



(11) **EP 3 305 983 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
11.04.2018 Bulletin 2018/15

(51) Int Cl.:
D21H 19/34 ^(2006.01) **A47L 13/17** ^(2006.01)
D21H 27/30 ^(2006.01)

(21) Application number: **16802897.5**

(86) International application number:
PCT/JP2016/060510

(22) Date of filing: **30.03.2016**

(87) International publication number:
WO 2016/194460 (08.12.2016 Gazette 2016/49)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

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(30) Priority: **29.05.2015 JP 2015110837**
29.05.2015 JP 2015110839

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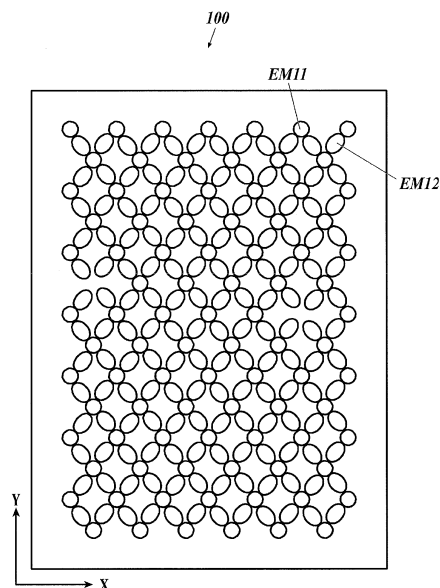
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(54) **WATER-DISINTEGRABLE SHEET**

(57) A hydrolysable sheet obtained by impregnating a base paper sheet, to which a water-soluble binder is added, with a chemical solution, wherein the base paper sheet is obtained by applying a ply process to a plurality of sheets of base paper and has a basis weight of from 30 gsm to 150 gsm, wherein a compounding ratio of soft-wood pulp to hardwood pulp is less than 1/1, wherein the chemical solution contains a cross-linking agent, which causes the water-soluble binder to initiate a cross-linking reaction, and a trihydric or higher alcohol, and wherein, with respect to a weight of the base paper sheet, the base paper sheet is impregnated with the trihydric or higher alcohol at 1% to 20% by weight.

FIG.1



EP 3 305 983 A1

Description

Technical Field

[0001] The present invention relates to a hydrolysable sheet.

Background Art

[0002] Conventionally, reusable wiping cloths made of woven fabrics are used to clean toilets. Recently, however, disposable wet sheets made of paper are used instead. It is preferable that such a wet sheet is provided in a state of being impregnated with a cleaning agent, and can be disposed of by being flushed down a toilet after use. For the disposable wet sheet, the wet paper impregnated with a cleaning agent is required to be strong enough to resist tearing at the time of wiping, and hydrolyzability is required so as not to clog a pipe or the like when being flushed down a toilet. As a technique for effectively achieving these, it is known to use a water-disintegrable sheet, to which a water-soluble binder or the like containing carboxymethyl cellulose (CMC) is added, as base paper (for example, see Patent Document 1).

Related-Art Documents

Patent Document

[0003] Patent Document 1: Japanese Examined Patent Publication No. 3865506

Summary of the Invention

Problem to be Solved by the Invention

[0004] Here, in a case where a hydrolysable sheet impregnated with a chemical solution containing a cleaning agent or the like is used as a wipe, a hydrolysable sheet that suppresses evaporation of water in the chemical solution is desired in order to develop a cleaning effect in work of wiping a target object.

[0005] In view of the above described problem, the present invention has an object to provide a hydrolysable sheet that can suppress evaporation of water in a chemical solution.

Means to Solve the Problem

[0006] In order to solve the above described problem, the invention recited in claim 1 is a hydrolysable sheet obtained by impregnating a base paper sheet, to which a water-soluble binder is added, with a chemical solution, wherein the base paper sheet is obtained by applying a ply process to a plurality of sheets of base paper and has a basis weight of from 30 gsm to 150 gsm, wherein a compounding ratio of softwood pulp to hardwood pulp is less than 1/1,

wherein the chemical solution contains a cross-linking agent, which causes the water-soluble binder to initiate a cross-linking reaction, and a trihydric or higher alcohol, and

wherein, with respect to a weight of the base paper sheet, the base paper sheet is impregnated with the trihydric or higher alcohol at 1% to 20% by weight.

[0007] The invention recited in claim 2 is a hydrolysable sheet obtained by impregnating a base paper sheet, to which a water-soluble binder is added, with a chemical solution,

wherein the base paper sheet is obtained by applying a ply process to a plurality of sheets of base paper and has a basis weight of from 30 gsm to 150 gsm,

wherein a compounding ratio of softwood pulp to hardwood pulp is less than 2/3,

wherein the chemical solution contains a cross-linking agent that causes the water-soluble binder to initiate a cross-linking reaction, and

wherein, with respect to a weight of the base paper sheet, the base paper sheet is impregnated with the chemical solution at 150% to 300% by weight.

[0008] The invention recited in claim 3 is the hydrolysable sheet according to claim 1 or 2 characterized in that the base paper sheet is in a state in which a content of the water-soluble binder increases from inside towards a front surface and a back surface in a thickness direction of the base paper sheet.

[0009] The invention recited in claim 4 is the hydrolysable sheet according to any one of claims 1 to 3 characterized in that embossments are formed on an entire surface of the hydrolysable sheet.

[0010] The invention recited in claim 5 is the hydrolysable sheet according to claim 4 characterized in that the embossments include

first embossments and

second embossments arranged around the first embossments, a shape of a protruding part of each of the second embossments differing from a shape of a protruding part of each of the first embossments.

[0011] The invention recited in claim 6 is the hydrolysable sheet according to claim 5 characterized in that the first embossments are arrayed in a rhomboid grid.

[0012] The invention recited in claim 7 is the hydrolysable sheet according to claim 6 or 7 characterized in that each of the second embossments is arrayed between two of the first embossments.

[0013] The invention recited in claim 8 is the hydrolysable sheet according to any one of claims 5 to 7 characterized in that

the first embossments contact the second embossments contact to form a conjoined embossment.

Advantage of the Invention

[0014] According to the present invention, it is possible to provide a hydrolysable sheet that suppresses evapo-

ration of water in a chemical solution.

Brief Description of the Drawings

[0015]

Fig. 1 is a plan view illustrating an example of a toilet cleaning sheet according to an embodiment.

FIG. 2A is an enlarged view and a cross sectional view of an embossed part of the toilet cleaning sheet.

FIG. 2B is an enlarged view and a cross sectional view of an embossed part of the toilet cleaning sheet.

FIG. 2C is an enlarged view and a cross sectional view of an embossed part of the toilet cleaning sheet.

FIG. 3A is an explanatory diagram illustrating an example of contact areas of embossments.

FIG. 3B is an explanatory diagram illustrating an example of a contact area of embossments.

FIG. 4 is a flowchart illustrating a method of producing the toilet cleaning sheet according to the embodiment.

FIG. 5 is a schematic diagram illustrating an example of a producing facility (liquid solution adding facility) of the toilet cleaning sheet according to the embodiment.

FIG. 6 is a schematic diagram illustrating an example of a producing facility (processing facility) of the toilet cleaning sheet according to the embodiment.

FIG. 7 is a plan view illustrating another example of a toilet cleaning sheet according to the embodiment.

FIG. 8 is a plan view illustrating another example of a toilet cleaning sheet according to the embodiment.

FIG. 9 is an enlarged view of part A of FIG. 8.

FIG. 10A is an end view taken through B-B of FIG. 9.

FIG. 10B is an end view taken through C-C of FIG. 9.

[Mode for Carrying Out the Invention]

[0016] In the following, a hydrolysable sheet that is an embodiment of the present invention will be described in detail with reference to the accompanying drawings. It should be noted that the scope of the invention is not limited to the illustrated examples.

[0017] It should be noted that for a hydrolysable sheet as the present invention, an example will be described in which the hydrolysable sheet is a toilet cleaning sheet 100. However, other than toilet cleaning sheets, a wet tissue impregnated with a chemical solution for cleaning/wiping is included as the hydrolysable sheet of the present invention. Further, a conveying direction of paper at the time of producing the toilet cleaning sheet 100 is described as the Y direction (longitudinal direction), and a direction perpendicular to the conveying direction is described as the X direction (lateral direction).

<Configuration of the toilet cleaning sheet 100>

[0018] First, a configuration of the toilet cleaning sheet

100 will be described. The toilet cleaning sheet 100 is obtained by applying a ply process to (obtained by stacking) a plurality of sheets (two sheets, for example) of base paper, and is impregnated with a predetermined chemical solution. Further, as illustrated in FIG. 1, an embossing process is applied to the entire sheet surface of the toilet cleaning sheet 100 to have two types of embossments EM11 and EM12. It should be noted that it is preferable that a contact area generated between an object to be cleaned up or the like and the two types of embossments EM11 and EM22 is preferably 15 mm² to 30 mm² per 100 mm².

[0019] For example, unevenness of wiping can be reduced by arranging the embossments EM11 in rhomboid grids, in comparison with a case in which the embossments EM11 are arranged in square grids or rectangular grids. Further, the embossments EM12 are arranged between the embossments EM11.

[0020] Further, a folding process is applied to the toilet cleaning sheet 100 to be folded in two at the central portion in the longitudinal direction (Y direction). Then, the toilet cleaning sheet 100 is stored, in a folded state, within a plastic case, a packaging film, or the like for storage, and, at the time of being used, is unfolded as needed to be used. It should be noted that a way of folding the toilet cleaning sheet 100 is not limited to folding it into two, but may be folding it into four or folding it into eight, for example.

[0021] Further, the toilet cleaning sheet 100 of the embodiment is composed of a hydrolysable fiber assembly such that after cleaning a toilet, the toilet cleaning sheet 100 can be discarded in the water tank of the toilet bowl.

[0022] A fiber obtained by mixing leaf bleached kraft pulp (LBKP) with needle bleached kraft pulp (NBKP) is used as the fiber assembly. A preferable material fiber has a compounding proportion of leaf bleached kraft pulp to components of the material fiber greater than 50% by weight. That is, a fiber of which a compounding ratio of needle bleached kraft pulp to leaf bleached kraft pulp is less than 1/1 is preferable. A more preferable material fiber has a compounding proportion of leaf bleached kraft pulp to the components of the material fiber greater than 60% by weight. That is, a fiber of which a compounding ratio of needle bleached kraft pulp to leaf bleached kraft pulp is less than 2/3 is more preferable. By increasing a compounding ratio of leaf bleached kraft pulp with respect to needle bleached kraft pulp, clearances between the fibers can be decreased and evaporation of water in the chemical solution can be suppressed. Further, in order to enhance the strength of a base paper sheet that is a base material of the toilet cleaning sheet 100, carboxymethyl cellulose (CMC) is applied, as a paper strength enhancing agent, to the base paper sheet. More specifically, CMC is applied such that a content of CMC increases from inside towards the front surface and the back surface in a thickness direction of the base paper sheet.

[0023] Further, the toilet cleaning sheet 100 of the em-

bodiment is impregnated with a predetermined chemical solution. Specifically, the predetermined chemical solution contains auxiliary agents such as a perfume, a preservative agent, a sterilizing agent, a paper strength enhancing agent, and an organic solvent, in addition to an aqueous cleaning agent. It is preferable that, with respect to a weight of the base paper sheet that is the base material of the toilet cleaning sheet 100, the base paper sheet is impregnated with the predetermined chemical solution at 150% to 300% by weight.

[0024] Any appropriate chemical solution may be used as the predetermined chemical solution. For example, in addition to a surfactant, a lower or higher (aliphatic) alcohol can be conjointly used as the aqueous cleaning agent. As the perfume, in addition to an aqueous perfume, one or several kinds can be selected from among oily perfumes such as orange oil. As the preservative agent, parabens such as methylparaben, ethylparaben, or propylparaben can be used, for example. As the sterilizing agent, benzalkonium chloride, chlorhexidine gluconate, povidone iodine, ethanol, cetyl benzanilium oxide, triclosan, chloroxylonol, isopropylmethylphenol, or the like can be used, for example. As the paper strength enhancing agent (cross-linking agent), boric acid, various metal ions, or the like can be used. As the organic solvent, a polyhydric alcohol such as glycol (dihydric), glycerin (trihydric), or sorbitol (tetrahydric) can be used. In the toilet cleaning sheet 100 of the embodiment, at least a polyhydric alcohol that is a trihydric or higher alcohol such as glycerin or sorbitol is used as the organic solvent. Thereby, it becomes possible to enhance the viscosity of the chemical solution to be added into the base paper sheet and to suppress evaporation of water included in the chemical solution. It is preferable that, with respect to the weight of the base paper sheet, the base paper sheet is impregnated with this trihydric or higher alcohol at 1% to 20% by weight. In order not to decrease a yield rate due to excessive enhancement of the viscosity of the chemical solution, the upper limit of this content rate is 20% by weight.

[0025] Further, the auxiliary agents of the components of the chemical solution described above can be appropriately selected and a component for satisfying another function may be contained in the chemical solution as needed.

[0026] As illustrated in FIG. 2A, a protruding part PR21 of each embossment EM11 has a curved surface shape.

[0027] Further, as illustrated in FIG. 2B, a protruding part PR22 of each embossment EM12 has a planar shape.

[0028] Because the embossments EM12 are arranged between the embossments EM11, the protruding parts PR21 of the embossments EM11 and the protruding parts PR22 of the EM12 are close to cohere, and thereby, a conjoint embossment EM 21 is formed as illustrated in FIG. 2C. Alternatively, the protruding parts PR21 of the embossments EM11 and the protruding parts PR22 of the embossments EM12 may be simply close to each

other without being conjoined.

[0029] By the two types of embossments EM11 and EM12 formed in this manner, a contact area with an object to be cleaned or the like can be increased. Therefore, hardness of the toilet cleaning sheet 100 is eased and the wiping performance is enhanced.

[0030] That is, by forming in combination, on the entire sheet surface of the toilet cleaning sheet 100, the embossments EM11 each of which has the protruding part PR21 with the curved surface and the embossments EM12 each of which has the protruding part PR22 with the planar surface, the contact area is increased only after each embossment is deformed when force is applied to the toilet cleaning sheet 100 at the time of wiping. Thus, as well as increasing the contact area, flexibility is also enhanced as a result of the deformation of each embossment.

[0031] For example, as illustrated in FIG. 3A, in a case where only the embossments EM11 are formed, contact areas CN31 generated by deformation of the embossments EM11 caused by force applied to the toilet cleaning sheet 100 at the time of wiping work discretely occur adjacent to the embossments EM11. On the other hand, in a case where the two types of embossments EM11 and EM12 are used in combination, as illustrated in FIG. 3B, a contact area CN32 generated by deformation of the embossments EM11 and EM12 caused by force applied to the toilet cleaning sheet 100 at the time of wiping work is increased in comparison with the contact areas CN31 of FIG. 3A.

[0032] Further, by the two types of embossments EM11 and EM12, effects of normal embossments can be similarly obtained, and texture, absorbability, bulkiness, and the like of the toilet cleaning sheet can be enhanced. Furthermore, by the conjoint embossment EM21, a good appearance effect based on applying the embossments can be obtained similar to normal embossments.

[Method of producing the toilet cleaning sheet 100]

[0033] Next, a method of producing the toilet cleaning sheet 100 will be described. FIG. 4 is a flowchart illustrating the method of producing the toilet cleaning sheet 100. FIG. 5 is a schematic diagram of a liquid solution adding facility that adds, to the base paper sheet of the toilet cleaning sheet 100, a binder solution containing a water-soluble binder. FIG. 6 is a schematic diagram of a processing facility that processes the base paper sheet to which the binder solution has been added by the solution adding facility illustrated in FIG. 5.

[0034] In the method of producing the toilet cleaning sheet 100, as illustrated in FIG. 4, first, a papermaking process (S1) is performed by a papermaking machine (not illustrated) to prepare paper as base paper.

[0035] Next, as illustrated in FIG. 4 and FIG. 5, in the solution adding facility, a ply process (S2) to obtain a ply continuous sheet 1B is applied to continuous dry base

paper 1A and 1A respectively fed from a plurality of (two, for example) primary web rollers 1 and 1, around which the prepared base paper is wound. A solution adding process (S3) is performed to add the binder solution to the ply continuous sheet 1B to obtain a continuous sheet 1C. A drying process (S4) is performed to dry the continuous sheet 1C. A slitting/winding process (S5) is performed to slit and wind the dried continuous hydrolysable sheet 1D. It should be noted that the number of primary web rollers may be changed as appropriate if the number is two or more. In the following description, an example will be described in which two rollers are used.

[0036] Next, as illustrated in FIG. 4 and FIG. 6, in the processing facility, an embossing process (S6) is performed to emboss the continuous hydrolysable sheet 1D, wound in the above described slitting/winding process (S5) and fed from a secondary web roller 11. A finishing process (S7) is performed to finish the embossed sheet 1E, to which the embossing process has been applied. Note that each of the processes will be described in detail later below.

(Papermaking process)

[0037] The papermaking process according to the present invention will be described. In the papermaking process of the present invention, for example, a papermaking material is used by a known wet type papermaking technique to form the base paper sheet. That is, after wetting the papermaking material, the material is dried by a dryer or the like to form the base paper sheet such as tissue paper or crepe paper. As a material of the base paper sheet, for example, known virgin pulp, recycled paper pulp, or the like may be used, and at least a pulp fiber is included. In particular, pulp obtained by mixing LBKP with NBKP in an appropriate proportion is suitable for the pulp to be the material. It should be noted that a rayon fiber, a synthetic fiber, or the like may be contained as a fiber other than the pulp fiber. Further, the base paper sheet of the present invention contains, as a flocculant, an anionic acrylamide-type polymer (referred to as the "anionic PAM" in the following). The anionic PAM is a polymer obtained by copolymerizing an acrylamide-type monomer and an anionic monomer. The acrylamide-type monomer is acrylamide alone, or a mixture of acrylamide and a nonionic monomer, as follows, copolymerizable with acrylamide. Examples of the nonionic monomer copolymerizable with acrylamide include methacrylamide, N, N-dimethylacrylamide, N, N-diethylacrylamide, N-isopropylacrylamide, N-isopropylcrylamide, N-hydroxyethylacrylamide, diacetone acrylamide, acryloylmorpholine, N-acryloylpyrrolidine, N-acryloylpiperidine, N-vinylrolidone, N-vinylformamide, and N-vinylacetamide. One of them may be used or two or more kinds may be used in combination. Examples of the anionic monomer include acrylic acid, methacrylic acid, acrylamide-2-methylpropanesulfonic acid, itaconic acid, maleic acid, fumaric acid, and neutralized salts thereof.

It should be noted that a monomer such as styrene, acrylonitrile, or (meth) acrylic acid ester may be blended as long as it does not impair the water solubility of the anionic PAM. It is preferable that an additive amount of the anionic PAM is approximately 10 ppm to 1000 ppm. By using such an anionic flocculant having an electric charge that is the same as that of pulp to make paper, the flocculation of the base paper sheet can be decreased and the hydrolyzability can be enhanced by a capillary action. It should be noted that in addition to the flocculant and pulp described above, chemicals for papermaking such as a wet paper strength agent, an adhesive agent, and a remover may be used as appropriate in the base paper sheet.

(Continuous dry base paper)

[0038] It is preferable that the continuous dry base paper 1A has, as a physical property, a basis weight approximately of from 15 gsm to 75 gsm. Further, a basis weight of the sheet (the continuous hydrolysable sheet 1D), containing the water-soluble binder, to which the ply process has been applied is approximately of from 30 gsm to 150 gsm. It should be noted that the basis weight is based on the standard of JIS P 8124. The continuous dry base paper 1A becomes, through the ply process (S2), the solution adding process (S3), the drying process (S4), and the slitting/winding process (S5) that are described later below, hydrolysable paper, to which the ply process has been applied, and the hydrolysable paper is processed into the toilet cleaning sheet 100 through the embossing process (S6), and the finishing process (S7) that are described later below.

(Ply process)

[0039] Next, the ply process (S2) of the embodiment will be described. In the ply process (S2), as illustrated in FIG. 5, the ply process is applied to the respective continuous dry base paper 1A and 1A, continuously fed from the web rollers 1, along the continuous direction, and the continuous dry base paper 1A and 1A are supplied to an overlapping part 2 to make the ply continuous sheet 1B. The overlapping part 2 is composed of a pair of rolls and applies the ply process to the respective continuous base paper 1A and 1A to form the ply continuous sheet 1B, to which the ply process has been applied. Note that when the continuous dry base paper 1A and 1A are overlapped with each other, the continuous dry base paper 1A and 1A may be lightly fastened by pin embossments (contact embossments) so as not to misalign the continuous dry base paper 1A and 1A.

(Binder solution)

[0040] Next, the binder solution will be described. The binder solution contains carboxymethyl cellulose (CMC) as a water-soluble binder. The concentration of car-

boxymethyl cellulose in the binder solution is 1% to 30% by weight. The concentration is preferably greater than or equal to 1% and less than 4% by weight.

[0041] A degree of etherification of CMC is preferably 0.6 to 2.0, is more preferably 0.9 to 1.8, and still more preferably 1.0 to 1.5. This develops excellent hydrolyzability and wet paper strength.

[0042] Further, water swellable material may be used as CMC. This enables, through cross-linking a specific metal ion in the chemical solution, to exert a function to keep an un-swelled fiber constituting the sheet and to impart strength as a wiping sheet to withstand cleaning/wiping work.

[0043] A component other than carboxymethyl cellulose included in the binder solution is a binder component such as polyvinyl alcohol, starch or a derivative thereof, hydroxypropyl cellulose, sodium alginate, tranth gum, guar gum, xanthan gum, gum arabic, carrageenan, galactomannan, gelatin, casein, albumin, purplan, polyethylene oxide, viscose, polyvinyl ethyl ether, sodium polyacrylate, sodium polymethacrylate, polyacrylamide, a hydroxylated derivative of polyacrylic acid, or a polyvinyl pyrrolidone/vinyl pyrrolidone vinyl acetate copolymer.

[0044] It is preferable to use a water-soluble binder including a carboxyl group in terms of having suitable hydrolyzability and developing wet strength by a cross-linking reaction. The water-soluble binder including the carboxyl group is an anionic water-soluble binder that easily generates a carboxylate within water. An example of the binder is a polysaccharide derivative, a macromolecule, or a natural product. The polysaccharide derivative may be a salt of carboxymethyl cellulose, carboxyethyl cellulose or a salt thereof, carboxymethylated starch or a salt thereof. In particular, an alkali metal salt of carboxymethyl cellulose is preferable.

[0045] The synthetic macromolecule may be a salt of a polymer or a copolymer of unsaturated carboxylic acids, a salt of a copolymer of an unsaturated carboxylic acid and a monomer copolymerizable with the unsaturated carboxylic acid, or the like. The unsaturated carboxylic acid may be acrylic acid, methacrylic acid, itaconic acid, crotonic acid, maleic anhydride, maleic acid, fumaric acid or the like. The monomer copolymerizable with these unsaturated carboxylic acids may be an ester of these unsaturated carboxylic acids, vinyl acetate, ethylene, acrylamide, vinyl ether, or the like. As the synthetic macromolecule, a macromolecule that uses acrylic acid or methacrylic acid as an unsaturated carboxylic acid is particularly preferable. Specifically, polyacrylic acid, polymethacrylic acid, a salt of a copolymer of acrylic acid and methacrylic acid, or a salt of a copolymer of acrylic acid or methacrylic acid and alkyl acrylate or alkyl methacrylate is particularly preferable. The natural product may be sodium alginate, xanthan gum, gellan gum, tragacanth gum, pectin or the like.

(Solution adding process)

[0046] Next, the solution adding process (S3) of the embodiment will be described. In the solution adding process (S3), as illustrated in FIG 5, the above described binder solution is sprayed from respective two-fluid-type spray nozzles 3 and 3 on both external surfaces of the ply continuous sheet 1B (surfaces for which the continuous dry base paper 1A and 1A do not face each other at the time of applying the ply process to the continuous dry base paper 1A and 1A). In this way, the water-soluble binder included in the binder solution can be added to the ply continuous sheet 1B. It should be noted that as a method of spraying the binder solution, for example, immediately after the respective two-fluid-type spray nozzles spray the above described binder solution to the external surfaces of sheets of the respective continuous dry base paper 1A and 1A fed from the above described primary web rollers 1 and 1 (to surfaces that the respective sheets do not face), a ply process may be applied to the continuous dry base paper 1A and 1A so as to generate a sheet equivalent to the above described continuous sheet 1C.

[0047] Each of the two-fluid-type spray nozzles 3 is a type of a spray nozzle that mixes and sprays liquid and compressed air divided into two systems, and is able to finely and uniformly spray liquid relative to a single-fluid-type spray nozzle that singly sprays compressed liquid. In a case where two-fluid-type spray nozzles are used in the embodiment, because the two-fluid-type spray nozzles apply, at a high pressure (spraying pressure that is higher than or equal to 1.5 MPa), the binder solution (having viscosity of 400 MPa.s to 1200 MPa.s) to each of the external surfaces of the ply continuous sheet 1B to which the ply process has been applied, the binder solution is easily added in the thickness direction of the sheet. In contrast, in a case where single-fluid-type spray nozzles are used in the embodiment, the single-fluid-type spray nozzles apply, at a spraying pressure lower than or equal to 1.5 MPa, the binder solution (having viscosity of 400 MPa.s to 1200 MPa.s) to each of the external surfaces of the ply continuous sheet 1B to which the ply process has been applied, whereby the binder solution is easily added in the thickness direction of the sheet, and the binder solution is uniformly applied to the sheet surfaces.

(Drying process)

[0048] Next, the drying process (S4) of the embodiment will be described. In the drying process (S4), as illustrated in FIG. 5, insoluble liquid components in the binder solution of the continuous sheet 1C described above are evaporated by the drying facility 4 to fix active components, CMC in particular, to the fiber. Here, because the impregnation amount of the binder solution decreases towards inside from the external surfaces (the front surface and the back surface) of the continuous sheet 1C in the thickness direction, the fixation amount

of CMC decreases towards inside in the thickness direction. Hence, when the chemical solution is added in the finishing process (S7) that will be described later below, towards inside in the thickness direction, a cross-linking reaction is less likely to occur and voids increase, and therefore the chemical solution can be trapped inside the sheet. Thereby, it is possible to obtain the toilet cleaning sheet 100 that does not easily dry. Further, because a large amount of cross-linking reactions of CMC occur in the vicinities of the external surfaces of the continuous sheet 1C, it is possible to strengthen the surface strength of the obtained toilet cleaning sheet 100. As the drying facility 4, a dryer facility with a hood that supplies hot air to the continuous sheet 1C to dry the continuous sheet 1C can be used. It should be noted that, in order to cause the sheets to more firmly adhere to each other, pressing rollers or turning rollers may be installed and then the continuous sheet 1C is passed through the pressing rollers or the turning rollers before the drying process (S4).

[0049] Further, as the drying facility described above, a facility that emits an infrared ray may be used. In this case, a plurality of infrared ray emitting parts are arranged in parallel in the conveying direction of the above described continuous sheet 1C, and infrared rays are emitted to the conveyed continuous sheet 1C to dry the sheet 1C. Because water is heated and dried by the infrared rays, the sheet can be uniformly dried and generation of wrinkles in the subsequent slitting/winding process can be prevented relative to a dryer using hot air.

(Slitting/winding process)

[0050] Next, the slitting/winding process (S5) of the embodiment will be described. In the slitting/winding process (S5), in order to obtain a web for when the continuous hydrolysable sheet 1D, to which the ply process has been applied, is processed by an off-line processing machine, while tension of the continuous hydrolysable sheet 1D, dried in the above described drying process (S4) and to which CMC has been fixed, is adjusted, the sheet is slit by a slitter 5 at a predetermined width and wound in a winder facility 6. A winding speed is appropriately determined in consideration of the ply process (S2), the solution adding process (S3), and the drying process (S4). It should be noted that if the winding speed is too fast, the sheet may break, and if the winding speed is too slow, the sheet may wrinkle. In the slitting/winding process (S5), the continuous hydrolysable sheet 1D, to which the ply process has been applied, is pressure-joined such that the continuous hydrolysable sheet 1D is further unified to be a single sheet.

(Embossing process)

[0051] Next, the embossing process (S6) of the embodiment will be described. In the embossing process (S6), as illustrated in FIG. 6, the continuous hydrolysable sheet 1D, fed from the secondary web roller 11, is em-

bossed by embossing rollers 12 to form predetermined shapes on the entire sheet surface. The sheet is embossed in order to enhance design quality as well as to enhance strength, bulkiness, wiping performance, and the like of the sheet.

(Finishing process)

[0052] Next, the finishing process (S7) of the embodiment will be described. In the finishing process (S7), as illustrated in FIG. 6, a series of processes, which include a process of cutting the embossed sheet 1E, a process of folding the respective cut sheets, impregnating the respective folded sheets with the above described chemical solution, and packaging the respective sheets impregnated with the above described chemical solution, are performed in a finishing facility 13. Here, it is preferable to use a polyvalent metal ion in the cross-linking agent included in the chemical solution, in a case where CMC is used as the water-soluble binder. In particular, it is preferable to use one kind or two or more kinds of polyvalent metal ions selected from among the group consisting of alkaline earth metals, manganese, zinc, cobalt, and nickel, in terms of sufficiently bonding the fibers to develop strength for withstanding use and of having sufficient hydrolyzability. It is particularly preferable to use ions of calcium, strontium, barium, zinc, cobalt, and nickel among these metal ions. As described above, through the respective processes, the toilet cleaning sheet 100 is produced.

[0053] As described above, according to the embodiment, by increasing a compounding ratio of leaf bleached kraft pulp with respect to needle bleached kraft pulp such that a compounding ratio of needle bleached kraft pulp to leaf bleached kraft pulp is less than 1/1, gaps between the fibers can be decreased and evaporation of water in the chemical solution can be suppressed. Further, because a trihydric or higher alcohol is added at 1% to 20% by weight with respect to the weight of the base paper sheet, it is possible to obtain the sheet having viscosity and to suppress evaporation of water in the chemical solution. Furthermore, the base paper sheet (continuous sheet 1C) is in a state in which the content of CMC increase from inside towards the front surface and the back surface in the thickness direction of the base paper sheet. Therefore, when the base paper sheet is impregnated with the chemical solution containing a cross-linking agent, towards inside in the thickness direction, the cross-linking reaction is less likely to occur and voids increase. Accordingly, the chemical solution can be confined inside the sheet. In this way, it is possible to obtain the toilet cleaning sheet 100 that does not easily dry. Further, because a large quantity of cross-linking reactions of CMC occur in the vicinities of the external surfaces of the base paper sheet, it is possible to strengthen the surface strength of the obtained toilet cleaning sheet 100.

[0054] Specific descriptions have been provided

above based on the embodiment of the present invention, but the present invention is not limited to the above described embodiment, and may be modified without departing from the scope of the invention. In the described embodiment of the present invention, an example is illustrated in which each of the embossments EM11 has the curved-shaped protruding part PR 21 and each of the embossments EM12 has the planar-shaped protruding part PR22, but the embossments are not necessarily limited to these shapes. For example, protruding parts of the embossments EM11 and the embossments EM12 may have planar shapes of differing heights. Alternatively, for example, each embossment EM11 may have a planar-shaped protruding part, and each embossment EM12 may have a curved-shaped protruding part.

[0055] In other words, a protruding part of each embossment may have any shape as long as two types of embossments (which are first embossments and second embossments) have protruding parts of different shapes and the second embossments are arranged around the first embossments.

[0056] Further, in the described embodiment of the present invention, the embossments EM12, each of which has the planar protruding part, are arranged between the embossments EM11, each of which has the curved surface protruding part, but the embossments EM11 may intersect with each other.

[0057] Further, in the described embodiment of the present invention, all the embossments EM11 and EM12 protrude towards the near side with respect to the drawing of FIG. 1, but embossments EM11 and EM12 having a convex shape towards the near side with respect to the drawing and embossments EM11 and EM12 having a concave shape towards the near side with respect to the drawing may be alternately arranged.

[0058] For example, as illustrated in FIG. 7, embossments EM11 and EM12 (portions illustrated by solid lines), each of which has a convex shape towards the near side with respect to the drawing of FIG. 7, and embossments EM11 and EM12 (portions illustrated by dashed lines), each of which has a concave shape with respect to the near side of the drawing of FIG. 7, may be alternately arranged to provide a household tissue that has high wiping performance for both surfaces of the toilet cleaning sheet 100 as well as enhancing surface strength of the household tissue by being embossed.

[0059] Further, in the described embodiment of the present invention, the protruding parts PR21 of the embossments EM11 and the protruding parts PR22 of the EM12 are close to cohere to be formed as the conjoined embossment EM21. However, the protruding parts PR21 of the embossments EM11 and the protruding parts PR22 of the EM12 may be simply close to each other without cohering.

[0060] Further, in the described embodiment of the present invention, an example is illustrated in which each embossment EM11 has a circular shape or an elliptical shape, but the shape of each embossment may be any

shape, such as a rectangular shape or a polygonal shape.

[0061] Further, it is preferable that heights HT21 and HT22 of the protruding parts of the embossment EM11 and EM12 in FIG. 2 are 0.40 mm to 0.75 mm, for example. It should be noted that the surfaces are three-dimensionally measured by a digital microscope made by KEYENCE Co. to measure the heights HT21 and HT22 of the protruding parts of the embossments EM11 and EM12, for example.

[0062] For example, when the heights are less than 0.40 mm, friction at the time of wiping becomes stronger and the wiping becomes difficult. When the heights exceed 0.75 mm, the shapes of the embossments EM11 and EM12 becomes easily deformed at the time of being packaged, and the appearance becomes worse.

[0063] Further, the embossed pattern is not limited to the above described pattern, but may be embossed patterns as illustrated in FIGS. 8 to 10. As illustrated in FIGS. 8 to 10, concave portions e2 have shapes obtained by inverting convex portions e1. The embossed pattern is formed such that the convex portions e1 and the concave portions e2 are alternately arranged in each of many lines and the convex portions e1 and the concave portions e2 in the adjacent lines are arrayed to be shifted with respect to each other by one-half pitch. In this way, by alternately forming the convex portions e1 and the concave portions e2 in both the longitudinal direction and the lateral direction, wiping performance of dirt can be enhanced relative to an embossed pattern in which convex portions are arranged in one line and convex portions are arranged in one line. It should be noted that the shapes of the convex portions e1 and the concave portions e2 are not particularly limited, and shapes such as circular shapes, elliptic shapes, and polygonal shapes may also be used. These shapes may be combined.

[Industrial Applicability]

[0064] The present invention is preferably applicable to a field of producing a hydrolysable sheet.

Description of Reference Symbols

[0065]

- 100 toilet cleaning sheet
- 1 primary web roller
- 1A continuous dry base paper
- 1B ply continuous sheet
- 1C continuous sheet
- 1D continuous hydrolysable sheet
- 1E embossed sheet
- 2 overlapping part
- 3 spray nozzle
- 4 first drying facility
- 5 slitter
- 6 winder facility
- 11 secondary web roller

12 embossing roller
 13 finishing facility
 EM11 embossment
 EM12 embossment
 EM13 embossment
 PR21 protruding part
 PR22 protruding part

each of the second embossments differing from a shape of a protruding part of each of the first embossments.

Claims

1. A hydrolysable sheet obtained by impregnating a base paper sheet, to which a water-soluble binder is added, with a chemical solution, wherein the base paper sheet is obtained by applying a ply process to a plurality of sheets of base paper and has a basis weight of from 30 gsm to 150 gsm, a compounding ratio of softwood pulp to hardwood pulp is less than 1/1, the chemical solution contains a cross-linking agent, which causes the water-soluble binder to initiate a cross-linking reaction, and a trihydric or higher alcohol, and with respect to a weight of the base paper sheet, the base paper sheet is impregnated with the trihydric or higher alcohol at 1% to 20% by weight.
 2. A hydrolysable sheet obtained by impregnating a base paper sheet, to which a water-soluble binder is added, with a chemical solution, wherein the base paper sheet is obtained by applying a ply process to a plurality of sheets of base paper and has a basis weight of from 30 gsm to 150 gsm, a compounding ratio of softwood pulp to hardwood pulp is less than 2/3, the chemical solution contains a cross-linking agent that causes the water-soluble binder to initiate a cross-linking reaction, and with respect to a weight of the base paper sheet, the base paper sheet is impregnated with the chemical solution at 150% to 300% by weight.
 3. The hydrolysable sheet according to claim 1 or 2, wherein the base paper sheet is in a state in which a content of the water-soluble binder increases from inside towards a front surface and a back surface in a thickness direction of the base paper sheet.
 4. The hydrolysable sheet according to any one of claims 1 to 3, wherein embossments are formed on an entire surface of the hydrolysable sheet.
 5. The hydrolysable sheet according to claim 4, wherein the embossments include
 - first embossments and
 - second embossments arranged around the first embossments, a shape of a protruding part of
6. The hydrolysable sheet according to claim 5, wherein the first embossments are arrayed in a rhomboid grid.
7. The hydrolysable sheet according to claim 5 or 6, wherein each of the second embossments is arrayed between two of the first embossments.
8. The hydrolysable sheet according to any one of claims 5 to 7, wherein the first embossments contact the second embossments to form a conjoined embossment.

FIG.1

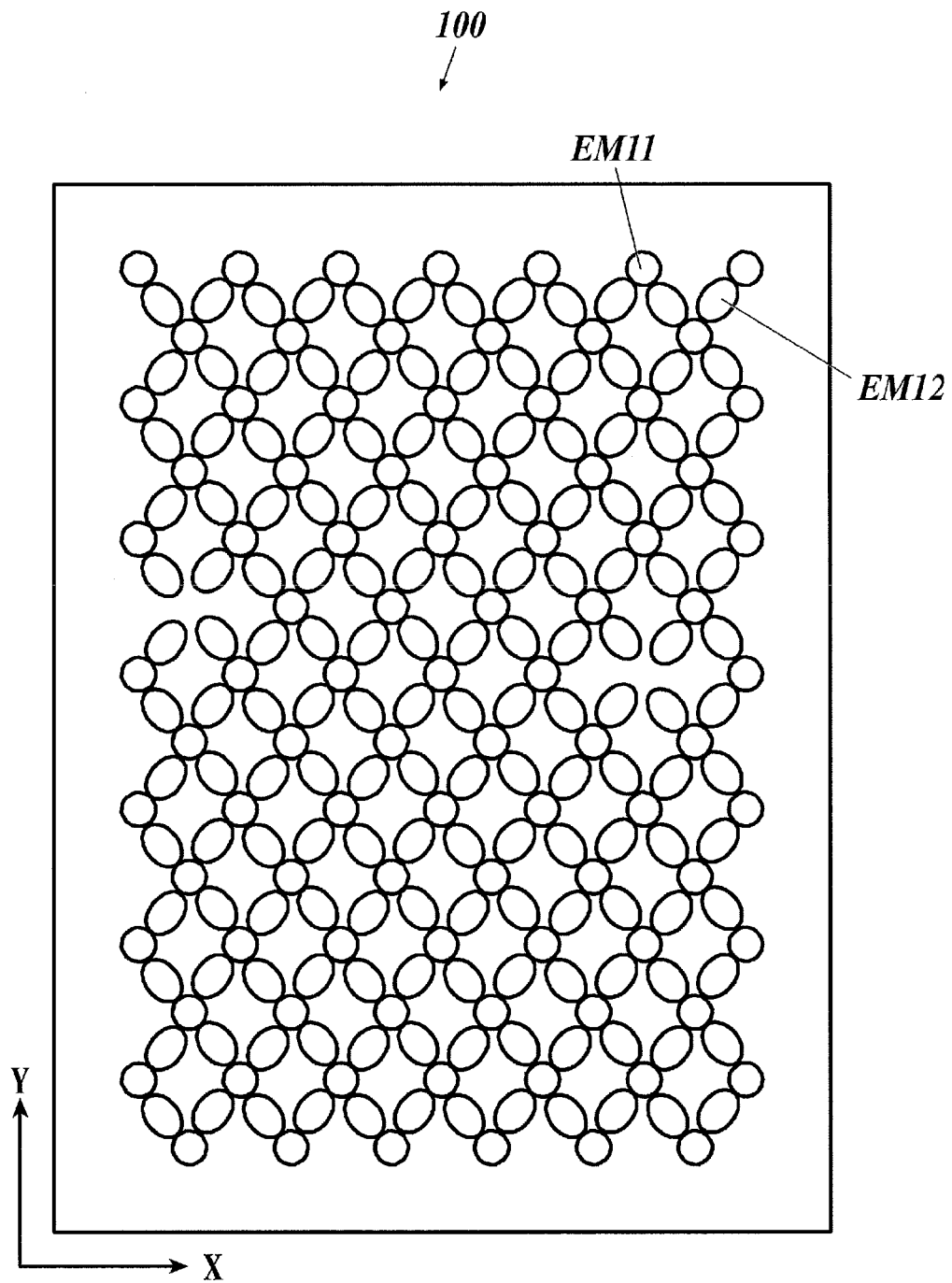


FIG.2A

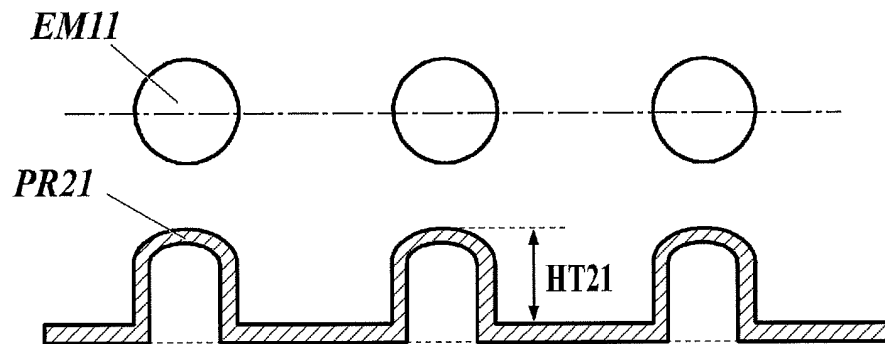


FIG.2B

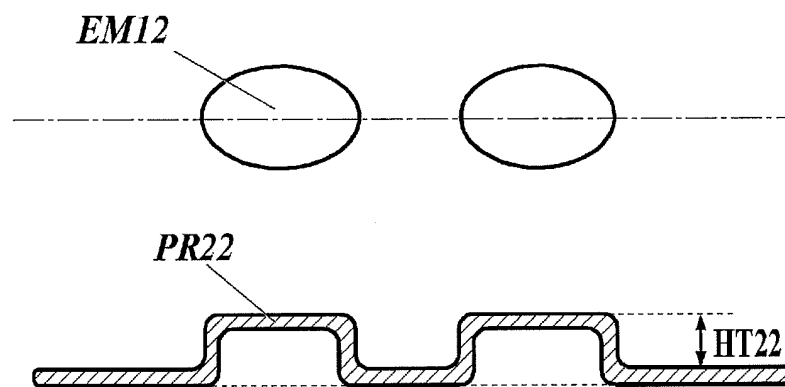


FIG.2C

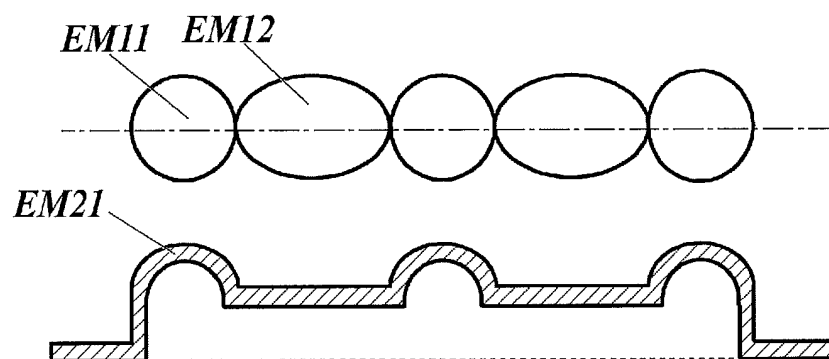


FIG.3A

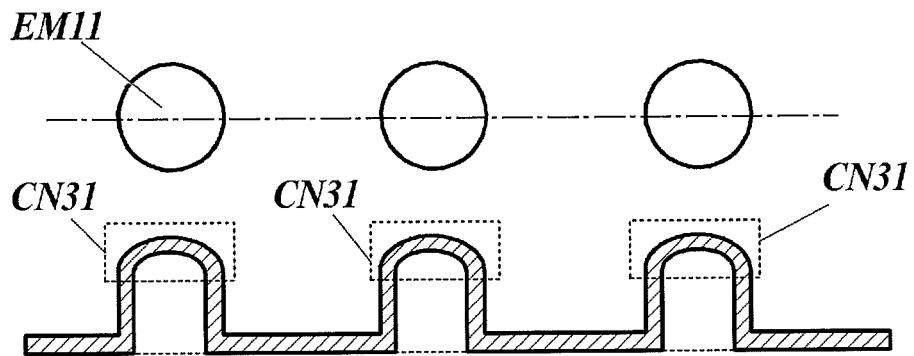


FIG.3B

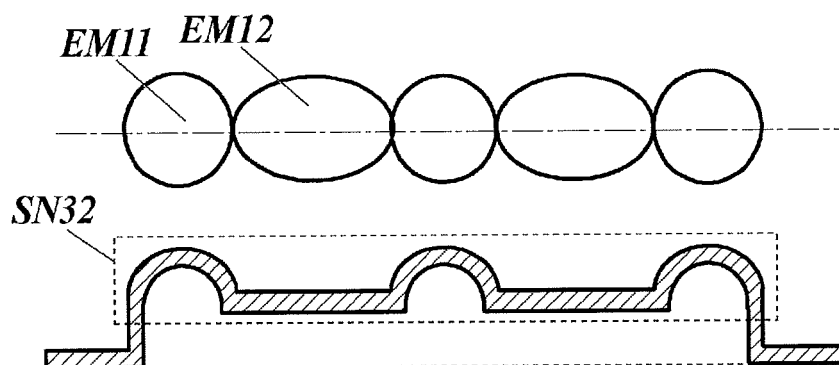


FIG.4

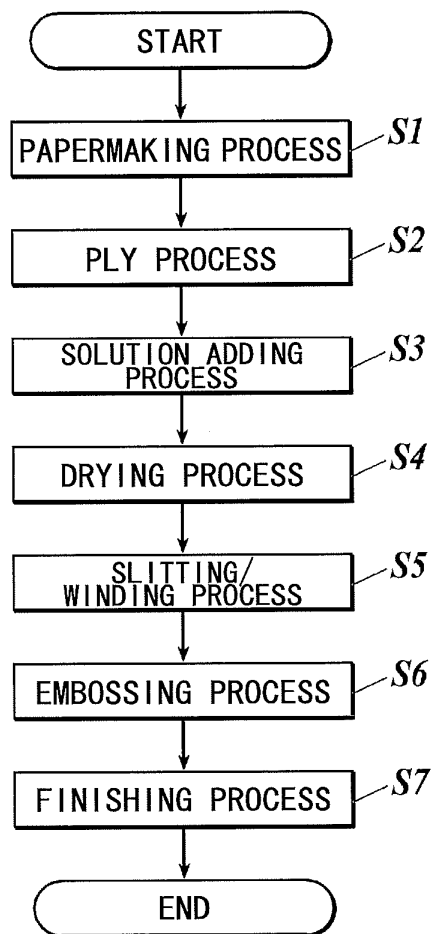


FIG.5

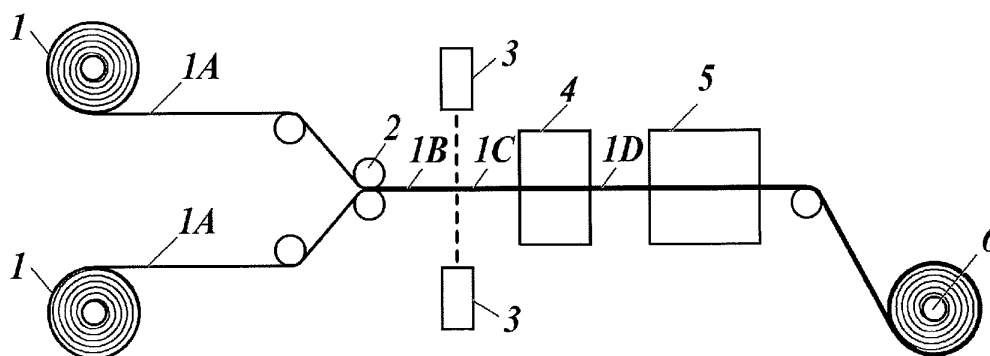


FIG.6

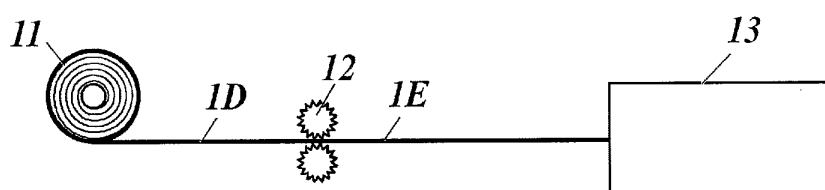


FIG. 7

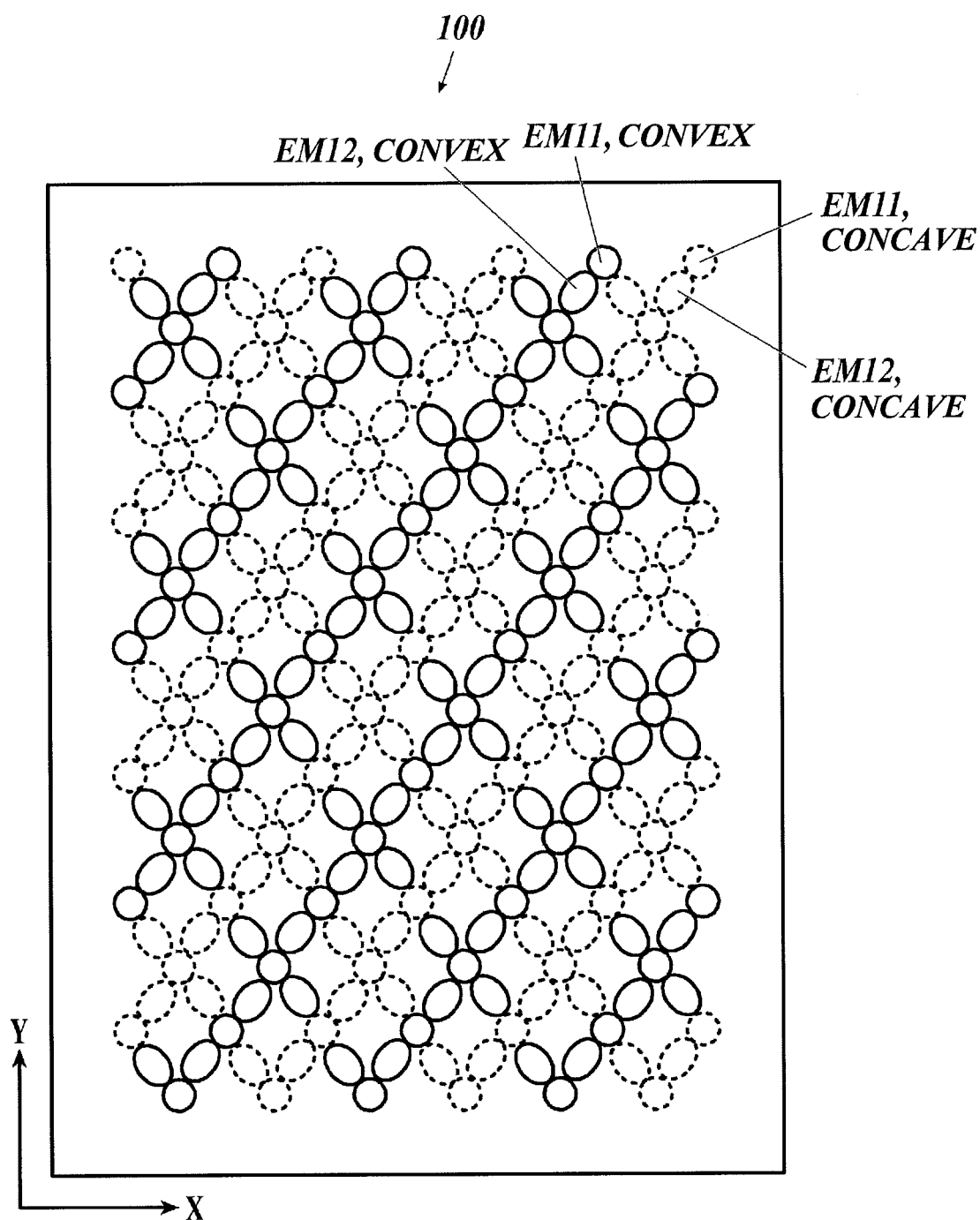


FIG.8

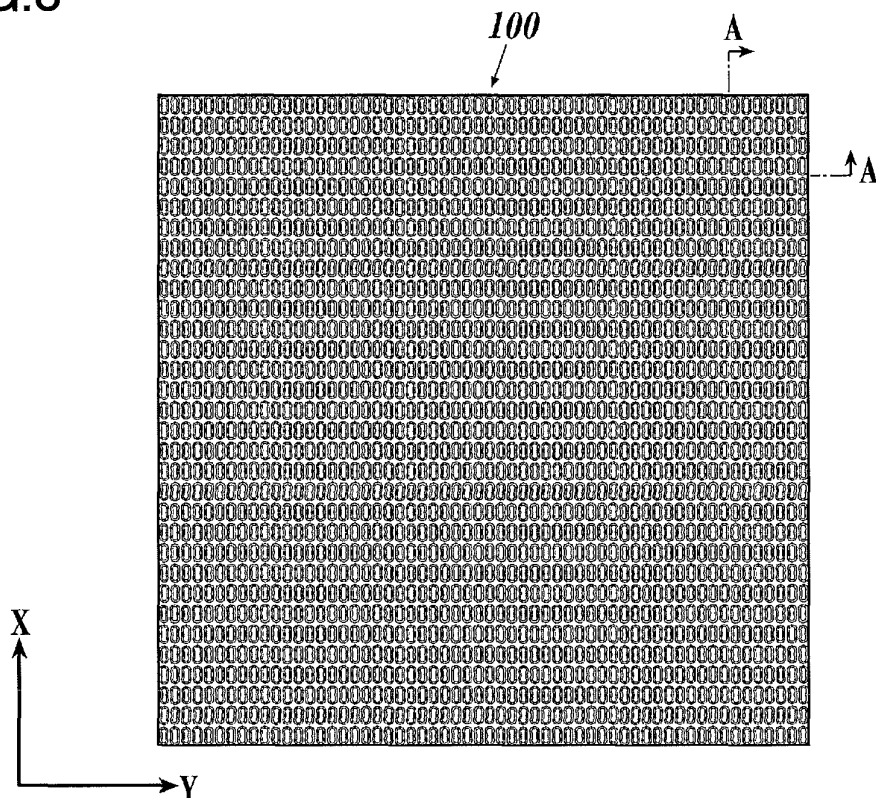


FIG.9

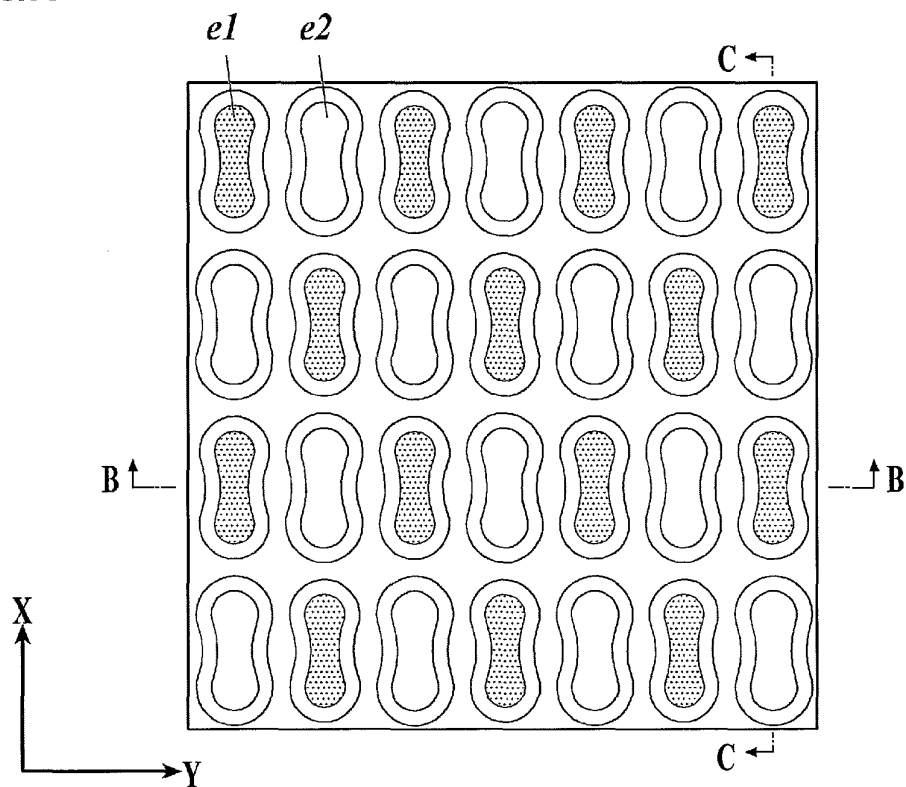


FIG.10A



FIG.10B



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/060510

A. CLASSIFICATION OF SUBJECT MATTER

D21H19/34(2006.01)i, A47L13/17(2006.01)i, D21H27/30(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)

D21H19/34, A47L13/17, D21H27/30

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2016
Kokai Jitsuyo Shinan Koho	1971-2016	Toroku Jitsuyo Shinan Koho	1994-2016

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 2011-30793 A (Daio Paper Corp.),	1-4
Y	17 February 2011 (17.02.2011), paragraphs [0024] to [0048]; fig. 1 (Family: none)	5-8
Y	JP 2007-154359 A (Kao Corp.), 21 June 2007 (21.06.2007), paragraphs [0035] to [0036]; fig. 3 & US 2007/0128411 A1 paragraphs [0042] to [0043]; fig. 3 & EP 1795638 A1 & EP 2278054 A1 & SG 132663 A	5-8



Further documents are listed in the continuation of Box C.



See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search

21 June 2016 (21.06.16)

Date of mailing of the international search report

05 July 2016 (05.07.16)

Name and mailing address of the ISA/

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Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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