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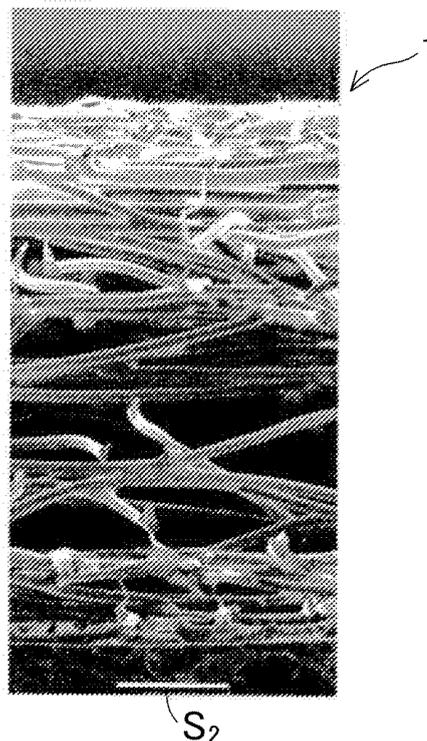
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(54) **LIQUID-ABSORBING SHEET AND PROCESS FOR PRODUCTION THEREOF**

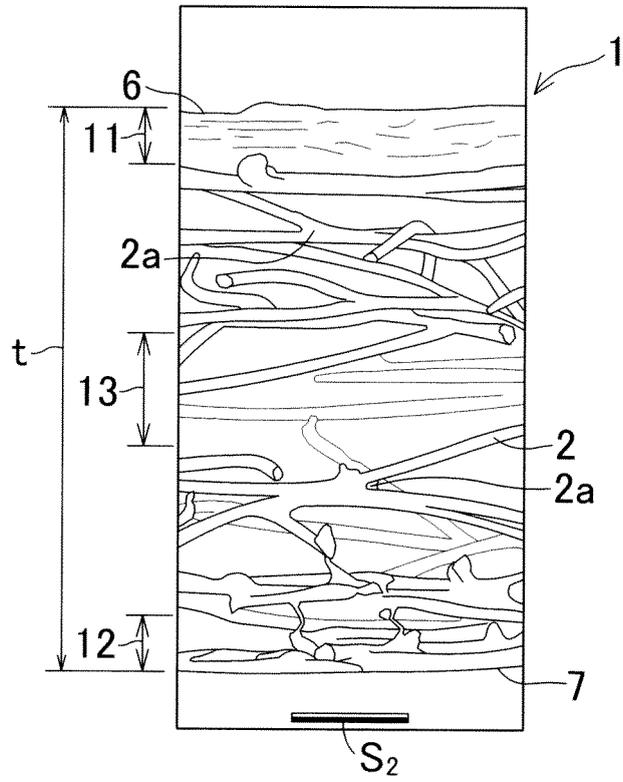
(57) The present invention aims to improve the handiness of a liquid-absorbent sheet used to absorb liquid leaching out from foodstuff such as fish or meat. The liquid-absorbent sheet 1 used for absorbing liquid leaching out from foodstuff such as fish or meat is formed of a non-woven fabric containing core-in-sheath type conjugate fibers 2 in at least 60% by weight. The conjugate fibers 2 having the sheath components fused together. Assumed that the thickness of the non-woven fabric is divided equally into 10 layers consisting of 1st to 10th layers, respective densities of the 1st layer and the 10th layer are adjusted to be higher than an average value obtained from respective densities of the 5th layer and the 6th layer.

FIG.2A



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FIG.2B



Description

TECHNICAL FIELD

5 **[0001]** The present invention relates to a liquid-absorbent sheet suitable for absorption of liquid leaching out from foodstuff and a method for making the same.

BACKGROUND ART

10 **[0002]** Liquid leaching from foodstuff such as fish or meat in showcases, refrigerators, defrost boxes or the like is commonly referred to as drip. To avoid undesirable change of taste and deterioration of visual quality of foodstuff due to this leaching liquid, it is well known to use the liquid-absorbent sheet as an underlay for such foodstuff so that this liquid-absorbent sheet may absorb the leaching liquid.

15 **[0003]** For example, the food pack disclosed by JP 57-9767 Y (PATENT DOCUMENT 1) is provided on the bottom of the container with the inside wall made of highly water-absorbent material such as sponge or fiber. Foodstuff such as fish or meat is loaded on this inside bottom wall and liquid leaching out from this foodstuff is absorbed by the inside bottom wall.

20 **[0004]** The oil- and water-absorbent sheet disclosed by JP 02-131885 Y (PATENT DOCUMENT 2) comprises a laminate of an oil-absorbent sheet and a water-absorbent sheet wherein the sheet adapted to come in direct contact with foodstuff is formed with a plurality of perforations. The oil-absorbent sheet is formed for example, of a non-woven fabric of polyolefin or a synthetic pulp sheet and the water-absorbent sheet is formed of a sheet material such as a paper, a non-woven fabric or a super-absorbent resin.

25 [PATENT DOCUMENT 1] JP 57-9767 Y

[PATENT DOCUMENT 2] JP 02-131885 Y

DISCLOSURE OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

30 **[0005]** According to the disclosure of JP 57-9767 Y (PATENT DOCUMENT 1), the container adapted to contain foodstuff is preferably provided with the liquid-absorbent sheet, for example, liquid-absorbent non-woven fabric or pulp sheet as the inside bottom wall in order to absorb liquid leaching out from foodstuff. According to the disclosure of JP 02-131885 Y (PATENT DOCUMENT 2), the liquid-absorbent sheet can be improved so that both oily components and aqueous components contained in leaching liquid may be absorbed at once. However, in addition to the improvement in absorption capacity as well as in strength of the liquid-absorbent sheet, there is a need for improvement in handiness of the liquid-absorbent sheet among the workers handling a large amount of the liquid-absorbent sheets of this type every day in various retail premises. The improvement in handiness, in other words, the improvement in handiness is needed, for example, from a number of liquid-absorbent sheets stacked in one hand, the individual liquid-sheets can be rapidly put on a display rack one by one with the other hand. Regrettably, any technique adapted to meet such need for the improvement of the liquid-absorbent sheet can not be found in the prior art.

40 **[0006]** In view of the problem as has been described above, it is an object of the present invention to improve the handiness of the liquid-absorbent sheet used to absorb liquid leaching out from foodstuff such as fish or meat.

MEASURE TO SOLVE THE PROBLEM

45 **[0007]** The present invention aims to solve the problem as has been described comprises a first aspect relating to a liquid-absorbent sheet and a second aspect relating to a method for making the same. The problem is solved, according to the present invention on the first aspect, by an improvement in the liquid-absorbent sheet formed of a non-woven fabric containing thermoplastic synthetic fiber and having a thickness defined by a first surface and a second surface extending in parallel to each other wherein one of the first and second surfaces may be brought into contact with foodstuff to absorb liquid leaching out from the foodstuff.

50 **[0008]** The improvement according to the present invention on the first aspect thereof is characterized in following features. The thermoplastic synthetic fiber is core-in-sheath type conjugate fiber having a fineness in a range of 1 to 6dtex wherein a fusion temperature of first thermoplastic synthetic resin forming the sheath component of the conjugate fiber is lower than a fusion temperature of second thermoplastic resin forming the core component of the conjugate fiber and the thermoplastic synthetic fibers intersecting one with another are entangled one with another as the sheath components are fused together at intersections of the conjugate fibers. The non-woven fabric has a basis weight in a

range of 30 to 80g/m² and contains the thermoplastic synthetic fiber at least in 60% by weight wherein, on an assumption that the thickness of the non-woven fabric extending from the first surface to the second surface is divided equally into 10 layers consisting of 1st to 10th layers, a density of the 1st layer inclusive of the first surface and a density of the 10th layer inclusive of the second surface are respectively higher than an average value obtained from respective densities of the 5th layer and the 6th layer both defined in the middle of the thickness.

[0009] According to one preferred embodiment of the invention on the first aspect, the liquid-absorbent sheet is shaped in a rectangle having a longitudinal direction and a transverse direction bisecting each other at right angles wherein a dimension in the longitudinal direction is larger than a dimension in the transverse direction and a Gurley's stiffness in the longitudinal direction measured in accordance with Method A (i.e., Gurley Method) specified in Section 60. 20. 1 of JIS L 1096 is at least 1.00mN.

[0010] According to another preferred embodiment of the invention on the first aspect, coefficients of static friction of the first surface and the second surface in the longitudinal direction are respectively in a range of 0.1 to 0.4.

[0011] According to still another preferred embodiment of the invention on the first aspect thereof, a density of the 1st layer and the 10th layer is respectively in a range of 0.07 to 0.3g/cm³ and an average value of respective densities of the 5th layer and the 6th layer is in a range of 0.005 to 0.03g/cm³.

[0012] According to yet another preferred embodiment of the invention on the first aspect thereof, the liquid-absorbent sheet contains cellulose-based fibers up to 40% by weight.

[0013] The problem as has been described is solved, according to the invention on the second aspect thereof, by an improvement in the method for making the liquid-absorbent sheet by an improvement in the liquid-absorbent sheet formed of a non-woven fabric containing thermoplastic synthetic fiber and having a thickness defined by a first surface and a second surface extending in parallel to each other wherein one of the first and second surfaces may be brought into contact with foodstuff to absorb any amount of liquid leaching out from the foodstuff.

[0014] The improvement according to the invention on the second aspect thereof is characterized by comprising the steps of:

(1) feeding web containing thermoplastic synthetic fibers in a machine direction, the thermoplastic synthetic fiber being core-in-sheath type conjugate fiber having a fineness in a range of 1 to 6dtex, a fusion temperature of first thermoplastic synthetic resin forming the sheath component of the conjugate fiber being lower than a fusion temperature of second thermoplastic resin forming the core component of the conjugate fiber, the web containing such thermoplastic synthetic fiber at least in 60% by weight wherein the web has a basis weight in a range of 30 to 80g/m² and a thickness defined by a pair of surfaces;

(2) guiding the web into a nip between a first heating roll having a surface temperature equal to or higher than the fusion temperature of the first thermoplastic synthetic resin and equal to or lower than the fusion temperature of the second thermoplastic synthetic resin and an unheated pressure roll so that the web would be further fed in the machine direction while one of the paired surfaces of the web is maintained in close contact with a peripheral surface of the first heating roll and the conjugate fibers would be fused together in a thickness direction of the web to form the first surface;

(3) guiding the web having passed the first heating roll into a nip between a second heating roll having a surface temperature equal to or higher than the fusion temperature of the first thermoplastic synthetic resin and equal to or lower than the fusion temperature of the second thermoplastic synthetic resin and an unheated pressure roll so that the web may be further fed in the machine direction while the other of the paired surfaces of the web is maintained in close contact with a peripheral surface of the second heating roll and the conjugate fibers forming the other surface may be fused together in the thickness direction of the web to form the second surface; and

(4) cooling the web down to an ambient temperature.

[0015] According to one preferred embodiment of the invention on the second aspect thereof, the method further includes, upstream of the step (1) or between the step (2) and the step (3) or downstream of the step (3), a step of feeding the web in the machine direction so as to pass through, under no load, a heating chamber maintained at a temperature equal to or higher than a fusion temperature of the first thermoplastic synthetic fiber and equal to or lower than a fusion temperature of the second thermoplastic synthetic fiber so that the conjugate fibers may be locally fused together at intersections thereof.

[0016] According to another preferred embodiment of the invention on the second aspect thereof, on an assumption that the thickness of the non-woven fabric extending from the first surface to the second surface is divided equally into 10 layers consisting of 1st to 10th layers, a density of the 1st layer inclusive of the first surface and a density of the 10th layer inclusive of the second surface are respectively higher than an average value obtained from respective densities of the 5th layer and the 6th layer both defined in the middle of the thickness.

[0017] According to another preferred embodiment of the invention on the second aspect thereof, an average value obtained from respective densities of the 1st layer and the 10th layer is in a range of 0.07 to 0.3g/cm³ and an average

value obtained from respective densities of the 5th layer and the 6th layer is in a range of 0.005 to 0.03g/cm³.

[0018] According to still another preferred embodiment of the invention on the second aspect thereof, a Gurley's stiffness in the machine direction measured in accordance with Method A (i.e., Gurley Method) specified in Section 60. 20. 1 of JIS L 1096 is at least 1.00mN.

5 **[0019]** According to yet another preferred embodiment of the invention on the second aspect thereof, the first surface and the second surface exhibit a coefficient of static friction in the machine direction in a range of 0.1 to 0.4.

[0020] According to further another preferred embodiment of the invention on the second aspect thereof, the web contains cellulose-based fibers up to 40% by weight.

10 EFFECT OF THE INVENTION

[0021] The liquid-absorbent sheet according to the present invention on the first aspect thereof achieves high Gurley's stiffness and high slipperiness of both the first surface and the second surface by fusing the conjugate fibers together in the 1st layer and the 10th layer. As a consequence, the individual liquid-absorbent sheets can be easily picked up from a stack of the liquid-absorbent sheets and placed on the display shelf or the like. Respective densities of the 1st layer and the 10th layer are higher than the average value obtained from respective densities of the 5th layer and the 6th layer forming together the middle layer and therefore the liquid-absorbent sheet having absorbed liquid leaching out from the foodstuff does not easily discharge liquid leaching out from the foodstuff and retained by the liquid-absorbent sheet.

20 **[0022]** The method according to the present invention on the second aspect thereof provides the liquid-absorbent sheet having the 1st layer and the 10th layer in which the thermoplastic synthetic fibers are fused together to achieve the high density and the smooth surfaces by putting one of the opposite surfaces in close contact with the peripheral surface of the first heating roll under a pressure and then putting the other surface in close contact with the peripheral surface of the second heating roll under a pressure. In addition, by feeding the web to pass through the heating chamber under no load, the web can obtain the middle layer between the 1st layer and the 10th layer in which the thermoplastic synthetic fibers are fused together but the density is maintained low. The core-in-sheath type conjugate fibers are used as the thermoplastic synthetic fibers of which the first thermoplastic synthetic resin having a low fusion temperature and forming the core components is fused together but the second thermoplastic synthetic resin is not fused together. Consequently, the thermoplastic synthetic fibers would not get out of the shape intrinsic to the fibers because of the contact with the first and second heating rolls. In the thermoplastic synthetic fibers, a thermoplastic synthetic resin having a low fusion temperature is used as the first thermoplastic synthetic resin forming the sheath components and another thermoplastic synthetic resin having a high fusion temperature and a high stiffness is used as the second thermoplastic synthetic resin forming the core components. In this way, the liquid-absorbent sheet having the high stiffness can be easily produced.

35 BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

- 40 [FIG. 1] Fig. 1 is a perspective view of a liquid-absorbent sheet.
 [FIG. 2] Fig. 2 is a partial sectional photo taken along the line II-II in Fig. 1.
 [FIG. 3] Fig. 3 is a diagram illustrating one example of a process for making the liquid-absorbent sheet.
 [FIG. 4] Fig. 4 is a photo similar to Fig. 2, showing another example of the liquid-absorbent sheet.
 [FIG. 5] Fig. 5 is a photo similar to Fig. 2, relating to a web.
 45 [FIG. 6] Fig. 6 is a photo similar to Fig. 2, relating to a first comparative sheet.
 [FIG. 7] Fig. 7 is a photo similar to Fig. 2, relating to a second comparative sheet.
 [FIG. 8] Fig. 8 is a photo similar to Fig. 2, relating to a third comparative sheet.
 [FIG. 9] Fig. 9 is a diagram successively illustrating procedures for density measurement of the liquid-absorbent sheet in A, B and C.
 50 [FIG. 10] Fig. 10 is a diagram similar to Fig. 3, illustrating another example of the process for making the liquid-absorbent sheet.

IDENTIFICATION OF REFERENCE NUMERALS USED IN THE DRAWINGS

55 **[0024]**

- 1 liquid-absorbent sheet
- 2 thermoplastic synthetic fiber (conjugate fiber)

- 6 first surface (upper surface)
- 7 second surface (lower surface)
- 11 1st layer (uppermost layer)
- 12 10th layer (lowermost layer)
- 5 13 middle layers (fifth and sixth layers)
- A longitudinal direction
- B transverse direction

DESCRIPTION OF THE BEST MODE FOR WORKING OF THE INVENTION

10 **[0025]** A liquid-absorbent sheet and a method for making the same both according to the present invention will be described in reference to the accompanying drawings.

15 **[0026]** Fig. 1 is photo of a liquid-absorbent sheet 1 suitable for use in fish- or meat-shops, restaurants or homes as viewed obliquely from above. While nothing is specified in terms of shape, the liquid-absorbent sheet 1 usually has a rectangular shape and a longitudinal direction A and a transverse direction B which are orthogonal to each other wherein a dimension in the longitudinal direction A is longer than a dimension in the transverse direction B. Additionally, the liquid-absorbent sheet 1 has a liquid-pervious upper and lower surfaces 6, 7 and preferably the liquid-absorbent sheet 1 assures that liquid leaching out from foodstuff can be reliably absorbed whether the foodstuff (not shown) is placed on the upper surface 6 or on the lower surface 7.

20 **[0027]** Of Fig. 2, A is a photo showing a partial cross section taken along the line II-II in Fig. 1 in a magnification ratio of 60 and B is a diagram illustrating outlines of predominant ones of conjugate fibers 2 in A. The liquid-absorbent sheet 1 is formed of a non-woven fabric made of core-in-sheath type conjugate fibers 2 locally fused together and having a basis weight in a range of 30 to 80 g/m² wherein the thickness t thereof is defined by the flat upper and lower surfaces 6, 7 as shown in Fig. 2. The conjugate fiber 2 has fineness in a range of 1 to 6dtex and a fiber length in a range of 30 to 70mm. The sheath component (not shown) is formed by thermoplastic synthetic resin having a fusing temperature lower than that of the core component. The core component, in turn, is formed preferably by thermoplastic synthetic resin having an elastic modulus higher than that of the thermoplastic synthetic resin forming the sheath component so as to enhance a stiffness of the liquid-absorbent sheet 1. Such combination of the thermoplastic synthetic resin forming the sheath component and the thermoplastic synthetic resin forming the core component may be achieved, for example, by combination of polyethylene/polypropylene, polyethylene/polyester or polypropylene/polyester. A scale S_2 indicated on the lower side of Fig. 2A as a horizontal line segment has a length corresponding to 166 μ m.

25 **[0028]** As will be apparent from Fig. 2, the plural conjugate fibers 2 have the respective sheath components fused together and thereby entangled with one another in regions 2a. As viewed in a thickness direction of the liquid-absorbent sheet 1, the conjugate fibers 2 are aggregated at a relatively high density in the vicinity of the upper surface 6 as well as in the vicinity of the lower surface 7 and at a relatively low density in a middle portion between the upper surface 6 and the lower surface 7. In one preferred embodiment of the liquid-absorbent sheet 1, density of an uppermost layer 11 including the upper surface 6 and occupying thickness of $1/10t$ as well as density of a lowermost layer 12 including the lower surface 7 and occupying thickness of $1/10t$ is adjusted to be higher than density of a middle layer 13 defined between the upper and lower surfaces 6, 7 and occupying thickness of $2/10$. In another preferred embodiment of the liquid-absorbent sheet 1, the density is adjusted to increase gradually from the middle layer 13 toward the uppermost layer 11 and the lowermost layer 12, respectively. In a particularly preferred embodiment of the liquid-absorbent sheet 1, at least the uppermost layer 11 and the lowermost layer 12 out of the total thickness t have a density in a range of 0.07 to 0.3g/cm³, respectively, and the middle layer 13 has a density in a range of 0.005 to 0.03g/cm³. Both the upper surface 6 and the lower surface 7 of the liquid-absorbent sheet 1 may be smoothed to assure that a high slipperiness among a plurality of the sheets 1 when these sheets 1 are stacked one on another and a coefficient of static friction in the longitudinal direction A of these sheets 1 as a rough indication of the slipperiness is preferably in a range of 0.1 to 0.4 as measured by HEIDON TRIBOGEAR Muse Type: 94i manufactured by SHINTO Scientific Co., Ltd. (Chiyoda-Ku, Tokyo). The liquid-absorbent sheet 1 preferably has a sufficiently high stiffness to prevent the sheet 1 from being bent or noticeably flexed when an edge of the sheet 1 is pinched. More specifically, a Gurley stiffness value of the liquid-absorbent sheet 1, a rough indication of such required stiffness, is at least 1.00mN as a result of the measurement carried out on the sheet 1 flexed in the longitudinal direction A in accordance with "flexural restitution A method" specified by JIS L 1096.

30 **[0029]** The liquid-absorbent sheet 1 formed in this manner may be used as an underlay for foodstuff such as fish or meat or as a packaging sheet for such foodstuff to absorb liquid leaching out from the foodstuff. When the liquid-absorbent sheet 1 shown by Fig. 2 is used for such purpose, either the upper surface 6 or the lower surface 7 may be put in contact with the foodstuff to assure that the liquid is absorbed by the sheet 1 through fiber interstices in the upper surface 6 or the lower surface 7 toward the middle layer 13. Salesclerk in a fish- or meat-shop uses the liquid-absorbent sheet 1 in a manner such that a plurality of the liquid-absorbent sheets 1 are held by one hand and the individual sheets are picked

up one by one with the other hand to placed on a display shelf or the like. In this case, the liquid-absorbent sheets 1 stacked in the hand are sufficiently slippery on one on another to allow the salesclerk to place these liquid-absorbent sheets 1 on the display shelf or the like quickly one by one. In addition, the liquid-absorbent sheet 1 includes the uppermost layer 11 and the lowermost layer 12 both formed so as to have a sufficiently high density to increase a stiffness of the sheet 1 as a whole. In consequence, the sheet 1 would not be readily bent or flexed and such flexural resistance also assists the sheets 1 to be quickly placed on the shelf one by one.

[0030] Fig. 3 is a diagram exemplarily illustrating a process for making the liquid-absorbent sheets 1. From the left hand in Fig. 3, carded web 51 formed of conjugate fibers 2 as material for the sheet 1 is fed in a machine direction MD. This web 51 has a first surface 51a and a second surface 51b and, under cooperation of a first guide roll 52, a second guide roll 56 both being non-heated pressure rolls and a first heating roll 53, the first surface 51a of the carded web 51 is put in close contact with a peripheral surface 54 of the first heating roll 53. The first heating roll 53 is heated at a temperature sufficient to fuse the sheath component (not shown) of the conjugate fiber coming in contact with the peripheral surface 54 thereof. Then the web 51 is guided by the second guide roll 56 to leave the first heating roll 53 and conveyed by an endless belt 57 to pass in non-pressurized state through a hot air treating chamber 58. Within the hot air treating chamber 58, the hot air heats the inside of the web 51 to fuse the sheath components of the conjugate fibers 2 and thereby to fuse the conjugate fibers 2 together in the respective regions 2a (See Fig. 2) at which the conjugate fibers 2 intersect one with another. The web 51 leaving the hot air treating chamber 58 is fed in the machine direction MD through non-heated third and fourth guide rolls 61, 62, preferably in this course of being fed, the sheath components of the conjugate fibers 2a are cooled to a temperature lower than the fusion temperature of the sheath components of the conjugate fibers 2. Then, under cooperation of a fifth guide roll 63, a sixth guide roll 66 both being non-heated pressure rolls and a second heating roll 64, the second surface 51b of the carded web 51 is put in close contact with a peripheral surface 65 of the second heating roll 64. The second heating roll 64 is heated at a temperature sufficient to fuse the sheath component of the conjugate fiber. The web 51 then guided by a sixth guide roll 66 and having left the second heating roll 64 is cooled to an ambient temperature and cut in appropriate size and shape to obtain the individual liquid-absorbent sheets 1. It should be appreciated that the web 51 may contain cellulose fiber in 40% or less in weight.

[0031] In the process illustrated by Fig. 3, the first heating roll 53 serves to fuse the conjugate fibers 2 together in the vicinity of the first surface 51a in the web 51 and the second heating roll 64 serves to fuse the conjugate fibers 2 together in the vicinity of the second surface 51b. The hot air treating chamber 58 serves to fuse the conjugate fibers 2 together in the middle portion of the web 51 in the thickness direction and thereby to fortify texture of the liquid-absorbent sheet 1. While the first and second guide rolls 52, 56 cooperate with the first heating roll 53 to pressurize the web 51 and thereby to put the first surface 51a of the web 51 in close contact with the first heating roll 53, the first and second guide rolls 52, 56 themselves are used in non-heated state, more preferably in cooled state so as not to heat the web 51. Similarly, while the fifth and sixth guide rolls 63, 66 cooperate with the second heating roll 64 to pressurize the web 51 and thereby to put the second surface 51b of the web 51 in close contact with the second heating roll 64, the fifth and sixth guide rolls 63, 66 themselves are used in non-heated state, more preferably in cooled state so as not to heat the web 51. A circumferential velocity of the first and second guide rolls 52, 56 is same as a circumferential velocity of the first heating roll 53 and a circumferential velocity of the fifth and sixth guide rolls 63, 66 is same as a circumferential velocity of the second heating roll 64.

[0032] The process illustrated by Fig. 3 will be described below on the basis of a specific embodiment of the liquid-absorbent sheet 1 obtained by this process. As starting material, the web 51 formed of core-in-sheath type conjugate fibers each consisting of polyethylene as the sheath component and polyester as the core component and having a fiber length of 50mm, a fineness of 2.0dtex and a basis weight of 50 g/m² were used. A temperature of the first heating roll 53 was set to 132°C, a hot air temperature of the hot air treating chamber 58 was set to 144°C, a temperature of the second heating roll 64 was set to 130°C and the web 51 was fed in the machine direction MD at a velocity of 50m/min. Linear pressure of the first and second guide rolls 52, 56 as well as the fifth and sixth guide rolls 63, 66 exerted on the web 51 was set to a range of 2 to 5kg/cm. The liquid-absorbent sheet 1 exemplarily shown by Fig. 2 was obtained under these conditions wherein the first surface 51a and second surface 51b of the web 1 correspond to the upper surface 6 and the lower surface 7 of the liquid-absorbent sheet 1. Thickness t of the liquid-absorbent sheet 1 under no load was 0.83mm as read off from the photo of Fig. 2 and 0.64mm under a load of 3g/cm² as read by a dial thickness gauge. In a state as shown by Fig. 2, density of the liquid-absorbent sheet 1 as a whole was 0.0635g/cm³ wherein density of the uppermost layer 11 inclusive of the upper surface 6 was 0.1708g/cm³, density of the lowermost layer 12 inclusive of the lower surface 7 was 0.1033g/cm³ and density of the middle layer 13 was 0.0122g/cm³. In the present invention, the thickness of the liquid-absorbent sheet 1 under no load is used to calculate the density of the liquid-absorbent sheet 1 as will be described later in details in reference to Fig. 9. The thickness of the liquid-absorbent sheet 1 under a load is used as convenient means to compare various embodiments of the liquid-absorbent sheet 1.

[0033] Referring Fig. 4, A is a photo similar to A of Fig. 2, exemplarily showing a partial cross section in a magnification ratio of 60 and B is a diagram similar to B of Fig. 2, illustrating outlines of conjugate fibers 2. To obtain the liquid-absorbent sheet 1 shown by Fig. 4, web 51 having a basis weight of 51g/m² and made of core-in-sheath type (polyester/polyethylene)

conjugate fibers having a fiber length of 45mm and a fineness of 2.2 dtex was used as starting material. Temperature of the first heating roll 53 was set to 132°C, temperature of the second heating roll 64 was set to 127°C and hot air temperature was set to a range of 147 to 150°C. A scale S_4 indicated on the lower side of Fig. 4A as a horizontal line segment has a length corresponding to 166 μ m.

[0034] Of Figs. 5, 6 and 7, Fig. 5 is a photo showing a cross section of the web 51 used as starting material to obtain the liquid-absorbent sheet 1 of Fig. 2 in a magnification ratio of 30 and Fig. 6A and Fig. 7A are photos showing cross sections of first and second comparative sheets 71, 72 to be compared with the liquid-absorbent sheet 1 of Fig. 2, respectively, in a magnification ratio of 30. Fig. 6A and Fig. 7A are diagrams similar to Fig. 2B, illustrating outlines of conjugate fibers 2.

[0035] The web 51 shown by Fig. 5 is in the state before the web 51 is fed to the first heating roll 53 in Fig. 3, in other words, before the web 51 is heat treated by the first heating roll 53 and the followers, therefore the conjugate fibers 2 are mechanically entangled one with another.

[0036] In the first comparative sheet 71 shown by Fig. 6, the web 51 has been subjected to heat treating by the first heating roll 53 but still not subjected to heat treating by the hot air treating chamber 58 and the second heating roll 64. In this state, the conjugate fibers 2 are densely aggregated and fused together only in the vicinity of a surface 71a on which the web 51 has come in contact with the first heating roll 53. A scale S_6 indicated on the lower side of Fig. 6 has a length corresponding to 333 μ m.

[0037] In the second comparative sheet 72, the web 51 exemplarily shown by Fig. 3 has passed through the hot air treating chamber at the temperature of 150°C at a feeding velocity of 50m/min but is still not subjected to heat treating by the first and second heating rolls 53, 64. Fig. 7 shows the cross section of the second comparative sheet 72 and a scale S_7 indicated on the lower side of Fig. 7 as a horizontal line segment has a length corresponding to 333 μ m.

[0038] Referring to Fig. 8, A is a photo showing a cross section of a third comparative sheet 73 in a magnification ratio of 100. The third comparative sheet 73 is formed of a non-woven fabric having a basis weight of 49.4g/m², which was obtained by joining a plurality of 2.0dtex rayon fibers 81 together using water-soluble binder. B is a diagram similar to Fig. 2, illustrating outlines of the rayon fibers 81. The third comparative sheet 73 is a typical liquid-absorbent sheet of prior art having thickness of 0.45mm and excellent so far as the flexural resistance is concerned. However, there are several problems in such liquid-absorbent sheet of prior art which have been left behind unsolved: for example, significantly deteriorated strength in wetted state; relatively poor in amount of water and oil; relatively poor in water-retention as well as oil-retention. A scale S_8 indicated on the lower side of Fig. 8 has a length corresponding to 100 μ m.

[0039] TABLE 1 is a characteristics comparison table comparing the liquid-absorbent sheet with the first, second and third comparative sheets 71, 72 and 73. In TABLE 1, the liquid-absorbent sheets 1 respectively shown by Figs. 2 and 4 are indicated as liquid-absorbent sheets 1a, 1b, respectively, the liquid-absorbent sheet having a basis weight of 30g/m² is indicated as liquid-absorbent sheet 1c and the liquid-absorbent sheet having a basis weight of 80g/m² is indicated as liquid-absorbent sheet 1d. Respective characteristics indicated in TABLE 1 were measured by following a series of procedures as will be described below.

[0040] 1) Thickness: Thickness of each test piece under a contact pressure of 3g/cm² was measured by the dial thickness gauge.

[0041] 2) Gurley's stiffness: Measurement was carried out on 3.8 × 2.5cm test pieces in accordance with Method A (i.e., Gurley Method) specified in Section 60. 20. 1 of JIS L 1096 by using GURLEY TYPE STIFFNESS TESTER (Model No. 311 manufactured by Yasuda Seiki Seisakusho, LTD.). For this measurement, two types of the test piece, i.e., the test piece of which the longitudinal direction corresponds to the machine direction MD in Fig. 3 and the test piece of which the longitudinal direction corresponds to the cross direction CD in Fig. 3 were prepared. The respective types of the test piece were referred herein simply as MD and CD and the measurement was carried out five times on MD and CD, respectively, and average values were calculated for the respective test pieces.

[0042] 3) Coefficient of static friction: As a measuring device, HEIDON TRIBOGEAR Muse (μ s) Type: 94i manufactured by SHINTO Scientific Co., Ltd. (Chiyoda-Ku, Tokyo) was used. Coefficients of static friction in the machine direction MD and in the cross direction CD was measured at five spots on the upper surface and the lower surface of the test piece and average values in the respective directions were calculated.

[0043] 4) Amount of absorbed water, amount of retained water and water retention rate: Previously weight measured 14 × 6cm test piece was placed on 10 mesh woven wire and immersed in saline solution. After immersion for 3 minutes, the test piece was taken out together with the woven wire from 0.9% saline solution and left at rest for 5 minutes. Thereafter, the test piece was weighed and a weight increase W_1 was defined as the amount of absorbed water. Then this test piece was sandwiched between a pair of glass sheets under a load of 420g and left at rest for 3 minutes. Thereafter, the test piece was weighed to determine a weight decrease W_2 so that $W_1 - W_2$ may be defined as the amount of absorbed water and $(W_1 - W_2)/W_1 \times 100$ may be defined as the water retention rate (%).

[0044] 5) Amount of absorbed oil, amount of retained oil and oil retention rate: These values were measured by the same procedures as the measuring procedures for the amount of absorbed water, the amount of retained water and the water retention rate except that 0.9% saline solution was replaced by commercially available salad oil.

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[0045] 6) Handiness (slipperiness of the test pieces): 30 test pieces each having a dimension of 14 × 6cm in the longitudinal direction A and the transverse dimension B, respectively, wherein the longitudinal direction A corresponds to the machine direction MD in Fig. 3 were used. Specifically, a skilled operator held these 30 test pieces in one hand and picked up the individual test pieces one by one with another hand. Such operation was observed to evaluate degrees of slipperiness between each pair of the adjacent test pieces in 4 levels: excellent, acceptable, unacceptable and faulty. Acceptable slipperiness of the third comparative sheet 73 which has been conventionally used was adopted as the evaluation criterion.

[0046] 7) Handiness (flexural deflection of the test pieces): In the course of evaluating "6. Handiness (slipperiness of the test pieces)", it was observed whether quick and smooth operation was disturbed or not due to bending or significant flexion of one or more test pieces to evaluate the handiness in 4 levels: excellent, acceptable, unacceptable and faulty. Excellent flexural resistance of the third comparative sheet 73 was adopted as the evaluation criterion.

[0047]

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[TABLE 1]

	Liquid-absorbent sheet				First comparative sheet	Second comparative sheet	Third comparative sheet
	1a	1b	1c	1d			
Basis weight (g/m ²)	50.0	53.0	31.2	78.8	52.2	52.5	49.4
Thickness (mm)	0.64	0.61	0.60	0.65	1.92	2.64	0.48
Gurley stiffness (mN)	MD	1.62	1.37	2.05	1.38	0.97	2.59
	CD	0.90	0.53	0.72	1.08	0.60	0.72
Coefficient of static friction	MD	0.23	0.25	0.30	0.54	1.02	0.41
	CD	0.27	0.36	0.26	0.35	0.46	0.52
Amount of absorbed water (g/m ²)	521	531	469	573	1165	1811	567
Amount of retained water (g/m ²)	449	486	359	539	938	1430	462
Water retention rate (%)	86	92	77	94	81	79	81
Amount of absorbed oil (g/m ²)	639	769	575	703	1944	2375	520
Amount of retained oil (g/m ²)	429	457	343	515	1255	1754	327
Oil retention rate (%)	67	60	60	73	65	74	63
Dry tension Strength (N/25mm)	MD	69.3	41.6	110.9	60.38	32.57	47.00
	CD	13.8	10.9	8.3	8.26	4.47	12.87
Wet tension Strength (N/25mm)	MD	53.8	86.4	32.3	60.26	31.63	18.36
	CD	22.1	11.6	13.3	8.10	4.70	3.37
Handiness (slipperiness)	Excellent	Excellent	Excellent	Excellent	Unacceptable	Faulty	Acceptable
Deflection (flexural resistance)	Acceptable	Acceptable	Acceptable	Excellent	Acceptable	Faulty	Excellent

[0048] In TABLE 1, the exemplary liquid-absorbent sheets designated by reference numerals 1a, 1b, 1c and 1d had

coefficients of static friction similar to or less than the coefficient of static friction of the third comparative sheet 73 and the individual sheets were smoothly picked up one by one from the stack of sheets in another hand. Gurley's stiffness of the liquid-absorbent sheet was sufficiently high, although not so high as Gurley's stiffness of the third comparative sheet 73, to eliminate a possibility that the liquid-absorbent sheet might be bent or significantly flexed even when the sheet is pinched by fingers. While the liquid-absorbent sheet was found to be as excellent as the third comparative sheet 73 with respect to the amount of absorbed water as well as the amount of absorbed oil, the liquid-absorbent sheet was found to be further excellent than the third comparative sheet 73 so far as water retention rate and oil retention rate are concerned. In addition, the liquid-absorbent sheet was found to be further excellent than the third comparative sheet 73 having the substantially same basis weight in dry tension strength as well as in wet tension strength. In view of a comprehensive evaluation, the liquid-absorbent sheet 1 exemplarily indicated in TABLE 1 as 1a, 1b, 1c and 1d was determined to be further excellent than the third comparative sheet 73 in dry tension strength as well as in wet tension strength. It is extremely easy for a plurality of such liquid-absorbent sheets 1 to be put on the display shelf one by one. Furthermore, the liquid-absorbent sheet 1 can effectively absorb aqueous and/or oily liquid leaching out from foodstuff and is not readily broken even when it is in a wetted state.

[0049] Compared to the liquid-absorbent sheet 1, the first comparative sheet 71 had a relatively large thickness and was apt to exhibit an increased coefficient of static friction. As a consequence, it was difficult to hold a number of the first comparative sheets 71 in one hand to use these first comparative sheets 71 as the liquid-absorbent sheets. In addition, when it was tried to pick up the first comparative sheets 71 one by one from a stack of them, it was difficult to pick up quickly and smoothly the individual sheets one by one due to a poor slipperiness. The second comparative sheet 72 was extremely large in thickness but extremely low in Gurley's stiffness and correspondingly extremely poor in the handiness as the liquid-absorbent sheet. While the first and second comparative sheets 71, 72 are excellent with respect to a high amount of absorbed water achieved by them, these comparative sheets 71, 72 are not preferable in consideration of unacceptably low water retention rate achieved by them. More specifically, the liquid-absorbent sheet characterized in high amount of absorbed water and low water retention rate will necessarily let off a large amount of leaching liquid once having been absorbed by this sheet when any external pressure is exerted thereon after used. In the case of such liquid-absorbent sheet, leaking liquid once having been absorbed therein may often fall in drops, for example, in the course of dealing with the used liquid-absorbent sheets. As will be understood in view of the extremely large thickness of these first and second comparative sheets 71, 72, the web 51 as the starting material fed to the step illustrated by Fig. 3 was not adequately compressed and, in consequence, large fiber interstices were left. Such large fiber interstices served to increase an apparent amount of absorbed water. In the case of the liquid-absorbent sheet 1 according to the invention, in contrast, the unique construction such that the density of the conjugate fibers 2 is high in the uppermost layer 11 and the lowermost layer 12 but sufficiently low in the middle layer 13 to meet a practically required amount of absorbed water. Furthermore, the presence of the uppermost layer 11 and the lowermost layer 12 having the high density serve to prevent the leaching liquid once absorbed by the sheet from being readily discharged.

[0050] Although use of the liquid-absorbent sheet 1 according to the present invention is not limited to any particular field, on the assumption that the sheet is supplied to fish- or meat-shops or home consumers, the sheet 1 preferably contains the conjugate fibers at least 2 in 60% by weight in order to assure the handiness (handleability), the water absorbability, the oil absorbability and the strength at an appropriate levels, respectively. The conjugate fiber 2 preferably has the fiber length in a range of 30 to 70mm and the fineness in a range of 1 to 6dtex. In addition, the liquid-absorbent sheet 1 may contain highly water-absorbent cellulose-based fiber such as rayon fiber or cotton fiber up to 40% by weight in order to enhance the amount of absorbed water and the water retention rate. It is also possible to mix the conjugate fibers 2 having different finenesses and thereby to adjust factors such as Gurley's stiffness, compaction property and/or feeling on user's hand. In the prevailing field-of-use, the liquid-absorbent sheet 1 preferably has a basis weight in a range of 30 to 80g/m². The basis weight of the liquid-absorbent sheet 1 less than 30g/m² may cause deficiency in its water absorbability. The basis weight of the liquid-absorbent sheet 1 exceeding 80g/m² may enhance its water absorbability beyond necessity.

[0051] A, B and C of Fig. 9 illustrate procedures to measure the density of the liquid-absorbent sheet 1 having the basis weight W . The procedures will be described below in details. Cross-sectional photo of the liquid-absorbent sheet 1 shown by Fig. 9A is same as the photo shown in Fig. 2 and, in this photo, dimension between a surface A and a surface B corresponding to the upper surface 6 and the lower surface 7 in Fig. 2 is measured to obtain the thickness t . Then, 256 tone levels image procession selected from the image analysis soft "Photoshop" available from Adobe is used to display the color hue of the cross-sectional photo into 256 tone levels. 1st to 127th tone levels are defined as fiber interstices (black) and 128th to 256 tone levels are defined as fibers (white) to convert the image (See Fig. 9B). Thereafter, the thickness t of the liquid-absorbent sheet 1 is divided equally into 10 layers, i.e., 1st to 10th layers as illustrated (by Fig. 9C) and the number of "whites" in each of these layers is counted. The number of "whites" counted in the 1st layer corresponding to the uppermost layer 11 in Fig. 2 is represented by A and the number of "whites" counted in the 10th layer corresponding to the lowermost layer 12 in Fig. 2 is represented by B. The 5th layer and the 6th layer occupying 2/10 of the thickness t in the middle of the liquid-absorbent sheet 1 as viewed in the thickness direction are bracketed

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as the middle layer 13 and an average value of the number of "whites" in the 5th and 6th layers is calculated as the number C of "whites" in the middle layer 13. Then, A/C and B/C are calculated to obtain respective density ratios with respect to the middle layer 13. Densities of the respective layers of the liquid-absorbent sheet 1 having the thickness t and the basis weight w are obtained by allocating the basis weight w to the respective layers depending on the respective ratios of "whites". A specific example will be described below.

[0052] An example of the liquid-absorbent sheet 1 has the thickness t of 0.00787cm and the basis weight w of 0.005g/cm². The numbers of "whites" in the 1st to the 10th layers are respectively as indicated in TABLE 2 and the ratios of the number of "whites" to the average value of the numbers of "whites" in the 5th and the 6th layers defined as 1 are also as indicated in TABLE 2. A relation between the density a of the middle layer 13 consisting of the 5th layer and the 6th layer is represented by a formula as will be described below.

[0053]

$$63.1 \times a \text{ (g/cm}^3\text{)} \times 0.00787 \text{ (cm)} = 0.005 \text{ (g/cm}^2\text{)}$$

$$a = 0.0101 \text{ (g/cm}^3\text{)}$$

Densities of the respective layers calculated on the basis of the above-mentioned value of a are as indicated in TABLE 2.

[0054]

[TABLE 2]

Layer No.	Number of "white"		Ratio of "whites"	Density
1	48283		13.8	0.1394
2	37282		10.6	0.1071
3	34006		9.7	0.0980
4	22896		6.5	0.0657
5	4139	Average	1	0.0101
6	2882	3511	1	0.0101
7	12550		3.6	0.0364
8	18897		5.4	0.0545
9	12873		3.7	0.0374
10	27405		7.8	0.0788
Total			63.1	

[0055] Fig. 10 is a diagram similar to Fig. 3, exemplarily illustrating the process for making the liquid-absorbent sheet according to the present invention. It should be understood here that the hot air treating chamber 58 in Fig. 3 is not included in the process illustrated by Fig. 10. According to this process, the web 51 is successively put in contact with the first heating roll 53 and the second heating roll 64 to heat the first and second surfaces 51a, 51b of the web 51 successively and thereby to fuse the conjugate fibers 2 together in the vicinity of these two surfaces 51a, 51b, respectively. In this way, the liquid-absorbent sheet 1 exemplarily shown by Fig. 2 is obtained.

[0056] According to the method for making the liquid-absorbent sheet, it is also possible to place the hot air treating chamber 58 exemplarily shown by Fig. 3 upstream of the first heating roll 53 or downstream of the second heating roll 64.

Claims

1. A liquid-absorbent sheet (1) formed of a non-woven fabric containing thermoplastic synthetic fibers (2) and having a thickness defined by a first surface (6) and a second surface (7) extending in parallel to each other and used for absorbing liquid leaching out from foodstuff with said first surface or said second surface which is in contact with

said foodstuff, said liquid-absorbent sheet being **characterized in that**:

5 said thermoplastic synthetic fiber is core-in-sheath type conjugate fiber having a fineness in a range of 1 to 6dtex wherein a fusion temperature of first thermoplastic synthetic resin forming the sheath component of said conjugate fiber is lower than a fusion temperature of second thermoplastic resin forming the core component of said conjugate fiber and said thermoplastic synthetic fibers intersecting one with another are entangled one with another as said sheath components are fused together at intersections of said conjugate fibers; and
 10 said non-woven fabric has a basis weight in a range of 30 to 80g/m² and contains said thermoplastic synthetic fiber at least in 60% by weight wherein, on an assumption that said thickness of said non-woven fabric extending from said first surface to said second surface is divided equally into 10 layers consisting of 1st to 10th layers, a density of said 1st layer (11) inclusive of said first surface and a density of said 10th layer (12) inclusive of said second surface are respectively higher than an average value obtained from respective densities of the 5th and the 6th layers (13, 13) both defined in the middle of said thickness.

15 2. The liquid-absorbent sheet according to Claim 1, wherein said liquid-absorbent sheet is shaped in a rectangle having a longitudinal direction (A) and a transverse direction (B) bisecting each other at right angles wherein a dimension in said longitudinal direction is larger than a dimension in said transverse direction and a Gurley's stiffness in said longitudinal direction measured in accordance with Method A (i.e., Gurley Method) specified in Section 60. 20. 1 of JIS L 1096 is at least 1.00mN.

20 3. The liquid-absorbent sheet according to Claim 2, wherein coefficients of static friction of said first surface and said second surface in said longitudinal direction are respectively in a range of 0.1 to 0.4.

25 4. The liquid-absorbent sheet according to any one of Claims 1 through 3, wherein a density of said 1st layer and said 10th layer is respectively in a range of 0.07 to 0.3g/cm³ and an average value of respective densities of said 5th layer and said 6th layer is in a range of 0.005 to 0.03g/cm³.

30 5. The liquid-absorbent sheet according to any one of Claims 1 through 4, wherein said liquid-absorbent sheet contains cellulose-based fibers up to 40% by weight.

35 6. A method for making a liquid absorbent sheet (1) formed of a non-woven fabric containing thermoplastic synthetic fibers (2) and having a thickness defined by a first surface (6) and a second surface (7) extending in parallel to each other and used for absorbing liquid leaching out from foodstuff with said first surface or said second surface which is in contact with said foodstuff, said method comprising the steps of:

40 (1) feeding web containing thermoplastic synthetic fibers in a machine direction, said thermoplastic synthetic fiber being core-in-sheath type conjugate fiber having a fineness in a range of 1 to 6dtex, a fusion temperature of first thermoplastic synthetic resin forming the sheath component of said conjugate fiber being lower than a fusion temperature of second thermoplastic resin forming said core component of said conjugate fiber, said web containing such thermoplastic synthetic fiber at least in 60% by weight wherein said web has a basis weight in a range of 30 to 80g/m² and a thickness defined by a pair of surfaces;

45 (2) guiding said web into a nip between a first heating roll having a surface temperature equal to or higher than said fusion temperature of said first thermoplastic synthetic resin and equal to or lower than said fusion temperature of said second thermoplastic synthetic resin and an unheated pressure roll so that said web would be further fed in said machine direction while one of said paired surfaces of said web is maintained in close contact with a peripheral surface of said first heating roll and said conjugate fibers would be fused together in a thickness direction of said web to form said first surface;

50 (3) guiding said web having passed said first heating roll into a nip between a second heating roll having a surface temperature equal to or higher than said fusion temperature of said first thermoplastic synthetic resin and equal to or lower than said fusion temperature of said second thermoplastic synthetic resin and an unheated pressure roll so that said web would be further fed in said machine direction while the other of said paired surfaces of said web is maintained in close contact with a peripheral surface of said second heating roll and said conjugate fibers forming said other surface would be fused together in the thickness direction of said web to form said second surface; and

55 (4) cooling said web down to an ambient temperature.

7. The method according to Claim 6 for making said liquid-absorbent sheet further including, upstream of said step (1) or between said step (2) and said step (3) or downstream of said step(3), a step of feeding said web in said

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machine direction so as to pass through, under no load, a heating chamber maintained at a temperature equal to or higher than said fusion temperature of said first thermoplastic synthetic fiber and equal to or lower than said fusion temperature of said second thermoplastic synthetic fiber so that said conjugate fibers would be locally fused together at intersections thereof.

- 5
8. The method according to Claim 6 or 7 for making said liquid absorbent sheet, wherein, on an assumption that said thickness of said non-woven fabric extending from said first surface to said second surface is divided equally into 10 layers consisting of 1st to 10th layers, a density of said 1st layer (11) inclusive of said first surface and a density of said 10th layer (12) inclusive of said second surface are respectively higher than an average value obtained from respective densities of the 5th and the 6th layers (13, 13) both defined in the middle of said thickness.
- 10
9. The method according to Claim 8 for making said liquid absorbent sheet, wherein an average value obtained from respective densities of said 1st layer and said 10th layer is in a range of 0.07 to 0.3g/cm³ and an average value obtained from respective densities of said 5th layer and said 6th layer is in a range of 0.005 to 0.03g/cm³.
- 15
10. The method according to any one of Claims 6 through 9 for making said liquid-absorbent sheet, wherein a Gurley's stiffness in said machine direction measured in accordance with Method A (i.e., Gurley Method) specified in Section 60. 20. 1 of JIS L 1096 is at least 1.00mN.
- 20
11. The method according to any one of Claims 6 through 10 for making said liquid-absorbent sheet, wherein said first surface and said second surface exhibit a coefficient of static friction in said machine direction in a range of 0.1 to 0.4.
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12. The method according to any one of Claims 6 through 11 for making said liquid-absorbent sheet, wherein said web contains cellulose-based fibers up to 40% by weight.
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FIG.1

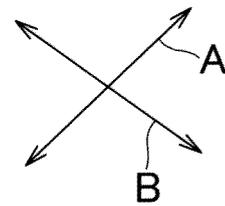
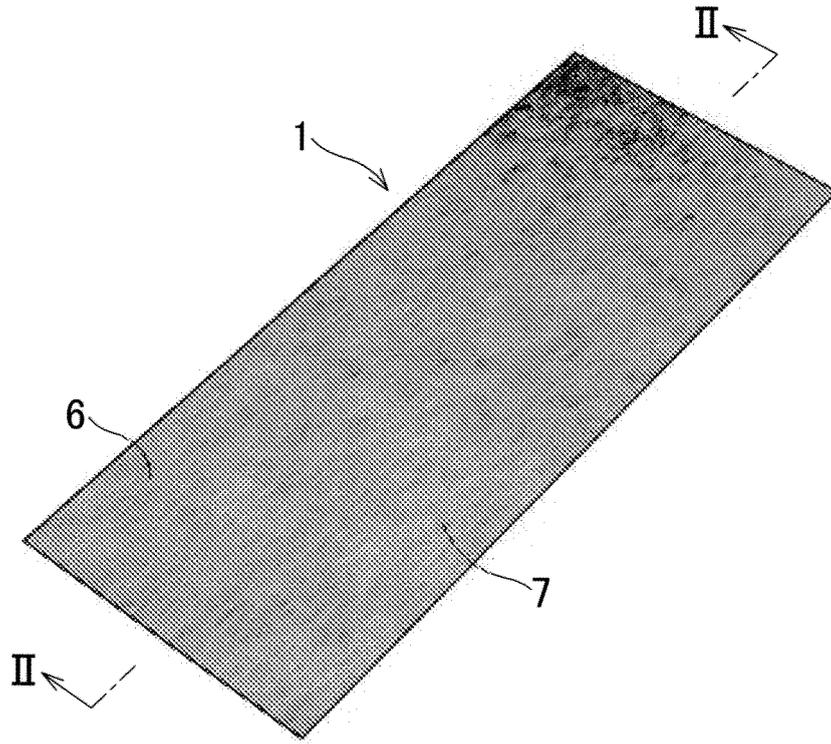


FIG. 2B

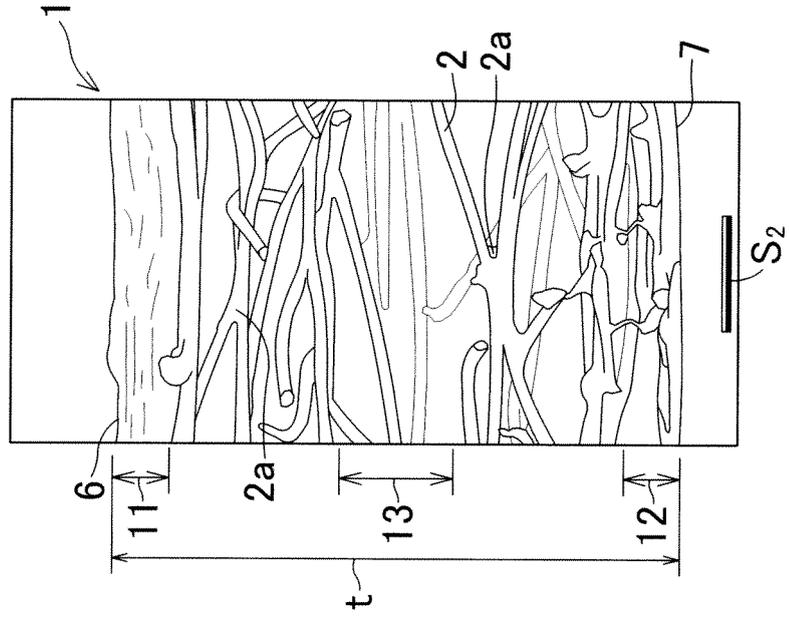


FIG. 2A

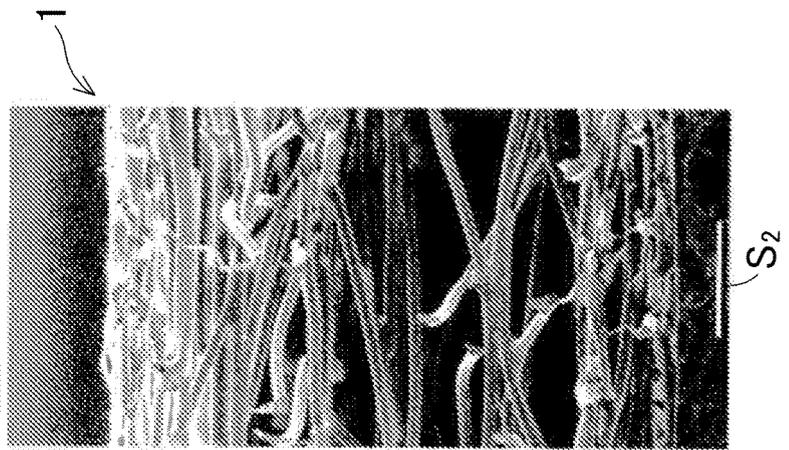


FIG.3

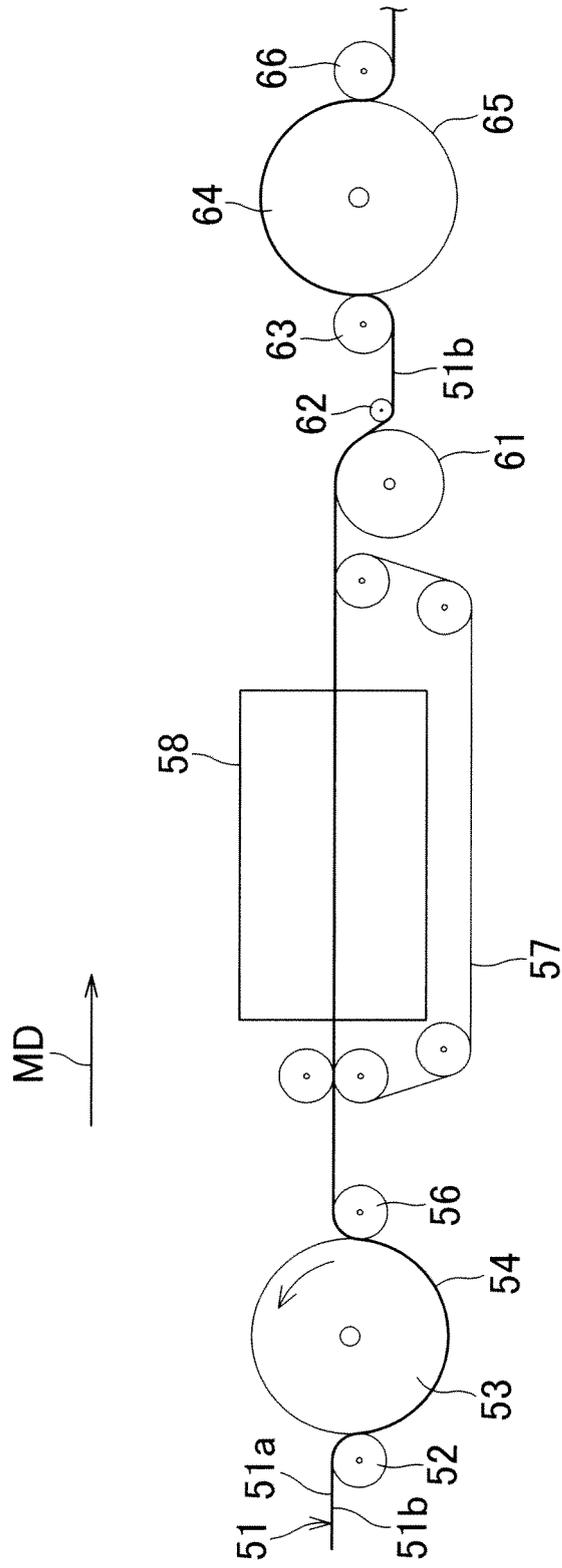


FIG. 4B

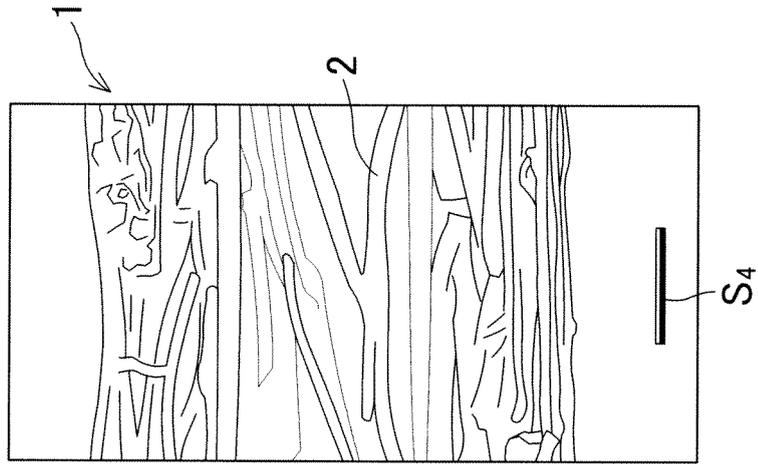


FIG. 4A

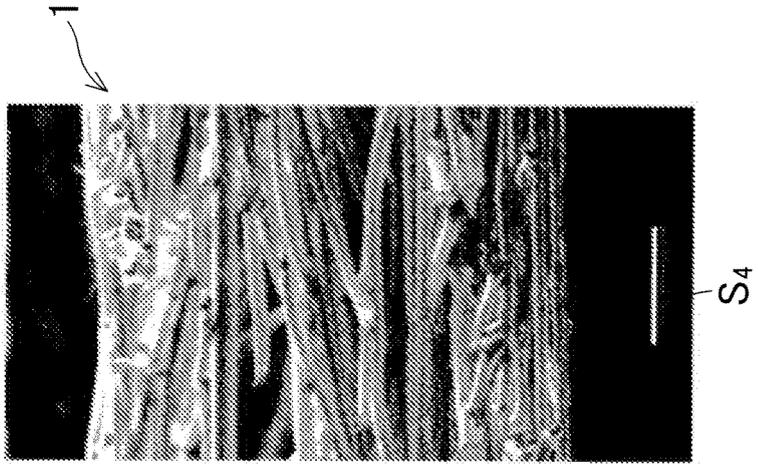


FIG.5

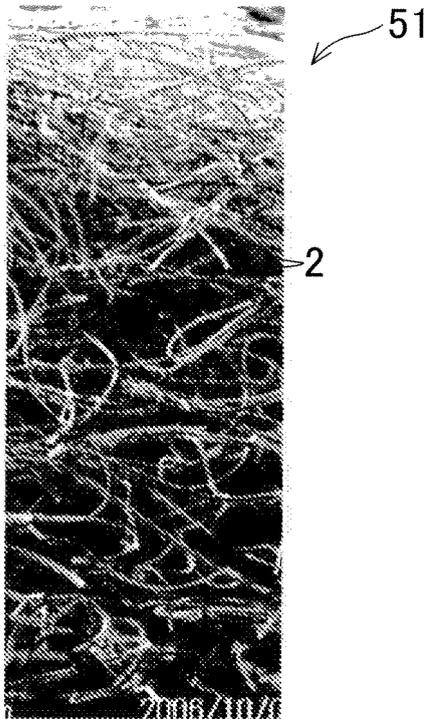


FIG. 6A

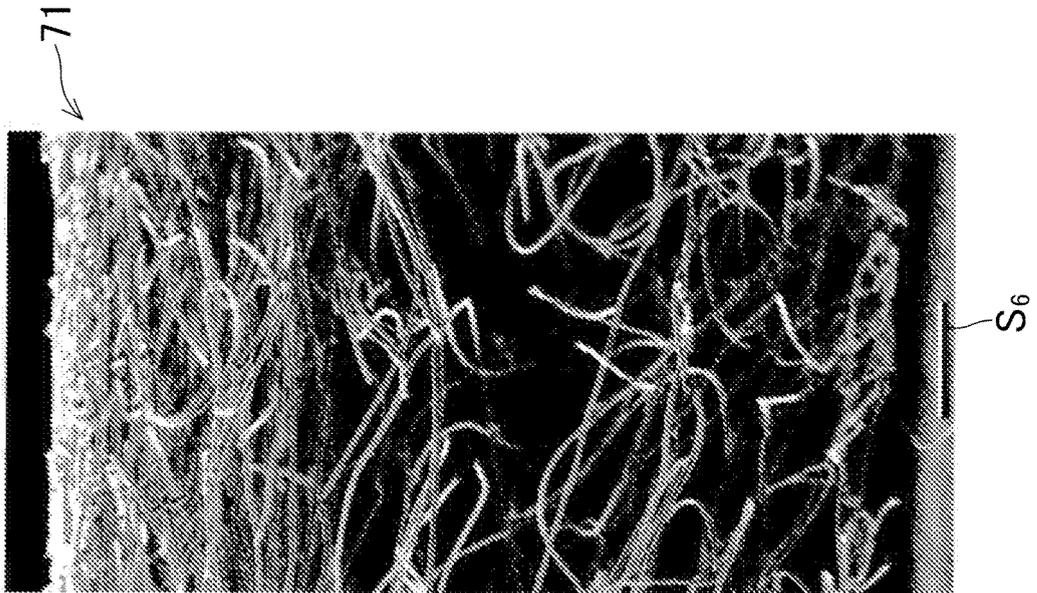


FIG. 6B

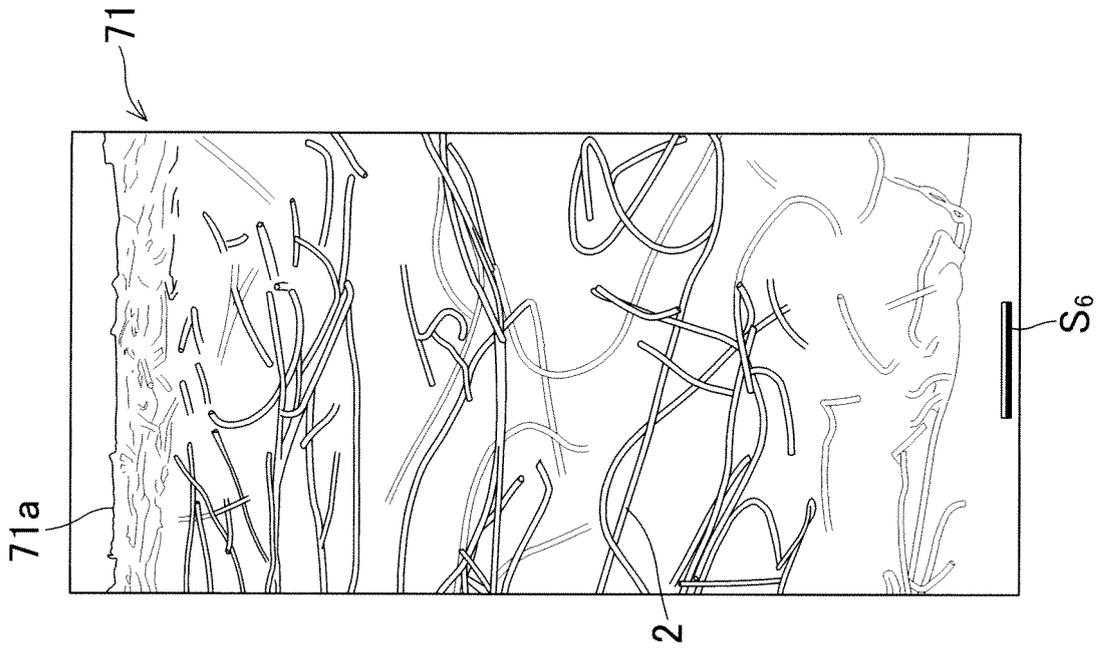


FIG.7B



FIG.7A

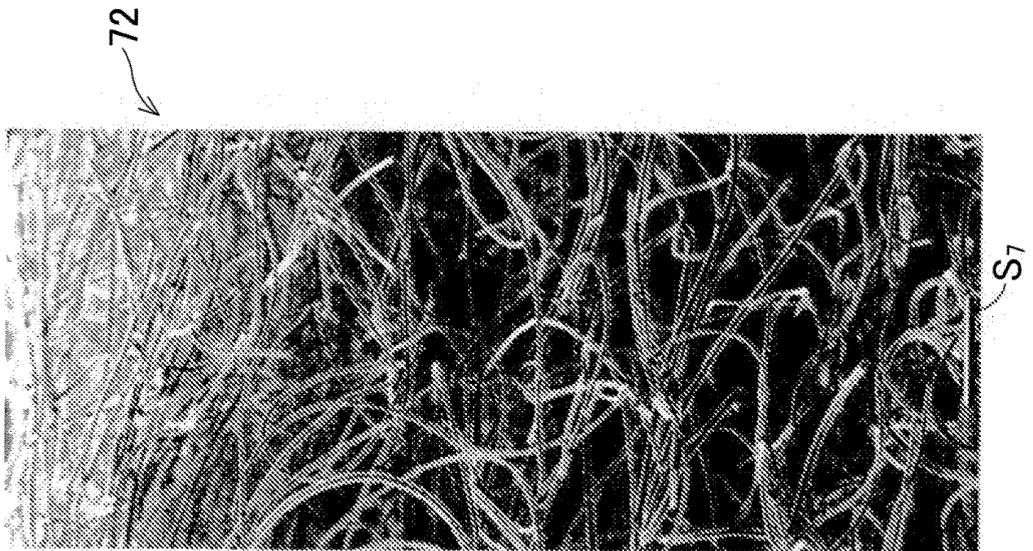


FIG. 8A

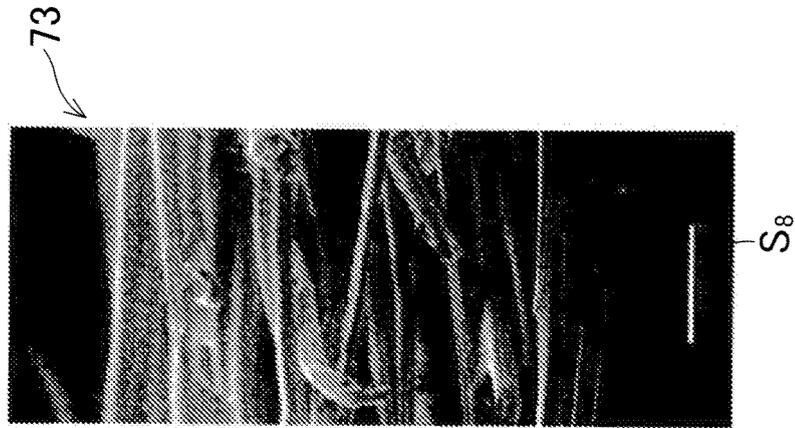


FIG. 8B

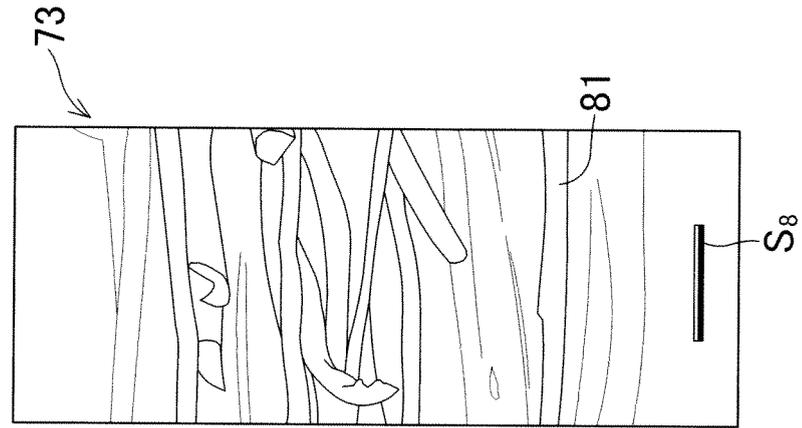


FIG.9A

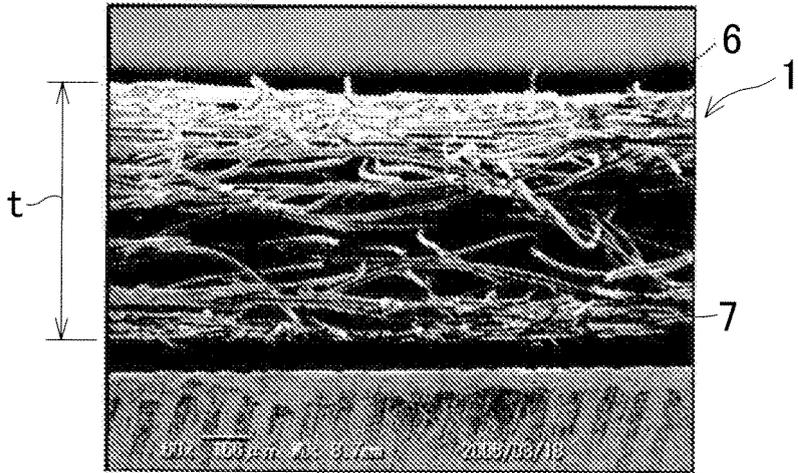


FIG.9B

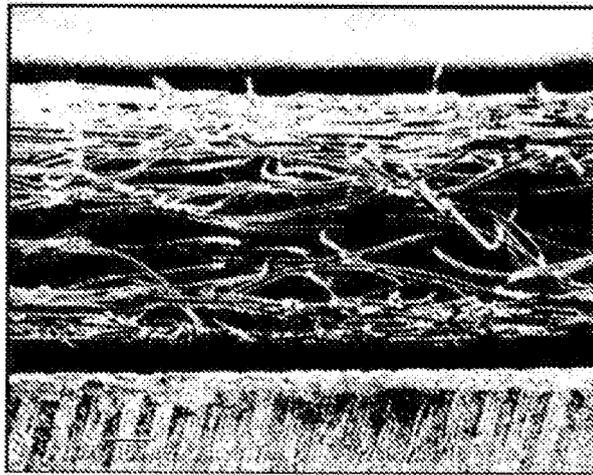


FIG.9C

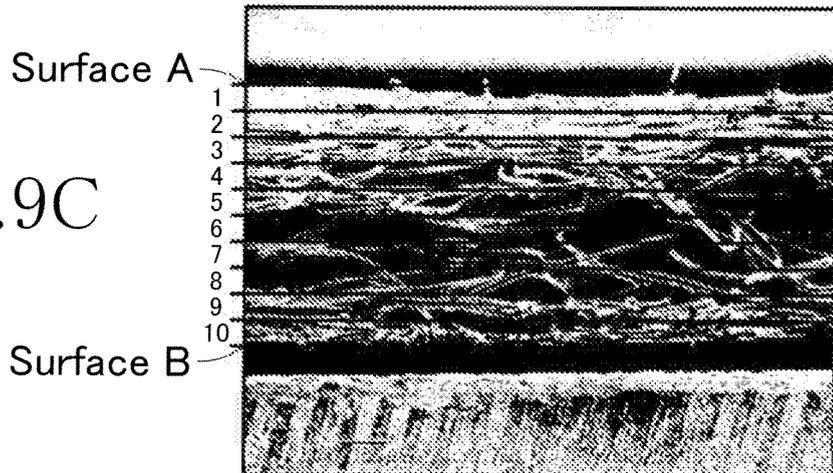
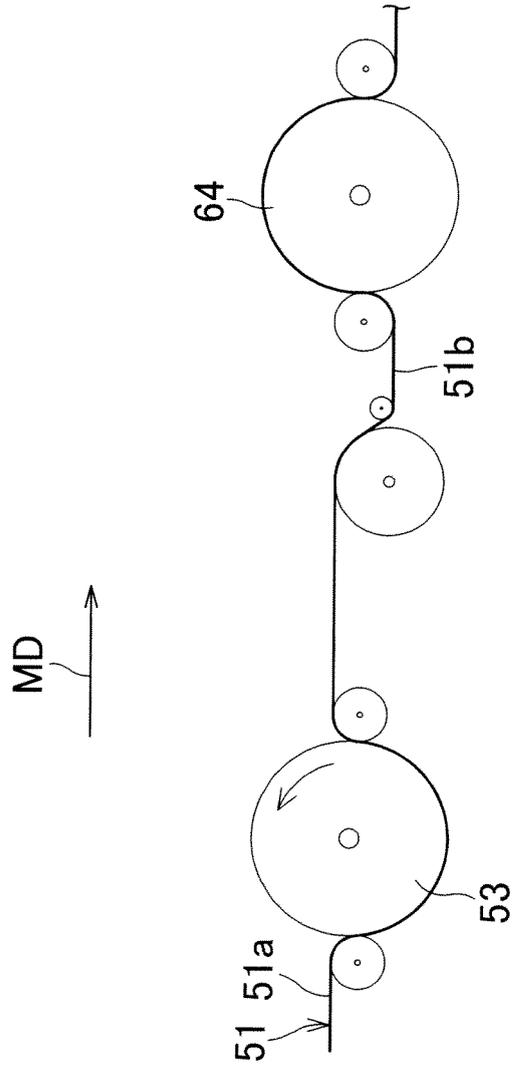


FIG.10



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/054532

A. CLASSIFICATION OF SUBJECT MATTER D04H1/54(2006.01)i, B65D81/26(2006.01)i, D01F8/04(2006.01)i, D04H1/42(2006.01)i, D06M17/00(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) D04H1/00-18/00, B65D81/18-81/30, B65D81/38, B65D85/50, D01F8/04, D06M17/00 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 1996-2008 Kokai Jitsuyo Shinan Koho 1971-2008 Toroku Jitsuyo Shinan Koho 1994-2008 Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPI		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2004-506507 A (The Procter & Gamble Co.), 04 March, 2004 (04.03.04), Claims; Par. Nos. [0020], [0024], [0026] & US 6534174 B1 & US 2003/0168153 A1 & EP 1311343 B1 & WO 2002/016025 A2	1-5 6-12
Y A	JP 2005-139603 A (Kao Corp.), 02 June, 2005 (02.06.05), Claims; Par. No. [0019] (Family: none)	1-5 6-12
Y A	JP 8-73507 A (Nippon Shokubai Co., Ltd.), 19 March, 1996 (19.03.96), Claims; Par. No. [0048] (Family: none)	2-5 6-12
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
<p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p>		
Date of the actual completion of the international search 21 May, 2008 (21.05.08)		Date of mailing of the international search report 03 June, 2008 (03.06.08)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (April 2007)

REFERENCES CITED IN THE DESCRIPTION

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- JP 57009767 A [0003]
- JP 2131885 Y [0004] [0005]
- JP 57009767 Y [0004] [0005]