutes for highly versatile tissue paper that is often used for facial use such as nose stuffing, and for wiping other than the human body, such as various articles and tables.

15 **[0003]** In this type of toilet paper, it is important to be difficult to tear as general-purpose tissue paper that is frequently used, and also since it is used for wiping after excretion, softness and fullness are also required. Furthermore, water disintegration is also required, assuming that it is disposed of in flush toilets.

[0004] However, toilet paper having such a strong property of tissue paper substitution is thick and hard to increase the resistance to tearing, and the texture is inferior to the dedicated product.

20 Citation List

Patent Literature

25 **[0005]** Patent Literature 1: JP 2017-169681A

Summary of Invention

Technical Problem

30 **[0006]** Therefore, a main object of the present invention is to provide toilet paper with excellent texture as well as strength that is excellent in versatility such as wiping of articles other than wiping after excretion.

Solution to Problem

35 **[0007]** Means for solving the above problems are as follows.

[0008] In the first means,
in toilet paper that is three or four-ply toilet paper,
a basis weight per ply of the toilet paper is 14.9 g/m² or more and 16.2 g/m² or less, an overall paper thickness is 297
40 μm or more and 435 μm or less,
a dry tensile strength in a longitudinal direction is 451 cN/25 mm or more and 1001 cN/25 mm or less, and
a ratio of a wet tensile strength in a horizontal direction to a dry tensile strength in a horizontal direction is 0.09 or more.

[0009] In the second means, the toilet paper according to the first means, whose water absorption rate is less than 2.6 seconds, is used.

45 **[0010]** In the third means, the toilet paper according to the first means, whose water disintegration is within 36 seconds, is used.

Advantageous Effects of Invention

50 **[0011]** According to the present invention, there is provided toilet paper with excellent texture as well as excellent strength when it is used for general purpose such as wiping of articles other than wiping after excretion.

Brief Description of Drawings

[0012]

55 Fig. 1 is a perspective view of a toilet paper roll according to an embodiment described herein.
 Fig. 2 is a view illustrating an MMD measuring device.

Description of Embodiments

[0013] The toilet paper according to the present embodiment is particularly suitable, for example, in the form of a rolled toilet paper roll formed in a long strip shape and wound around a paper tube. In the case of the toilet paper roll form, it is desirable that the dimensions, etc. be 101 to 106 mm in width L1, 100 to 120 mm in diameter L2, 18 to 70m in roll length (maximum length of toilet paper), and 35 to 50 mm in paper tube inner diameter L3. When the toilet paper roll has such size, a common toilet paper roll paper holder can be used, and can be easily used for wiping after excretion in a toilet space. Further, the length of the toilet paper is sufficient for general use such as tissue paper in addition to the above-described use for wiping after excretion.

[0014] The toilet paper according to the present invention is non-moisturizing agent applied toilet paper to which no moisturizing agent is substantially added by external application or the like. Examples of the moisturizing agents as external additives are polyols including polyhydric alcohols such as glycerin, diglycerin, propylene glycol, 1,3-butylene glycol, and polyethylene glycol, and saccharide such as sorbitol, glucose, xylitol, maltose, maltitol, mannitol, and trehalose. However, it is not denied that the above components are contained if they affects only to the extent not to worthy of moisturizing toilet paper. When a moisturizing agent is applied, it is difficult to secure strength. However, softeners or soft moisturizing agents that determine the softness and paper strength of the base paper itself to be internally added during papermaking may be added. Examples of the softener include fatty acid polyester-based compounds and fatty acid amide-based compounds. Among them, the fatty acid amide-based compound has an effect of coating a fiber surface.

[0015] The toilet paper according to the present embodiment has a three or four-ply structure. That is, three sheets are stacked to form one set, or four sheets are stacked to form one set. By having a multi-ply structure such as three-ply or four-ply, the overall paper thickness can be increased while making each ply thin, in particular, it is possible to enhance the texture such as "softness" and "fullness" and to make it harder to tear. Note that, in the case of two-ply, it is difficult to develop a sense of thickness, and it is easy to feel weakness in tearing resistance when used for wiping articles as a general-purpose product. In addition, in the case of five-ply or more, even if each ply is thinned, it becomes difficult to feel the softness when the skin is wiped in whole, and it becomes difficult to develop good texture, and when each ply is too thin, it tends to tear. In particular, in the case of five-ply or more, embossing is applied, a strong sense of rigidity is felt. The toilet paper according to this embodiment has the following characteristics in either of the three plies or four plies, such that the toilet paper is resistant to tearing and excellent in texture.

[0016] The toilet paper according to the present embodiment has three or four-ply structure, and when the following basis weight, paper thickness, the ratio of the wet tensile strength in the horizontal direction to the dry tensile strength in the longitudinal direction and the dry tensile strength in the horizontal direction are all satisfied, the toilet paper is hard to tear and has excellent texture.

[0017] The toilet paper according to the present embodiment has a basis weight of 14.9 g/m² or more and 16.2 g/m² or less per ply. When the basis weight of one ply is within this range, in the case of the above three or four-ply structure, the toilet paper is sufficiently hard to tear and has good texture, and also it is easy to develop water disintegration.

[0018] In the toilet paper according to the present embodiment, the total thickness of the three plies or four plies is 297 μm or more and 435 μm or less. When the paper thickness is within this range, sufficient tear resistance can be ensured in the case of three or four plies with the above basis weight, and the texture can be further improved, and the softness can be particularly improved.

[0019] Note that the basis weight according to the present invention is based on the basis weight measuring method based on JIS P 8124 (1998). The paper thickness is obtained by sufficiently conditioning a test piece under the conditions of JIS P 8111 (1998) and then measuring the thickness of the test piece using a dial thickness gauge (thickness measuring instrument) "PEACOCK G type" (made by OZAKI MFG CO., LTD.) under the same conditions. Specifically, a plunger is placed on a measurement stand after confirming that there is no dust or dirt between the plunger and the measuring stand, a memory of the dial thickness gauge is moved to set a zero point, then the plunger is moved up to place a test piece on a measurement stand, the plunger is moved down slowly, and a gauge is read at this time. At the time of measurement, it is necessary to consider that the terminal of a metal plunger (a circular plane having a diameter of 10 mm) is perpendicular to a paper plane. Note that the load at the time of measuring the paper thickness is about 70 gf.

[0020] The toilet paper according to the present embodiment has a dry tensile strength in the longitudinal direction of 451 cN/25 mm or more and 1001 cN/25 mm or less. This dry tensile strength is a very high value compared to a product dedicated to wiping after excretion. First, the toilet paper of the present embodiment has such a high dry tensile strength and does not easily break when used for general purposes. Further, when the dry tensile strength in the longitudinal direction is high, the smoothness of the texture becomes particularly easy to develop.

[0021] In the toilet paper of the present embodiment, the ratio of the wet tensile strength in the horizontal direction to the dry tensile strength in the horizontal direction is 0.09 or more. This is a higher value than the conventional product. Here, it is said that the "dry tensile strength in the horizontal direction" has an influence not on individual functionalities such as "softness" and "fullness" but on the overall "texture" functionalities. When an evaluator evaluates the tissue paper using only the comprehensive evaluation criteria of "texture" after the evaluator freely touches the sample, instead

of the specific evaluation criteria such as "softness" and "fullness", it has been found that there is a certain correlation between the evaluation of the "texture" and the "dry strength in the horizontal direction". The dry tensile strength in the horizontal direction is desirably 180 cN/25 mm or more and 395 cN/25 mm or less. On the other hand, the horizontal wet paper strength tends to show the weakest value among the indexes indicating the strength of paper. When the horizontal wet paper strength is high, the toilet paper is excellent in wiping durability in a wet state, and is excellent in security at the time of wiping after use of a so-called shower toilet. In the toilet paper roll according to the present embodiment, the ratio of the wet tensile strength in the horizontal direction to the dry tensile strength in the horizontal direction is as high as 0.09 or more. In other words, it has an excellent balance between texture and durability. Here, regarding the wet tensile strength in the horizontal direction, it is desirable that the thickness be 25 cN/25 mm or more and 40 cN/25 mm or less from the viewpoint of not being teared in actual use such as wiping after excretion in a toilet space and having to have a sense of security at the time of wiping. In this range, when the ratio of the wet tensile strength in the horizontal direction to the dry tensile strength in the horizontal direction is 0.09 or more, it is very preferable to secure softness during use.

[0022] Note that the longitudinal direction of the paper is also referred to as a machine direction (MD) and is the flow direction during papermaking. The horizontal direction of the paper is also referred to as a cross direction (CD) and is a direction perpendicular to the flow direction (MD) during papermaking. Further, the dry tensile strength according to the present invention is a value measured based on JIS P 8113 (2006), and is measured as follows. A test piece used is cut to a width of about 25 mm (± 0.5 mm) and a length of about 150 mm in both the longitudinal and horizontal directions. The test piece is measured with multiple plies. As a tester, a load cell tensile tester TG-200N manufactured by Minebea Co., Ltd. or its equivalent is used. Note that the gripping interval is set to 100 mm and the pulling speed is set to 100 mm/min. The measurement is performed in the procedure of tightening both ends of a test piece to grips of the tester, applying a tensile load on the piece of paper in an up-down direction, and reading the indicated value (digital value) when the paper breaks. Five sets of samples are prepared and measured in each of the longitudinal and horizontal directions five times, and the average of the measured values is defined as the dry tensile strength in each direction. The product is measured for dry tensile strength by stacking a plurality of sheets according to the number of plies of the product. With respect to the base paper, multiple sheets are laminated, and the dry tensile strength is measured according to the number of plies of the product.

[0023] Further, the wet tensile strength is a value measured based on JIS P 8135 (1998), and is measured as follows. A test piece used is cut to a width of about 25 mm (± 0.5 mm) and a length of about 150 mm in both the longitudinal and horizontal directions. In the case of multi-ply tissue paper, the measurement is performed with multiple plies. As a tester, a load cell tensile tester TG-200N manufactured by Minebea Co., Ltd. or its equivalent is used. Note that the gripping interval is set to 100 mm and the pulling speed is set to 50 mm/min. The test piece used is one that has been cured by a dryer at 105°C for 10 minutes. The measurement is performed in the procedure of, after tightening both ends of the test piece to grips of the tester, applying water horizontally at a width of about 10 mm to the center of the test piece by using a flat brush soaked in water, after that, immediately applying a tensile load to the piece of paper in the up-down direction, and reading the indicated value (digital value) when the paper breaks. Five sets of samples are prepared and measured in each of the longitudinal and horizontal directions five times, and the average of the measured values is defined as the wet tensile strength in each direction. Regarding the wet tensile strength, multiple sheets are laminated and the wet tensile strength is measured according to the number of plies of the product.

[0024] In the toilet paper of the present embodiment, it is desirable that the value of MMD, which is an index indicating the surface property, be 6.6 or more and 10.3 or less. If the MMD is less than 6.6, the surface excessively slides, and the wiping properties decrease, and if it exceeds 10.3, the texture is deteriorated, and the toilet paper may not be suitable for use as toilet paper. Note that, in the measurement of MMD, using the measuring device 100 illustrated in Fig. 2, while bringing the contact surface of a friction element into contact with the surface of the measurement sample to which a tension of 20 g/cm is applied in a predetermined direction at a contact pressure of 25 g, moving 2 cm at a speed of 0.1 cm/s in substantially the same direction as the direction in which the tension is applied, the friction coefficient at this time is measured using a friction tester KES-SE (manufactured by KATO TECH CO., LTD.) or its equivalent. The value obtained by dividing the friction coefficient by a friction distance (moving distance = 2 cm) is MMD. The friction element is formed of twenty piano wires P each having a diameter of 0.5 mm adjacent to one another, and has a contact surface formed to have a length and a width of 10 mm. The contact surface is formed with a unit bulging portion whose tip is formed of twenty piano wires P (curvature radius: 0.25 mm).

[0025] The toilet paper according to the present embodiment desirably has a softness of 1.8 cN/100 mm or more and 3.5 cN/100 mm or less. Softness is one of the indices to show that the lower the value, the softer the more. In the case of tissue paper or toilet paper, when the softness is 1.0 cN/100 mm or less, it is considered sufficiently soft. The measurement of softness refers to a value measured based on a handle-o-meter method according to the JIS L 1096 E method (1990). However, a test piece is made into a size of 100 mm x 100 mm, and a clearance is set to 5 mm. The measurement is performed five times each in the longitudinal direction and the lateral direction in one ply, and the average value of all ten times is obtained, and note that although the softness has no unit, it may be represented in

cN/100 mm in consideration of the size of the test piece.

[0026] Examples of the raw material pulp for toilet paper, that is, the fiber material that constitutes toilet paper, include mechanical pulp such as grandwood pulp (GP), pressurized ground wood pulp (PGW), thermomechanical pulp (TMP), chemical pulp such as semi-chemical pulp (CP), softwood high yield unbleached kraft pulp (HNKP), softwood bleached kraft pulp (NBKP), hardwood unbleached kraft pulp (LUKP), hardwood bleached kraft pulp (LBKP), and waste paper pulp such as dinking pulp (DIP) and waste pulp (WP). Fibers other than pulp may be included.

[0027] Pulp can be used alone or in combination of two or more. Preferably, chemical pulp containing no filler or foreign matter is preferred. In particular, a material containing more LBKP (also referred to as L wood or hardwood pulp) than NBKP (also referred to as N wood or softwood pulp) is used. That is, a chemical pulp having a ratio of NBKP to LBKP (NBKP/LBKP) of 50/50 to 30/70 is preferred. Since NBKP has a larger fiber thickness than LBKP, the bulkiness increases as NBKP is used more. Further, the raw pulp may contain woody plants and herbs such as straw pulp, bamboo pulp, and kenaf pulp. Furthermore, although waste paper pulp may be blended, it is difficult for waste paper pulp to develop "softness", it is highly desirable that the raw pulp be composed only of the virgin pulp NBKP and LBKP.

[0028] On the other hand, fibers other than pulp are chemical fibers including polyester-based fibers such as polyethylene terephthalate, polybutylene terephthalate, and copolymers thereof, polyolefin-based fibers such as polyethylene, polypropylene, and polystyrene, polyacrylate fiber such as polyacrylonitrile, polyacrylate fibers such as modacrylic, polyamide-based fibers such as nylon 6, nylon 66 and nylon 12, synthetic fibers such as polyvinyl alcohol fiber, polyvinylidene chloride fiber, polyvinyl chloride fiber, and urethane fibers, semi-synthetic fibers such as triacetate fiber, and diacetate fibers, regenerated cellulose fibers such as viscose rayon, cuprammonium rayon, polynosic rayon, and lyocell, and regenerated fibers spun from a solution of collagen, alginic acid, chitin and the like. The polymer constituting the chemical fiber may be in the form of a homo-polymer, a modified polymer, a blend, a copolymer, or the like.

[0029] On the other hand, the toilet paper according to the present embodiment desirably has a water absorption rate of less than 2.4 seconds. When the water absorption rate is less than 2.4 seconds, water can be rapidly absorbed when spilled water is wiped off or when a so-called shower toilet is used for wiping. In addition, it can be used for wiping of articles other than wiping after excretion, that is, for wiping the rim of a wash basin or a toilet, or on a table or a floor. Furthermore, when toilet paper is made into a roll-shaped product, in the manufacturing process, the end of the winding called a tail is fixed with a tail glue. The tail glue quickly permeates, and the tail portion can be stably fixed. The measurement of the water absorption rate is based on the old JIS S 3104 (1985). For the test of water absorption, using a pipette etc. adjusted such that the volume of one drop is about 0.1 mL, a test piece (one set of multiple sheets) is placed on a support stand having a hole with a diameter of 40 mm or more in the center, and one drop of distilled water at a temperature of $20 \pm 1^\circ\text{C}$ is dropped from a height of 10 mm. The time from when the water drop contacts the test piece until the water drop is completely absorbed, and the reflected light disappears is measured in 0.1 second units. The test is performed five times, and the average is determined.

[0030] In addition, the toilet paper of the present embodiment desirably has a water disintegration of 36 seconds or less. When the water disintegration is within 36 seconds, the risk of clogging pipes when excrement is flushed into a flush toilet or the like is reduced remarkably. The measurement of the water disintegration (unraveling) is based on JIS P 4501 (1993). In unraveling test, a 300 mL beaker containing 300 mL of water (water temperature of $20 \pm 5^\circ\text{C}$) is placed on a magnetic stirrer, and the rotation speed of a rotor is adjusted to 600 ± 10 rotations/minute. A test piece having a size of 114 ± 2 mm square is put in it, and a stopwatch is pushed. Due to the resistance of the test piece, the rotational frequency of the rotor once drops to about 500 and increases as the test piece is unraveled. When the rotational frequency has recovered to 540, the stopwatch is stopped to measure the time in unit of seconds. The test is performed five times, the ease of unraveling is expressed with the average of test results. The rotor has a disk shape with a diameter of 35 mm and a thickness of 12 mm.

[0031] In the toilet paper of the present embodiment, it is desirable that adjustment of the dry tensile strength and the wet tensile strength can be easily performed by internally adding the dry paper strength agent or the wet paper strength agent to a paper stock or wet paper. However, the adjustment may be performed by a method not using a paper strength agent, which adjusts the number of plies, pulp type, pulp mixing ratio, and the like. A wet paper strength agent tends to balance wet paper strength with water disintegration.

[0032] Examples of the dry paper strength agent include starch, polyacrylate amide, CMC (carboxymethyl cellulose), or a salt thereof such as sodium carboxymethyl cellulose, calcium carboxymethyl cellulose, zinc carboxymethyl cellulose, and the like. When a dry paper strength agent is internally added, it may be added to pulp slurry in an amount of about 1.0 kg/pulp t or less.

[0033] Examples of a wet paper strength agent include polyamide polyamine epichlorohydrin resin, urea resin, acid colloid/melamine resin, and thermally crosslinkable coating PAM, and the like. When a wet paper strength agent is used, a temporary wet paper strength agent (transient wet paper strength agent) is more desirable. Particularly, a cationic temporary wet paper strength agent is desirable. While essentially maintaining the strength of the paper immediately after contact with water, the temporary wet strength agent quickly reduces the wet strength of paper thereafter. Therefore, the surface does not become rough or the toilet paper does not break with the amount of water at the time of wiping.

While having versatility, particularly having strength that is excellent for wiping of moisture in a versatile manner, as well as having excellent texture, the toilet paper can be tore down by a large amount of water at the time of disposal, for example, by a water flow in a flush toilet. Examples of the temporary wet paper strength agent include TS-20 manufactured by SEIKO PMC CORPORATION, a polymer aldehyde-functional compound such as glyoxylated polyacrylate amide and cationic glyoxylated polyacrylamide, copolymers of acrylamide monomers modified with a dihydric aldehyde of glyoxal and other copolymerizable unsaturated monomers, or dialdehyde starch and the like. These may be used in combination. When a wet paper strength agent is added, the content in paper is about 0.5 to 20.0 kg/pulp t. The preferred content is 1.0 to 12.0 kg/pulp t. The more preferred content is 4.0 to 8.0 kg/pulp t. If it is less than 0.5 kg/pulp t, the wet paper strength may not be sufficiently increased, and if it exceeds 20.0 kg/pulp t, the water disintegration may be excessively slow.

[0034] On the other hand, the tissue paper according to the present embodiment is a three-ply or four-ply tissue paper, but may be embossed. More preferably, it is desirable that the embossing be double embossing in which a convex faces the inside of the ply stack. In the case of double embossing, it is desirable that embossing be performed on one to two plies in the case of three plies, and that embossing be performed on one to three plies in the case of four plies. That is, there may be a ply that has not been embossed in the plies. In addition, it is desirable to perform a laminate embossing that has a structure in which a known laminating paste such as starch, carboxymethylcellulose, an aqueous ink, or the like is applied to the top of the convex, and the plies are bonded to each other via the top of the convex. The area, depth, and range of each emboss in the embossing are not necessarily limited, but it is desirable to form five to thirty embosses per 10 mm square such that the embossing pressure application area is 5 to 20% of the whole, the emboss having a substantially flat top surface on one side, its top surface area being 0.50 to 2.50 mm², and the emboss concave depth being 0.05 to 0.50 mm. The emboss concave depth is measured by a one-shot 3D measurement macroscope VR-3200 manufactured by KEYENCE CORPORATION or its equivalent, and image analysis software "VR-H1A" or its equivalent software. The measurement is performed under the conditions of a magnification of twelve times and a visual field area of 24 mm × 18 mm. However, the magnification and the visual field area can be appropriately changed depending on the size of the emboss. As a specific measurement procedure, an emboss concave depth (measurement section curve) profile at a line segment crossing the longest portion of the peripheral edge of one emboss in the image is obtained using the above software. Of "contour curves" obtained by removing, by a low-pass filter, the surface roughness component shorter than $\lambda_c:800 \mu\text{m}$ (λ_c is a "filter that defines the boundary between the roughness component and the undulation component" described in JIS-B0601 "3.1.1.2") from the cross-sectional curve of this embossed concave depth profile, the minimum value sandwiched between the two inflection points P1 and P2 that are convex upward and the inflection point P1 and P2 is obtained to determine the minimum value Min of the depth. Further, the average value of the depth values of the inflection points P1 and P2 is defined as the maximum value Max of the depth. In this way, the depth of the embossed concave portion = maximum value Max - minimum value Min. Further, the distance (length) of the inflection points P1 and P2 on the X-Y plane is defined as the length of the longest portion. Similarly, the depth of the embossed concave is measured for the shortest portion in the direction perpendicular to the longest portion, and the larger value is adopted as the embossed concave depth. The above measurement is performed for any ten embosses on the toilet paper surface, and the average value of the measurement results is defined as the final emboss concave depth.

[0035] On the other hand, the toilet paper of the present embodiment is particularly suitable for a toilet paper roll. The preferred form of the toilet paper roll made of the toilet paper of the present embodiment desirably has a winding hardness of 0.45 to 0.60 kgf, a winding length of 20 to 30 m, and a winding diameter of 100 to 117 mm. The winding hardness is measured by a π gauge manufactured by MURATEC-KDS CORPORATION or its equivalent. Specifically, a π gauge is wound around the circumference of the roll and pulled to the left and right in the tangential direction of the roll to squeeze the center of the roll, and the tension when the diameter of the center of the roll is reduced by 3 mm from the original state is measured with a push-pull gauge. The winding diameter was measured with a π gauge in the same manner as above. Herein, the π gauge is wound around a roll circumference with a stainless steel measure to read a diameter from the length.

[0036] Hereinafter, the effects of the toilet paper according to the present invention will be further described with reference to examples.

Examples

[0037] Toilet paper rolls of the toilet paper according to Examples of the present invention (Examples 1 to 9), Comparative Examples 1 to 4, and Conventional Examples 1 to 6 were produced, and the physical property values and composition values of the toilet paper wound on the toilet paper rolls were measured, and sensory tests were conducted for "durability/hard to tear when wet (objective)", "softness of skin touch", "fullness" and "smoothness". Methods of measuring the basis weight, paper thickness, dry and wet tensile strength, MMD, softness, winding hardness, water absorption rate, and water disintegration are as described above.

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[0038] The test method for sensory evaluation is as follows. The tests are performed by fifteen evaluators, each sample is evaluated five times per evaluator, and the average of the values excluding an abnormal value score is defined as the evaluator's score in a certain sample. Further, scoring is performed by setting the score of Conventional Example 1 to four points, scoring each sample with one to seven points, and calculating the average value of each evaluator. Note that the evaluation is performed by nine evaluators, and if each evaluator performs five evaluations on each sample, a sufficiently unbiased evaluation is possible.

[0039] A total of nineteen types of toilet paper as samples are used, including four types of comparative examples, nine types of the examples, and six types of conventional examples which are commercially available. Note that Conventional Example 1 of a commercial product serving as a reference sample is toilet paper with the highest market share, and is a sample that is touched by most consumers.

[0040] Items of the sensory evaluation are four items: "durability/hard to tear when wet (objective)", "softness of skin touch", "fullness", and "smoothness".

[0041] For "durability/hard to tear when wet (objective)", by wiping off the water on a pottery surface inside a wash basin (TOTO compact hand washer (handle type faucet) LSL870AP), whether the reference sample can perform wiping operation without tearing was scored in a seven-point scale with the reference sample score being four point.

[0042] For "softness of the touch", the softness of the skin when an evaluator pulls out the toilet paper and touches it with his/her hand was scored on a seven point scale by setting the score of the reference sample to four points.

[0043] For "fullness", the fullness obtained when an evaluator pulls out, crumple, and touches the toilet paper was scored on a seven point scale with the score of the reference sample being four points.

[0044] For "smoothness", the smoothness obtained when an evaluator pulls out, touches and traces the toilet paper by hand was scored on a seven point scale with the score of the reference sample being four points.

[Table 1]

		COMPARATIVE EXAMPLE 1	COMPARATIVE EXAMPLE 2	COMPARATIVE EXAMPLE 3	COMPARATIVE EXAMPLE 4	EXAMPLE 1	EXAMPLE 2	EXAMPLE 3	EXAMPLE 4	EXAMPLE 5	EXAMPLE 6	EXAMPLE 7	EXAMPLE 8	EXAMPLE 9	CONVENTIONAL EXAMPLE 1	CONVENTIONAL EXAMPLE 2	CONVENTIONAL EXAMPLE 3	CONVENTIONAL EXAMPLE 4	CONVENTIONAL EXAMPLE 5	CONVENTIONAL EXAMPLE 6
BASE PAPER MAKING	PULP BLENDING																			
	NBRP %	35	35	35	35	35	35	35	35	35	35	35	35	35	-	-	-	-	-	-
	LBRP %	65	65	65	65	65	65	65	65	65	65	65	65	65	-	-	-	-	-	-
	CREPE RATIO %	18	18	18	18	18	18	18	18	20	18	20	18	20	-	-	-	-	-	-
	SOFTENER kg/pulp t	1.7	0	1.7	0	0	1.7	1.7	1.7	0	1.7	0	1.7	0	-	-	-	-	-	-
	MOISTURIZING AGENT	1.0	0	1.0	0	0	1.0	1.0	1.0	0	1.0	0	1.0	0	-	-	-	-	-	-
	BASIS WEIGHT (IP)	15.4	15.8	15.4	15.8	15.8	16.5	16.5	15.3	15.2	15.8	15.2	15.8	15.3	16.1	-	-	-	-	-
	PAPER THICKNESS (IP) µm	115	134	115	155	161	115	111	114	135	123	135	125	134	-	-	-	-	-	-
	DRY STRENGTH IN LONGITUDINAL DIRECTION (NUMBER OF PRODUCT PLES)																			
	DRY STRENGTH IN HORIZONTAL DIRECTION (NUMBER OF PRODUCT PLES)	136	186	272	304	278	232	332	400	302	375	330	421	389	-	-	-	-	-	-
PRODUCT QUALITY	SOFTNESS (IP) cN/100 mm	2.2	1.9	2.2	2.3	2.0	2.2	2.3	2.8	1.7	2.9	1.9	2.8	2.0	-	-	-	-	-	-
	MMD 1/100	9.9	8.1	9.0	9.2	12.1	7.6	7.4	7.9	11.0	8.2	11.3	8.3	11.2	-	-	-	-	-	-
	BASIS WEIGHT (IP) g/m²	16.5	15.0	16.5	15.0	15.0	16.2	15.0	14.9	15.3	14.9	15.3	15.0	15.8	15.4	15.3	13.8	14.3	15.0	14.1
	NUMBER OF PLES	2	2	2	2	3	3	4	4	3	4	3	4	3	3	4	3	3	4	4
	PAPER THICKNESS µm	235	240	312	288	302	359	404	400	297	413	324	435	356	345	392	264	303	401	448
	DENSITY MASS PER 1 cm² g/cm²	0.14	0.13	0.11	0.10	0.15	0.14	0.15	0.15	0.15	0.14	0.14	0.14	0.13	0.13	0.16	0.16	0.14	0.15	0.13
	DRY STRENGTH IN LONGITUDINAL DIRECTION (NUMBER OF PRODUCT PLES)																			
	DRY STRENGTH IN HORIZONTAL DIRECTION (NUMBER OF PRODUCT PLES)																			
	Dry strength in horizontal direction (number of product ples)	110	157	228	242	234	187	290	338	246	343	286	389	313	335	314	293	283	596	439

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DIRECTION (NUMBER OF PRODUCT PLIES) WET STRENGTH IN	16	20	21	24	25	29	27	29	30	36	32	39	32	21	20	23	22	18	37
	LONGITUDINAL DIRECTION (NUMBER OF PRODUCT PLIES) WET STRENGTH IN HORIZONTAL DIRECTION DRY STRENGTH IN HORIZONTAL DIRECTION RATIO	0.15	0.13	0.09	0.10	0.11	0.09	0.15	0.09	0.12	0.10	0.10	0.11	0.10	0.06	0.08	0.08	0.03	0.08
SOFTNESS cN/100 mm	2.0	1.7	2.1	2.4	1.8	2.3	1.6	2.2	3.5	2.4	1.9	2.6	2.5	2.6	2.0	2.3	2.4	2.7	2.7
MMD 1/100 mm	9.3	7.5	8.9	8.8	9.3	9.1	6.6	7.2	9.0	7.6	10.1	7.7	10.3	8.9	8.3	8.4	8.6	9.9	10.3
ROLL WIDTH mm	114	114	104	104	104	104	104	104	104	104	104	104	104	100	105	103	103	110	106
WINDING HARDNESS kgf	0.79	0.55	0.89	0.63	0.90	0.55	0.66	0.61	1.04	0.88	1.17	0.97	1.15	5.84	5.78	3.00	2.81	6.34	5.85
WATER DISINTEGRATION SECONDS	24	28	21	21	19	17	14	21	32	20	35	26	36	49	38	45	37	99	96
WATER ABSORPTION SECONDS	5.3	6.5	4.7	4.4	2.2	2.4	1.3	1.2	2.0	1.2	1.0	1.1	1.0	2.7	2.9	7.6	5.5	2.8	2.6
EMBOSS RATE	APPLIED	APPLIED	APPLIED	APPLIED	APPLIED	APPLIED	APPLIED	APPLIED	APPLIED	APPLIED	APPLIED	APPLIED	APPLIED	NOT APPLIED	NOT APPLIED	APPLIED	NOT APPLIED	NOT APPLIED	NOT APPLIED
SENSORY EVALUATION RESULT SEVEN POINT EVALUATION MAXIMUM SEVEN POINT MINIMUM ONE POINT	DURABILITY/HARD TO TEAR WHEN WET (OBJECTIVE)	3.4	3.3	3.0	3.3	4.5	4.3	4.6	4.6	4.8	4.7	4.8	4.8	4.0	3.9	4.0	4.1	4.2	4.3
	SOFTNESS OF SKIN TOUCH	4.0	4.1	4.5	4.0	4.5	4.5	4.4	4.4	4.3	4.2	4.3	4.2	4.0	4.0	4.0	4.0	4.2	4.1
	SOFTNESS	3.0	3.0	3.2	3.3	3.8	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.0	4.0	3.5	3.8	4.0	4.0
	SMOOTHNESS	4.3	4.0	4.2	4.5	4.5	4.5	4.4	4.4	4.3	4.2	4.3	4.2	4.0	4.0	4.0	4.0	4.2	4.1

[0045] When the results of the sensory evaluation in Table 1 are confirmed, the examples according to the present invention show the values much superior to each conventional example in each of the sensory evaluations of "durability/hard to tear when wet (objective)", "softness of skin touch", "fullness", "smoothness". On the other hand, even when compared with the comparative example, the results are excellent in each of the "durability/hard to tear when wet (objective)", "fullness", and "smoothness". Comparative Example 3 is highly evaluated for "softness of skin touch", considering that three plies or four plies is applied in the examples, whereas two plies is applied in Comparative Example 3, it can be evaluated that "softness of skin touch" equal to or more than that of Comparative Example 3 in which two plies is applied is obtained while applying multi plies in the example. Furthermore, in the examples according to the present invention, the sensory evaluation is excellent, and the water absorption rate is higher and more durable than in the conventional examples and the comparative examples. That is, the toilet paper according to the present invention is a toilet paper which is hardly torn in wiping other than the human body, and which is excellent in texture at the time of wiping humans.

Reference Signs List

[0046]

- 1 toilet paper roll
- 10 toilet paper
- 20 paper core
- L1 width of toilet paper roll
- L2 diameter of toilet paper roll
- L3 paper core diameter
- 100 MMD measuring device

Claims

1. Toilet paper that is three or four-ply toilet paper, wherein a basis weight per ply of the toilet paper is 14.9 g/m² or more and 16.2 g/m² or less, an overall paper thickness is 297 μm or more and 435 μm or less, a dry tensile strength in a longitudinal direction is 451 cN/25 mm or more and 1001 cN/25 mm or less, and a ratio of a wet tensile strength in a horizontal direction to a dry tensile strength in a horizontal direction is 0.09 or more.
2. The toilet paper according to claim 1, wherein a water absorption rate is less than 2.6 seconds.
3. The toilet paper according to claim 1, wherein a water disintegration is 36 seconds or less.

FIG.1

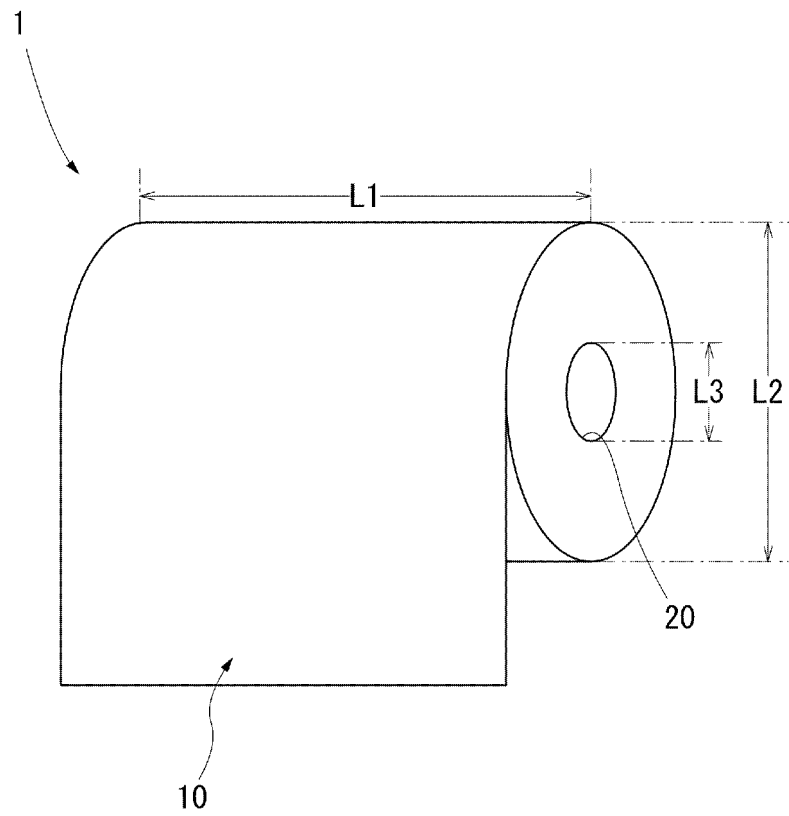
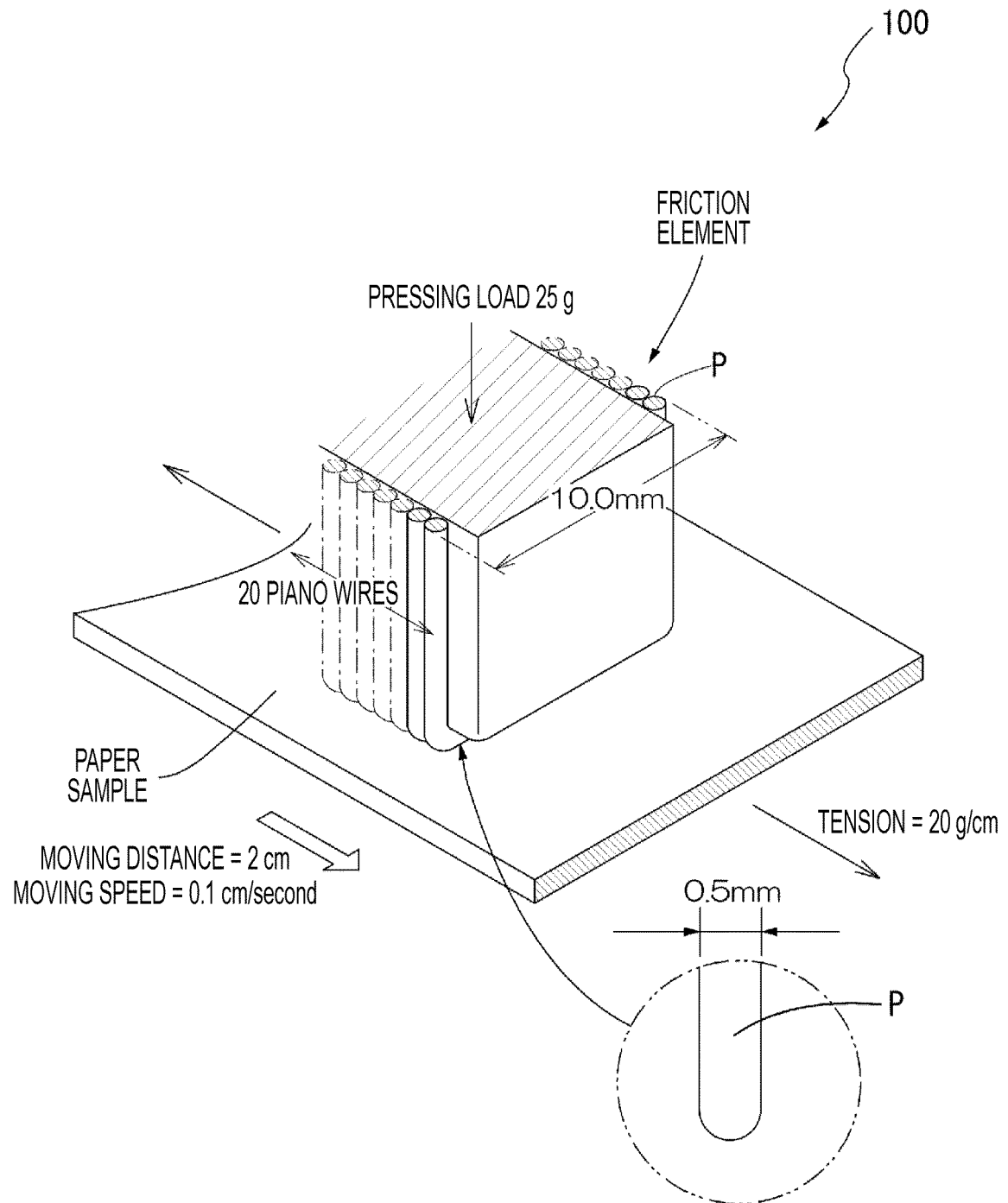


FIG. 2



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/045438

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. A47K10/16 (2006.01) i

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. A47K10/16

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2019
Registered utility model specifications of Japan	1996-2019
Published registered utility model applications of Japan	1994-2019

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	JP 2009-161900 A (DAIO PAPER CORPORATION) 23 July 2009, paragraphs [0036], [0037], [0043], [0059], table 1 (Family: none)	1, 3
Y		2
Y	JP 2015-126771 A (NIPPON PAPER CRECIA CO., LTD.) 09 July 2015, paragraphs [0036], [0066], table 1 (Family: none)	2
A	JP 2005-168582 A (DAIO PAPER CORPORATION) 30 June 2005, paragraph [0034], table 1 (Family: none)	1-3



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

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Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/045438

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2016-193042 A (DAIO PAPER CORPORATION) 17 November 2016, paragraph [0021] & US 2018/0023255 A1, paragraph [0030] & WO 2016/158385 A1 & EP 3278695 A1 & CN 107105947 A & KR 10-2017-0131345 A	1-3

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2017169681 A [0005]