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(71) Applicant: **CHISSO CORPORATION**

Osaka-shi Osaka 530 (JP)

(72) Inventors:

• **NAGANO, Koki**

Kusatsu-shi, Shiga 525 (JP)

• **HIRABAYASHI, Shigeru**

Shiga 524 (JP)

(74) Representative:

VOSSIUS & PARTNER

Siebertstrasse 4

81675 München (DE)

(54) NONWOVEN SHORT FIBRE FABRIC AND ABSORBENT ARTICLE MADE BY USING SAME

(57) A non-woven fabric comprising staple fibers, having a fiber length of 3 to 25 mm and a single fiber fineness of 1 to 100 denier, and is produced by the fibers being dropped while being dispersed to be accumulated and adhered at the intersection point of the staple fibers. The non-woven fabric has a specific volume of 40 to 200 cm³/g, and the number of fiber lumps having a volume of not less than 1 mm³ is not more than 5 lumps

per 20 g of the non-woven fabric. The bulky non-woven fabric of the present invention in which the sufficient contribution to bulkiness by fibers is exhibited is suitable for sanitary materials, such as disposable diapers, sanitary napkins, incontinence pads, nursing pads or the like, or wipes etc.

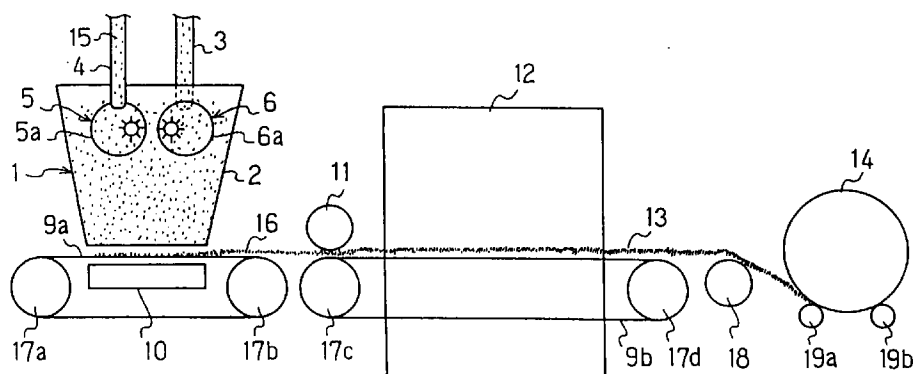


FIG. 1

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Description

TECHNICAL FIELD

5 [0001] The invention relates to a non-woven fabric comprising staple fibers. More specifically, it relates to a non-woven fabric comprising staple fibers, which is suitable for sanitary materials such as disposable diapers, sanitary napkins, incontinence pads, nursing pads or the like, or wipers, and to absorbent articles using the non-woven fabric comprising staple fibers.

10 BACKGROUND ART

[0002] Hitherto, as this kind of non-woven fabric comprising staple fibers, Japanese Patent Publication No. Sho 52-12830 discloses a non-woven fabric produced by a process wherein thermal adhesive conjugated fibers are aligned by the use of a carding machine and then piled up and entangled to be adjusted to the predetermined basis weight, followed by conducting a thermal adhesion between fibers by a thermal treatment.

15 [0003] However, the above mentioned conventional non-woven fabrics lose the bulkiness of the non-woven fabric contributed by fibers, because the fibers of the non-woven fabric are arranged in the machine direction by combing fibers with a card clothing having needles of the carding machine. Therefore, the bulky non-woven fabrics in which the sufficient contribution by fibers is exhibited have not been produced, and the conventional non-woven fabrics are not always satisfactory.

20 [0004] The object of the present invention is to provide a bulky non-woven fabric in which the sufficient contribution to bulkiness by fibers of the non-woven fabric is exhibited.

DISCLOSURE OF INVENTION

25 [0005] The non-woven fabric comprising staple fibers of the present invention and the absorbent article using the non-woven fabric of the present invention are as follows.

30 (1) A non-woven fabric formed of staple fibers, which comprises at least one kind of staple fiber having a fiber length of 3 to 25 mm and a single fiber fineness of 1 to 100 denier, and is produced by the fibers being dropped and dispersed to be accumulated and adhered at the intersection point of each staple fiber; the non-woven fabric has a specific volume of 40 to 200 cm³/g, the number of fiber lumps having a volume of not less than 1 mm³ is not more than 5 lumps per 20 g of the non-woven fabric.

35 (2) The non-woven fabric comprising staple fibers according to the above item (1), wherein the fiber length of the staple fiber is in the range of 5 to 10 mm.

(3) The non-woven fabric comprising staple fibers according to the above item (1), wherein at least one kind of staple fiber is a staple fibers having 3 to 20 spiral type crimps per inch (2.54 cm).

(4) The non-woven fabric comprising staple fibers according to the above item (1), wherein at least one kind of staple fiber is a thermoplastic fiber.

40 (5) The non-woven fabric comprising staple fibers according to the above item (1), wherein at least one kind of staple fiber is olefin thermoplastic fiber or polyester thermoplastic fiber.

(6) The non-woven fabric comprising staple fibers according to the above item (1), wherein at least one kind of staple fiber is a thermoplastic conjugated staple fiber having a component which is capable of thermal adhesion as one component.

45 (7) The non-woven fabric comprising staple fibers according to the above item (1), wherein at least one staple fiber is a staple fiber having an eccentric core and sheath type structure comprising high crystalline polypropylene as a core component and high density polyethylene as a sheath component.

(8) An absorbent article using the non-woven fabric comprising staple fibers according to any one of the above items (1) to (7).

50 BRIEF DESCRIPTION OF DRAWINGS

[0006]

55 Fig. 1 is a side elevational view of an apparatus for producing the non-woven fabric of the present invention.
Fig. 2 is a partial cutaway view of an air laid apparatus 1 of the apparatus shown in Fig. 1.
Fig. 3 is a cross sectional view taken on line E-E' of the apparatus according to Fig. 2.

BEST MODE FOR CARRYING OUT THE INVENTION

[0007] As the fibers used for the non-woven fabric comprising staple fibers of the present invention, the following examples can be mentioned: natural fibers such as pulp, cotton and the like; regenerated fibers such as rayon; semi synthetic fibers such as acetate; and synthetic fibers such as nylon, vinylon, polyester, acrylic, polyethylene, polypropylene, polystyrene and the like. The fibers used for the non-woven fabric of the present invention are not particularly limited as long as they are adhered in a case where binders are used and they do not give an adverse effect on the uniformity of the non-woven fabric. However, thermal adhesive thermoplastic fibers being capable of thermal adhesion between fibers at the intersection points in a short time, without using powder-like binders that fall in the form of small particles or water soluble binders that need to be dried, are preferable.

[0008] The fiber length of the staple fiber constituting the non-woven fabric comprising staple fibers of the present invention needs to be in the range of 3 to 25 mm. Preferably, it is in the range of 3 to 15 mm, more preferably, in the range of 5 to 10 mm. In particular, in the case of the spiral type crimps, the number of crimps is approximately 5 crimps per inch (2.54 cm). Therefore, the appropriate fiber length is 5 mm which corresponds to the length of once winding of crimp and 10 mm which corresponds to the length of twice winding of crimps. If the fiber length is less than 3 mm, the strength of the non-woven fabric lowers. Moreover, if the fiber length is more than 25 mm, it is difficult to produce a uniform web, because fibers are entangled with each other before passing through a sieve or a screen.

[0009] The fiber thickness is in the range of 1 to 100 denier, preferably in the range of 1.5 to 35 denier. More preferably, it is in the range of 1.5 to 20 denier. If the fiber thickness is less than 1 denier, the density of the fiber in the cylindrical screen increases, so that a uniform web cannot be produced. On the other hand, if the fiber thickness is more than 100 denier, the ability of fibers to entangle each other becomes strong, so that it is difficult to produce a uniform web.

[0010] The specific volume of the non-woven fabric comprising staple fibers of the present invention is in the range of 40 to 200 cm³/g. Preferably, it is in the range of 70 to 150 cm³/g. It is not preferable for the specific volume of the non-woven fabric to be less than 40 cm³/g, since the non-woven fabric becomes hard. Also, it is not preferable for the specific volume of the non-woven fabric to be more than 200 cm³/g, since the strength of the non-woven fabric is lowered.

[0011] Moreover, in the non-woven fabric comprising staple fibers of the present invention, the number of fiber lumps having a volume of not less than 1 mm³ is not more than 5 lumps per 20 g of the non-woven fabric. It is not preferable for the fiber lumps of such size included in the non-woven fabric to be more than the above mentioned range, since there arise some disadvantages: the non-woven fabric becomes not-uniform, has a rough touch and becomes non-uniform in the coloring due to fiber lumps.

[0012] In a case where the fibers used for the non-woven fabric of staple fibers of the present invention are conjugated fibers comprising at least two components (hereinafter, the component (A) and the component (B) will be used for an abbreviation), the below mentioned resins etc. can be used as materials.

[0013] As resins of the component (A), the following can be used: polyolefins such as polypropylene, high density polyethylene, medium density polyethylene, low density polyethylene, linear low density polyethylene, binary copolymer or terpolymer of propylene with other α -olefin and the like; polyamides; polyesters such as polyethylene terephthalate, polybutylene terephthalate, low melting point polyester from copolymerizing diol and terephthalic acid / isophthalic acid etc., polyester elastomer and the like; fluororesin; the mixture of the above mentioned resins; other resins that can be spun.

[0014] As resins of the component (B), the following can be used: polyolefins such as polypropylene, high density polyethylene, medium density polyethylene, low density polyethylene, linear low density polyethylene, binary copolymer or terpolymer of propylene with other α -olefin and the like; polyamides; polyesters such as polyethylene terephthalate, polybutylene terephthalate, low melting point polyester from copolymerizing diol and terephthalic acid / isophthalic acid etc., polyester elastomer and the like; fluororesin; the mixture of the above mentioned resins; other resins that can be spun.

[0015] It is preferable that the difference in the melting point between the component (A) and the component (B) is not less than 10 °C. Consequently, when the thermal treatment is conducted at the temperature not less than the melting point of the low melting point component and less than the melting point of the high melting point component, the low melting point component of the conjugated fiber melts and the high melting point component remains as it is. As a result, the thermal adhesive non-woven fabric having a three dimensional network structure can be formed. Moreover, in the above, when the melting point is not clearly determined, the melting point denotes the softening point. The measurement of the softening point is conducted under the conditions specified in JIS K 2531.

[0016] As the combination examples of the resin component (A) and (B), the following examples can be mentioned: high density polyethylene / polypropylene, low density polyethylene / propylene — ethylene — butene-1 crystalline terpolymer, high density polyethylene / polyethylene terephthalate, nylon 6 / nylon 66, low melting point polyester / polyethylene terephthalate, polypropylene / polyethylene terephthalate, polyvinylidene fluoride / polyethylene terephthalate, the mixture of linear low density polyethylene and high density polyethylene / polyethylene terephthalate and the like.

[0017] It is preferable that a thermoplastic conjugated fiber comprises olefin resin or polyester resin, or the combina-

tion thereof. As the combination examples of such resin components (A) and (B), the following examples can be mentioned: high density polyethylene / polypropylene, low density polyethylene / propylene — ethylene — butene-1 crystalline terpolymer, high density polyethylene / polyethylene terephthalate, low melting point polyester / polyethylene terephthalate, polypropylene / polyethylene terephthalate, linear low density polyethylene / polyethylene terephthalate and the like.

[0018] The shapes of the conjugated fiber are not limited and can be a core and sheath type, an eccentric core and sheath type, a side-by-side type, a multi-layer type having three layers or more, a hollow multi-layer type, a modified (non-circular) multi-layer type etc. and other structures in which the low melting point resin component forms at least one part of the fiber surface.

[0019] The preferable combination of the component constituting the conjugated fibers and the shape is: the thermoplastic conjugated fiber having an eccentric core and sheath type structure comprising high crystalline polypropylene as a core component and high density polyethylene as a sheath component and having spiral type crimps. A fiber having spiral type crimps has much space per a single fiber, so that a web formed by piling up fibers has a very high bulkiness.

[0020] The bulkiness of the web depends much on the number of crimps of the thermoplastic fibers used for a non-woven fabric. In particular, it is preferable that the thermoplastic fiber has 3 to 20 spiral type crimps per an inch (2.54 cm). Herein, "3 to 20 crimps per an inch (2.54 cm)" denotes that 3 to 20 crimps are included in an inch (2.54 cm) of fiber length. Preferably, it is a fiber having 5 to 15 spiral type crimps per an inch (2.54 cm), more preferably it is a fiber having 5 to 10 spiral type crimps per an inch (2.54 cm). Preferably, the non-woven fabric using fibers having the above mentioned range of number of crimps has high bulkiness. If the number of the spiral type crimps is considerably less than 3 crimps per an inch (2.54 cm), the fiber is not different from the straight type fiber and the bulkiness tends to be lowered. On the other hand, in a case where the spiral type crimps are far more than 20 crimps per an inch (2.54 cm), the space per a single fiber becomes small, and thus the bulkiness of the non-woven fabric conversely tends to be reduced.

[0021] In the above mentioned conjugated fiber, the composition ratio of the low melting point component to high melting point component is: the low melting point resin component is in the range of 10 to 90 wt. % and the high melting point resin component is in the range of 90 to 10 wt.%. More preferably, the low melting point resin component is in the range of 30 to 70, wt.% and the high melting point resin component is in the range of 70 to 30 wt.%. If the low melting point component is less than 10 wt.%, the tensile strength of the thermal adhesive non-woven fabric comprising conjugated fibers tends to be reduced. On the other hand, if the low melting point component is more than 90 wt.%, too little core component remains without melting, so that the bulkiness of the thermal adhesive non-woven fabric comprising conjugated fibers tends to be reduced.

[0022] In the case of the straight type staple fibers, the non-woven fabric has a uniformity, but does not have the high bulkiness, thus making the non-woven fabric very flat. As a result, the applicability as commercial products is reduced. However, in a case where the staple fiber having actual crimps is used, the non-woven fabric having a high bulkiness can preferably be produced.

[0023] As the shape of the crimps of staple fibers used for the non-woven fabric comprising staple fibers, the following examples can be mentioned: spiral (three dimensional crimps) type crimps, zig-zag type crimps, wave type crimps or the like. The staple fibers having any of the above mentioned shapes of crimps can be applied to a non-woven fabric comprising staple fibers of the present invention. The most preferable crimp is a spiral type crimp.

[0024] In a case where the shape of crimps of staple fiber is the spiral type crimps, fibers are not entangled with each other so much and the bulkiness of the resultant non-woven fabric becomes very high. This tendency is remarkably found when a fiber has the above mentioned preferable range of fiber length and the shape of the spiral is approximately circular.

[0025] In a case where the shape of crimps of staple fiber is the zig-zag type crimps, the larger the number of the crimps is, the more securely and deeply the crimps are set. As a result, the bulkiness of the resultant non-woven fabric is higher. However, if the number of the crimps is far more than the above mentioned preferable range, fibers tend to be easily entangled with each other and an uniform non-woven fabric is not obtained.

[0026] In a case where the shape of crimps of staple fiber is the wave type crimps, the tendency of the fibers to entangle is more remarkable, so that large fiber lumps generate and easily cause the blocking of a sieve or screen. Consequently, the production of the non-woven fabric becomes difficult.

[0027] However, with any type of crimp, unless the number of crimps or the fiber length is much different from the above mentioned preferable range, the effect of the present invention is not harmed.

[0028] In a case where webs are produced by the use of the conventional carding machine, fibers are entangled and then the webs are drawn, so that the bulkiness of the web is reduced. Therefore, as the preferable embodiment of the present invention, methods in which a web is not drawn are to be sought. One example of such methods is: the method in which a web is produced by fibers that are dropped while being dispersed to be accumulated. In the method in which fibers are successively dropped with dispersion to be accumulated, fibers are not drawn with being entangled, and therefore the bulkiness of the fiber itself is not lost. The non-woven fabric in which the sufficient contribution to bulkiness

by fibers is exhibited can be produced.

[0029] In a case where webs are produced by fibers being dropped with dispersion to be accumulated, if the fibers are long, a uniform dispersion is difficult and the resultant non-woven fabric has a coarse density. On the other hand, if fibers are short, a uniform dispersion is easily obtained, and the non-woven fabric without coarse density can be produced. Moreover, one of the methods to enhance a uniform dispersion of fibers is to make fibers pass through a sieve or screen. In a case where fibers are made to pass through a sieve or screen, even staple fibers are entangled before passing the screen or sieve and the fiber lumps of the entangled fibers pass through the screen and are piled up in the non-woven fabric. As a result, the resultant non-woven fabric is sometimes not-uniform and includes fiber lumps. The non-woven fabric contaminated with fiber lumps sometimes has a rough touch and non-uniform coloring due to the subtle reflecting property of the fiber lumps.

[0030] There are staple fibers that are easily entangled and staple fibers that are less easily to be entangled. If classified, the staple fibers having a zig-zag type crimps and having a large number of crimps and / or having high crimp set force tend relatively to be easily entangled. Moreover, the staple fibers having the wave type crimps with fish-hook shaped ends tend to be easily entangled. The staple fibers having the spiral type crimps are particularly preferable since their ends of fibers are approximately on the same circumference and are not easily entangled.

[0031] A fiber lump that gives an adverse effect on the uniformity of the non-woven fabric is divided into two types: one is the entangled fibers and another is the portion where the fibers are not sufficiently opened. In the not-opened portions, individual fibers are spaced closely after the opening step. Therefore, the effective method for preventing the generation of fiber lumps is to space each fiber less closely. Specifically, not-opened portions can be reduced by selecting a shape of crimps. When the shape of crimps is the wave type, fibers are easily dispersed and few not-opened portions are generated as compared with the zig-zag type crimps. Furthermore, when the shape of crimps is the spiral type, fibers are easily be dispersed and few not-opened portions are generated as compared with the wave type crimps. In other words, the entanglement of fibers and generation of the not-opening portion can be inhibited by selecting the shape of crimps.

[0032] In other words, the object of the present invention, namely to provide the bulky non-woven fabric in which sufficient contribution to bulkiness by fibers is exhibited, can be attained by producing the non-woven fabric in the following way: a web is produced by making short fibers pass through a sieve or screen and dropped with uniform dispersion in three dimensions to be accumulated, and by thermally adhering the intersection point of each fiber by thermal treatment.

[0033] In the non-woven fabric produced by the method of making fibers pass through a sieve or screen, fibers are dropped with dispersion in three dimensions to be accumulated. Such non-woven fabric has a greater specific volume as compared with the non-woven fabric in which fibers are aligned in one direction by the carding machine. The non-woven fabric having a large specific volume has a soft touch and is particularly suitable for products that directly contact the users' skin, for example, absorbent articles of disposable diapers, sanitary napkins or the like. Moreover, since the high specific volume denotes the high bulkiness and high cushioning property, such non-woven fabric is preferably used for applications that requires a cushioning property, for example, bandage or eye bandage, table linen, cooking towel, packing materials for glass or ceramics, packing materials for fresh products and flowers, packing materials for instruments and furniture and the like.

[0034] The thermal adhesive conjugated fibers used for the non-woven fabric comprising staple fibers of the present invention can be produced by, for example, the following step.

[0035] Resins for a core component and a sheath component are melted and discharged from, for example, the composite spinneret having 100 to 350 holes. At this time, unstretched fibers are cooled by cooling just below the spinneret. Unstretched fibers of 3 to 400 denier are produced by taking up at the discharging volume of 100 to 200 g/min and at the taking up speed of 40 to 1300 m/min. The unstretched fibers are stretched between the two rollers heated at temperatures of 60 to 120°C, while making the rotating speed of the second roll greater than that of the first roll. Stretched fibers of 1 to 100 denier are produced by stretching with the ratio of the rotating speed of the first roll to the second roll in the range of 1 : 2 to 1 : 5. Finishing agents are applied to the stretched fibers by using a contact roller, followed by making the stretched fibers pass through a box-type crimp processor to produce a tow having crimps. It is preferable that the number of crimps is 0 to 25 crimps per an inch. Since the tow contains approximately 10 wt.% of water, it is dried by the use of a drier at 60 to 120°C. The dried tow is cut with a push-cutting type cutter into fibers having the constant length ranging from 3 to 25 mm. Such fiber length is substantially shorter than fibers used for the non-woven fabric produced by the conventional carding process.

[0036] At the time of producing the non-woven fabric, a plurality of forming heads are used and the non-woven fabric having a different fineness or a different shape of staple fiber is used at each forming head. Consequently, the non-woven fabric having a density gradient in the thickness direction can be produced. The non-woven fabric having a density gradient in the thickness direction, produced by the above mentioned method, can be used as non-woven fabric materials for filters, such as a liquid filter, an air filter etc.

[0037] When the non-woven fabric comprising staple fibers produced by the above mentioned method is used for

absorbent articles such as disposable diapers, they can be used for a non-woven fabric as a surface material, second sheet, or back layer material sheet. In particular, since the non-woven fabric comprising staple fibers has a high bulkiness, it is preferably used for the second sheet that requires the high bulkiness. Moreover, the non-woven fabric comprising mixture of pulp, thermal adhesive fibers and high absorptive materials is preferably used as absorbent articles which do not lose shape when absorbing urine.

[0038] The non-woven fabric comprising staple fibers of the present invention can be produced as follows with staple fibers having a fiber length of 3 to 25 mm and by the use of the air laid type apparatus.

[0039] As shown in Fig. 1 to Fig. 3, an air laid type apparatus comprises: a casing 2 having a trapezoidal shaped cross section and having an opening portion in its bottom face only; fiber feeding openings 3 and 4 which are provided at both ends of the casing 2; web forming heads 5 and 6 corresponding to the feeding openings 3 and 4, comprising cylindrical screens 5a and 6a which are positioned parallel to the side face of the casing 2 and are capable of rotating; needle rolls 5b and 6b which are provided in a way to contact each inner wall of the cylindrical screens 5a and 6a, and fiber circulation zones 7 and 8 which are respectively provided at the both ends of cylindrical screens 5a and 6a and at the both ends of the casing 2. A net conveyor 9a is provided just below the lower face of the air laid type apparatus. A pair of drive rolls 17a and 17b and a suction unit 10 are attached to the net conveyor 9a. Moreover, an apparatus for carrying out the next step in the air laid type apparatus comprises: a suction drier 12 for thermally adhering the conjugated fibers constituting a web, a net conveyor 9b which makes the web pass through the suction drier 12, a pair of drive rolls 17c and 17d for driving the net conveyor 9b thereunder; and a pressing roll 11 on the drive roll 17c across the net conveyor 9b. Moreover, a feed roll 18 for feeding the produced thermal adhesive non-woven fabric 14 and a pair of drive rolls 19a and 19b for driving a take-up roll 14 are provided.

[0040] In the above mentioned apparatus, staple fibers are mechanically opened by the use of an opening apparatus (not shown) and then are fed to the fiber feeding circulation duct connected to the fiber inserting openings 3 and 4. At this time, the fiber bundle is nearly dissolved. Fibers 15 which are fed into the fiber inserting openings 3 and 4 are mixed and circulated while moving in the passage formed by cylindrical screens 5a and 6a and circulating zones 7 and 8 in the direction of arrows C1, C2, C3, and C4 and in the direction of arrows D1, D2, D3, and D4 of Fig.2. The circulated fibers are discharged through the rotating cylindrical screens 5a and 6a by means of centrifugal force and shearing effect generated by both the rotations of the needle rolls 5b and 6b rotating in the direction of arrow AA' and the cylindrical screens 5a and 6a rotating in the direction of arrow BB'. The discharged fibers are sucked by the use of the suction unit 10 from the lower portion of the casing 2 and are collected on the net conveyor 9a. The collected web 16 is pressed between the web pressing roll 11 and the drive roll 17c of the net conveyor 9b. At this time, the collected fibers are oriented in random directions and form a web.

[0041] The web 16 is pressed by using the pressing roll 11 and provided to the suction drier 12 and then thermally treated at a temperature not less than the melting point of the low melting point component and not more than the melting point of the high melting point component, for example, in the range of 90 to 170 °C, for 3 to 10 seconds. By this thermal treatment, the low melting point component of the conjugated fiber is melted and the high melting point component of the conjugated fiber remains as it is. Thus, the thermal adhesive non-woven fabric 13 having a three dimensional network structure is formed and taken up by the take-up roll 14.

[0042] In order to arrange the air carried staple fibers more randomly, the production method of making the staple fibers pass through a sieve or net which comprises a wide variety of mesh is conducted. Specifically, it is preferable that the method of making the staple fibers pass through a screen with dispersion to be accumulated is conducted.

[0043] The shape of holes of the screen of the cylindrical screens 5a and 6a is generally a laterally longer rectangle. It is preferable that the laterally longer rectangle having the longitudinal length of which is 1 to 3 mm and the lateral length of which is 15 to 30 mm. The shape of the holes is not limited to a laterally longer rectangle and may be circle, triangle, quadrangle, polygon and oval besides a laterally longer rectangle. It is preferable that the rate of the hole area of the screen is 20 to 50 %. By selecting the above mentioned hole shape and the rate of hole area, a uniform web can be produced.

[0044] Among the non-woven fabrics comprising staple fibers of the present invention, the non-woven fabric comprising thermal adhesive conjugated fibers is thermally adhered in the intersection point of each fiber by thermal treatment using the suction drier 12 after the formation of web. This thermal treatment may be conducted by the use of heating apparatus such as a thermal calendar roll etc. instead of the suction drier 12. The basis weight of the resultant non-woven fabric is not particularly limited. However, it is preferable that the basis weight is about 10 to 1000 g/m². In the case of surface materials for disposable diapers, the basis weight is about 10 to 60 g/m²; in the case of wipes, about 10 to 500 g/m²; in the case of filters, about 10 to 1000 g/m². Moreover, the apparent density of the non-woven fabric is not particularly limited. However, it is preferably about 0.017 to 0.10 g/cm³ when the hand feeling is taken into consideration.

[0045] The non-woven fabric having higher density can be produced by carrying out a thermal pressing process or thermal rolling process or the like as an after-processing treatment.

[0046] In a case where the thermal adhesive non-woven fabric comprising staple fibers of the present invention is

thermally adhered at the intersection point of each fiber by the use of a thermal calendar roll, it is preferable to make the rate of the thermo-compression area be in the range of 10 to 30 %. By selecting the above range of the rate of thermo-compression area, the non-woven fabric which is excellent in resistance against falling off of fibers and strength and has a soft hand feeling and touch can easily be provided.

[0047] The non-woven fabrics comprising staple fibers of the present invention can be used for a wide variety of applications by themselves, or after being laminated, sewn, or thermally adhered with another material. For example, when they are used as a member of pants type disposable diapers, they can be used for the portion where both hand feeling and strength are required, for example, as front surface materials, back sheets etc. As a matter of course, when the non-woven fabric is used for the pants type disposable diapers and the like, they can be used in combination with other members or thermal adhesive non-woven fabric such as a stretchable and contractable material for closely contacting with the trunk or legs portions. Moreover, the thermal adhesive non-woven fabric can be used as cover materials of the above mentioned front surface materials or back surface materials or the like, by laminating other non-woven fabric or tissue papers, webs, films or the like.

[0048] The non-woven fabric comprising staple fibers of the present invention can be used as wipes for furniture, cars and the like by applying various kinds of lubricant.

[0049] Further, the non-woven fabric comprising staple fibers can be made into filter materials by subjecting the non-woven fabrics to an after-processing treatment such as a pleat processing, forming into a cylindrical shape, winding the thermal adhesive non-woven fabric to form into a cylindrical shape, and winding while heating to form into a thermally adhered cylindrical shape.

[0050] Hereinafter, the present invention will be further described by referring to the Examples but is not limited to them alone.

[0051] The definition of values of the physical properties etc. of the thermal adhesive non-woven fabric in the Examples and the measuring method for determining the values are as follows.

[0052] The specific volume of the non-woven fabric comprising staple fibers of Table 1 is determined and measured in the below mentioned method.

(1) Specific Volume

[0053] The basis weight and the thickness of the non-woven fabric were measured and the value calculated by the following equation was defined as the specific volume.

$$\text{Specific Volume} = (Y \times 100 \times 100) / X$$

wherein X denotes the basis weight of the non-woven fabric (g/m^2) and Y denotes the thickness of the non-woven fabric (cm).

[0054] Moreover, the size of the non-woven fabric sample used herein was 25 cm $\times$ 25 cm.

[0055] The number of the fiber lumps of the non-woven fabric comprising staple fibers of Table 1 was determined and measured by the below mentioned method.

(2) Number of Fiber Lumps

[0056] The number of fiber lumps having a volume not less than 1 mm³ existing in 20 g of the non-woven fabric was defined as the number of fiber lumps.

[0057] However, ten pieces of 20 g of non-woven fabric were sampled and the average value of each number of fiber lumps observed in each sample was defined as the number of fiber lumps.

(3) Hand Feeling and Appearance of Non-Woven Fabric

[0058] Five panelists evaluated the hand feeling of the non-woven fabric in the viewpoints of uniformity, a rough feeling, and non-uniformity in the color phase, the color phase becoming non-uniformity due to the fiber lumps. The hand feeling and appearance of the non-woven fabric were judged based on the following standards. When three or more panelists evaluated that the non-woven fabric had at least one defect among the following items: that is, the non-woven fabric had a non-uniformity; the non-woven fabric had a rough feeling; and the non-woven fabric is not uniform in color phase, then the hand feeling was regarded as "bad". In any other cases, the hand feeling of the non-woven fabric was judged as "good".

Example 1

[0059] A method for producing a non-woven fabric where rayon staple fibers and thermal adhesive fibers are mixed and the intersection points of fibers are adhered by thermal treatment:

5 **[0060]** 40 wt. % of rayon fibers having 12 zig-zag type crimps per inch (2.54 cm), the fiber fineness of 1.5 d/f and the fiber length of 5 mm (hereinafter, the expression like "1.5 d/f $\times$ 5 mm" will be used for an abbreviation) and 60 wt. % of an eccentric core and sheath type conjugated fiber comprising polypropylene as a core component and high density polyethylene as a sheath component, having 7 spiral type crimps per inch (2.54 cm) and being 3 d/f $\times$ 5 mm were fed into and made to pass through an opening apparatus and thereby fibers were opened mechanically. Then, the opened
10 fibers were fed into an air laid type apparatus shown in Fig. 1 to Fig. 3 and treated therein. Specifically, rayon fibers and thermal adhesive fibers 15, which were made to pass through the opening apparatus, were inserted into the fiber insertion openings 3 and 4 by way of the fiber feeding circulation duct and discharged from the rotating cylindrical screens 5a and 6a. The discharged fibers were collected on the net conveyor 9a having the suction apparatus 10 moving at the speed of 90 m/min to form the web 16. After the web 16 was compressed with the web compressing roll 11, it was ther-
15 mally treated at 150 °C for three seconds by the use of the suction drier 12, and thereby high density polyethylene of the sheath component was melted and adhered to produce the non-woven fabric 13. Then the non-woven fabric 13 was taken up into the take-up roll 14.

[0061] As to the physical properties, the resultant non-woven fabric had a basis weight of 25 g/m², a thickness of 3.6 mm, specific volume of 143 cm³/g, and the number of the fiber lumps of 2.1 lumps per 20g. The results are shown in
20 Table 1.

Example 2

[0062] A method for producing thermal adhesive staple fibers:

25 **[0063]** High crystalline polypropylene having MFR (melt flow rate) of 11 g per 10 minutes (the conditions 14 specified in JIS K7210) as a core component and high density polyethylene having MI (melt index) of 16.5 g per 10 minutes (the conditions 4 specified in JIS K 7210) were spun out of an eccentric core and sheath type spinneret having 621 holes at the discharging ratio of high crystalline polypropylene to high density polyethylene of 5 : 5 and at the discharging volume of 450 g/min, and then taken up at the speed of 592 m/min to produce 11 denier unstretched fibers. When spinning was
30 conducted, fibers were cooled by air cooling just below the spinneret, and then finishing agent comprising lauryl phosphate potassium salt as a main component was applied by using a contact roll.

[0064] This unstretched fiber was stretched between the first roll and the second roll to produce a stretched fiber having the fineness of 3 denier and spiral type crimps. At this time, the first roll was 90 °C and the second roll was 20 °C, and the rotating ratio of the first roll to the second roll was set to be 1 : 4.5. This stretched fiber having spiral type crimps
35 was cut into fibers of 5 mm in length by using the push-cutting type cutter.

[0065] Hereinafter, the method for producing a non-woven fabric comprising the thermal adhesive fibers will be explained.

[0066] The conjugated fibers were fed into and made to pass through an opening apparatus and opened mechanically, and then treated by feeding the opened fibers to the air-laid type apparatus shown in Fig. 1 to Fig. 5. Specifically,
40 the opened conjugated fiber 18 was fed into the fiber inserting openings 3 and 4 by way of the fiber feeding circulation duct and discharged from the rotating cylindrical screen 5a and 6a. The discharged fibers were collected on the net conveyor 9a having the suction apparatus 10 moving at the speed of 90 m/min to form into the web 16. After the web was compressed with the web compressing roll 11, it was thermally treated at 150 °C for three seconds by the use of suction drier 12, and thereby high density polyethylene of a sheath component was melted and adhered to produce the
45 non-woven fabric 13. Then the non-woven fabric 13 was taken up by the take-up roll 14.

[0067] As to the physical properties, the resultant non-woven fabric had a basis weight of 25 g/m², a thickness of 4.6 mm, specific volume of 185 cm³/g, and the number of the fiber lumps of 1.2 lumps per 20g. The results are shown in Table 1.

50 Example 3

[0068] The non-woven fabric was produced under the same conditions as Example 2 except that the fiber length of the conjugated fiber was made to be 10 mm.

[0069] As to the physical properties, the resultant non-woven fabric had a basis weight of 25 g/m², a thickness of 4.4 mm, specific volume of 176 cm³/g, and the number of the fiber lumps of 1.9 lumps per 20g. The results are shown in
55 Table 1.

Example 4

[0070] The non-woven fabric was produced under the same conditions as Example 2 except that the fiber length of the conjugated fiber was made to be 15 mm.

[0071] As to the physical properties, the resultant non-woven fabric had a basis weight of 25 g/m², a thickness of 4.25 mm, specific volume of 170 cm³/g, and the number of the fiber lumps of 3.8 lumps per 20g. The results are shown in Table 1.

Example 5

[0072] A method for producing the non-woven fabric using polyester staple fibers and side-by-side type conjugated fiber: 30 wt. % of polyester fibers having 14 zig-zag type crimps per inch (2.54 cm), and being 2 d/f × 5 mm and 70 wt. % of side-by-side type conjugated fibers comprising a polypropylene component and a high density polyethylene component, having 6 spiral type crimps per inch (2.54 cm) and being 2 d/f × 5 mm were fed into and made to pass through an opening apparatus, thus opening the fibers mechanically. Then, the opened fibers were fed into an air laid type apparatus shown in Fig. 1 to Fig. 3 and treated therein. Specifically, the opened polyester fibers and side-by-side type conjugated fibers 15 were inserted into the fiber insertion openings 3 and 4 by way of the fiber feeding circulation duct and discharged from the rotating cylindrical screens 5a and 6a. The discharged fibers were collected on the net conveyor 9a having the suction apparatus 10 moving at the speed of 90 m/min to form into the web 16. After the web was compressed with the web compressing roll 11, it was thermally treated at 150 °C for three seconds by the use of the suction drier 12, and thereby high density polyethylene of the sheath component was melted and adhered to produce the non-woven fabric 13. Then the non-woven fabric 13 was taken up by the take-up roll 14.

[0073] As to the physical properties, the resultant non-woven fabric had a basis weight of 25 g/m², a thickness of 3.4 mm, specific volume of 137 cm³/g, and the number of the fiber lumps of 2.2 lumps per 20g. The results are shown in Table 1.

Example 6

[0074] A method for producing thermal adhesive staple fibers:

[0075] The non-woven fabric was produced under the same conditions as Example 2 except that high crystalline polypropylene having MFR of 11 g per 10 minutes (the conditions 14 specified in JIS K7210) and high density polyethylene having MI of 16.5 g per 10 minutes (the conditions 4 specified in JIS K 7210) were spun out of a side-by-side type composite spinneret having 621 holes at the discharging ratio of high crystalline polypropylene to high density polyethylene of 5 : 5 and at the discharging volume of 450 g/min, and then taken up at the speed of 592 m/min to produce 8.1 denier unstretched fibers.

[0076] As to the physical properties, the resultant non-woven fabric had a basis weight of 25 g/m², a thickness of 4.5 mm, specific volume of 181 cm³/g, and the number of the fiber lumps of 1.3 lumps per 20g. The results are shown in Table 1.

Example 7

[0077] Fibers were produced under the same conditions as Example 6 except that the number of holes of the spinneret was 60, the discharging volume was 200 g/min, the taking-up speed was 417 m/min, the unstretched fiber was 72 denier, the stretched fiber was 18 denier and the number of spiral crimps was 6 crimps per inch (2.54 cm).

[0078] The conditions for producing non-woven fabrics were made to be the same as Example 5.

[0079] As to the physical properties, the resultant non-woven fabric had a basis weight of 25 g/m², a thickness of 3.9 mm, specific volume of 156 cm³/g, and the number of the fiber lumps of 0.5 lumps per 20g. The results are shown in Table 1.

Example 8

[0080] A method for producing thermal adhesive staple fibers:

[0081] Polypropylene having MFR of 16 g per 10 minutes (the conditions 14 specified in JIS K7210) as a core component and high density polyethylene having MI of 16.5 g per 10 minutes (the conditions 4 specified in JIS K 7210) were spun out of a core and sheath type spinneret having 621 holes at the discharging ratio of high crystalline polypropylene to high density polyethylene of 5 : 5 and at the discharging volume of 450 g/min and taken up at the speed of 919 m/min, to thus produce 7.1 denier of unstretched fibers. When spinning was conducted, fibers were cooled by air cooling just below the spinneret.

[0082] This unstretched fiber was stretched between the first roll and the second roll to form 2 denier stretched fiber. At this time, the first and second rolls were heated at 90 °C respectively and the rotating ratio of the first roll to the second roll was set to be 1 : 4. A finishing agent comprising lauryl phosphate potassium salt as a main component was applied to this stretched fiber by using a contact roll. Then, they were made to pass through a box type crimp processing apparatus to produce a tow having 14 zig-zag type crimps per inch.

[0083] Since this tow contained a water component, it was dried at the temperature of 90 °C by using a drier and then it was cut into fibers of 10 mm in length by using a push-cutting type cutter.

[0084] The conditions for producing the non-woven fabrics were made to be the same as Example 5.

[0085] As to the physical properties, the resultant non-woven fabric had a basis weight of 25 g/m², a thickness of 2.8 mm, specific volume of 79 cm³/g, and the number of the fiber lumps of 4.5 lumps per 20g. The results are shown in Table 1.

Example 9

[0086] A method for producing the thermal adhesive fibers comprising staple fibers:

[0087] 114 denier of unstretched fibers were produced by the use of a spinneret having 60 holes by taking up at the discharging volume of 200 g/min and at the taken-up speed of 263 m/min, then they were produced into 32 denier stretched fibers. Thermally adhesive conjugated fibers were produced under the same conditions as Example 8 except that 10 crimps per inch of zig-zag type crimps were provided and the fiber length was 10 mm.

[0088] The conditions for producing a non-woven fabric were made to be the same as Example 5.

[0089] As to the physical properties, the resultant non-woven fabric had a basis weight of 25 g/m², a thickness of 2.6 mm, specific volume of 45 cm³/g, and the number of the fiber lumps of 3.6 lumps per 20g. The results are shown in Table 1.

Example 10

[0090] Fibers were produced under the same conditions as Example 8 except that 340 denier unstretched fibers were produced by the use of a spinneret having 100 holes by taking up at the discharging volume of 200 g/min and at the taken-up speed of 53 m/min while cooling the fibers with water at the time of spinning, then they were produced into 100 denier stretched fibers, and the 10 zig-zag type crimps per inch were provided and the fiber length was 25 mm.

[0091] The conditions for producing a non-woven fabric were made to be the same as Example 5.

[0092] As to the physical properties, the resultant non-woven fabric had a basis weight of 25 g/m², a thickness of 2.65 mm, specific volume of 58 cm³/g, and the number of the fiber lumps of 2.4 lumps per 20g. The results are shown in Table 1.

Example 11

[0093] A method for producing thermal adhesive staple fibers:

[0094] High crystalline polypropylene having MFR of 11 g per 10 minutes (the conditions 14 specified in JIS K7210) as a core component and high density polyethylene having MI of 16.5 g per 10 minutes (the conditions 4 specified in JIS K 7210) as a sheath component were spun out of a core and sheath type spinneret having 621 holes at the discharging ratio of high crystalline polypropylene to high density polyethylene of 5 : 5 and at the discharging volume of 350 g/min, and then taken up at the speed of 995 m/min to produce 5.1 denier of unstretched fibers. When spinning was conducted, fibers were cooled by air cooling just below the spinneret.

[0095] The unstretched fibers were stretched between the first roll and the second roll. At this time, the first roll was heated at 90 °C and the second roll was heated at 20 °C and the rotating ratio of the first roll to the second roll was set to be 1 : 4.5. After a finishing agent comprising lauryl phosphate potassium salt as a main component was applied to this stretched fiber by using a contact roll, they were made to pass through a box-type crimps processing apparatus to produce a tow having 9 wave type crimps per inch. The stretched fibers having wave type crimps were cut into fibers of 5 mm in length by using a push-cutting type cutter.

[0096] The conditions for producing the non-woven fabric were made to be the same as Example 5.

[0097] As to the physical properties, the resultant non-woven fabric had a basis weight of 23 g/m², a thickness of 3.75 mm, specific volume of 163 cm³/g, and the number of the fiber lumps of 1.8 lumps per 20g. The results are shown in Table 1.

Example 12

[0098] A method for producing the thermal adhesive staple fibers:

[0099] Polypropylene having MFR of 10 g per 10 minutes (the conditions 14 specified in the JIS K7210) and polypropylene having MI of 23 g per 10 minutes (the conditions 14 specified in the JIS K 7210) were spun out of a side-by-side type spinneret having 350 holes at the discharging ratio of each polypropylene of 5 : 5 and at the discharging volume of 200 g/min, and then taken up at the speed of 635 m/min to produce 8.1 denier unstretched fibers. When spinning was conducted, fibers were cooled by air cooling just below the spinneret. A finishing agent containing lauryl phosphate potassium salt as a main component was applied by using a contact roll.

[0100] The unstretched fibers were stretched between the first roll and the second roll to produce 2 denier stretched fibers having spiral type crimps. At this time, the first roll was heated at 90 °C and the second roll was heated at 20 °C and the rotating ratio of the first roll to the second roll was set to be 1 : 4.5. The unstretched fiber having spiral type crimps was cut into fibers of 10 mm in length by using a push-cutting type cutter.

[0101] The conditions for producing the non-woven fabric were made to be the same as Example 5.

[0102] As to the physical properties, the resultant non-woven fabric had a basis weight of 25 g/m², a thickness of 3.25 mm, specific volume of 130 cm³/g, and the number of the fiber lumps of 1.4 lumps per 20g. The results are shown in Table 1.

Example 13

[0103] A method for producing the thermal adhesive staple fibers:

[0104] High crystalline polyethylene terephthalate having the intrinsic viscosity of 0.68 dl/g as a core component and high density polyethylene having MI of 16.5 g per 10 minutes (the conditions 4 specified in JIS K 7210) as a sheath component were spun out of a core and sheath type spinneret having 621 holes at the discharging ratio of high crystalline polyethylene terephthalate to high density polyethylene of 5 : 5 and at the discharging volume of 450 g/min and taken up at the speed of 1035 m/min to produce 6.3 denier unstretched fibers. When spinning was conducted, fibers were cooled by air cooling just below the spinneret.

[0105] The unstretched fibers were stretched between the first roll and the second roll. At this time, the first and second rolls were heated at 90 °C respectively and the rotating ratio of the first roll to the second roll was set to be 1 : 3.3. A finishing agent comprising lauryl phosphate potassium salt as a main component was applied to the stretched fibers by using a contact roll. Then, they were made to pass through a box-type crimps processing apparatus to produce a tow having 5 wave type crimps per an inch (2.54 cm). The stretched fiber having wave type crimps was cut into fibers of 10 mm in length by using a push-cutting type cutter.

[0106] The conditions for producing the non-woven fabrics were made to be the same as Example 5.

[0107] As to the physical properties, the resultant non-woven fabric had a basis weight of 25 g/m², a thickness of 3.0 mm, specific volume of 101 cm³/g, and the number of the fiber lumps of 2.6 lumps per 20g. The results are shown in Table 1.

Comparative Example 1

[0108] The non-woven fabric was produced under the same conditions as Example 2 except that the fiber length was 38 mm and a carding apparatus was used at the time of production of a web.

[0109] As to the physical properties, the resultant non-woven fabric had a basis weight of 25 g/m², a thickness of 0.9 mm, specific volume of 36 cm³/g, and the number of the fiber lumps of 0.9 lumps per 20g.

[0110] The resultant non-woven fabric had a smaller specific volume as compared with other Examples, because of the non-woven fabric produced by the carding process. The results are shown in Table 1.

Comparative Example 2

[0111] The non-woven fabric was produced under the same conditions as Example 2 except that the fiber length was 30 mm.

[0112] As to the physical properties, the resultant non-woven fabric had a basis weight of 25 g/m², a thickness of 2.75 mm, specific volume of 110 cm³/g, and the number of the fiber lumps of 8.5 lumps per 20g.

[0113] The non-woven fabric was produced by an air laid method. However, the fiber length was longer than 25 mm, so that fibers are easily entangled and the resultant non-woven fabric had many fiber lumps. Therefore, the resultant non-woven fabric was inferior in uniformity; had a rough touch; and had not uniformed hue, namely, many white portions were found remarkably in the non-woven fabric due to fiber lumps. Therefore, this non-woven fabric was evaluated as bad in hand feeling and appearance. The results are shown in Table 1.

Example 14

[0114] In a commercially available disposable diaper having roughly an "I" shape in a plan view like the side cross sectional shape of a rail of railway, only the front surface material of the paper diaper was replaced by the thermal adhesive non-woven fabric substantially prepared in Example 2.

[0115] The commercially available disposable diaper comprised; a front surface material which was produced from the non-woven fabric comprising polyethylene / polypropylene thermal adhesive conjugated staple fibers and the intersection points of the fibers were thermally adhered; a water absorptive material comprising a pulp and high absorptive resin as main components; and back surface material comprising polyethylene film. Only the front surface material was cut off with a knife and removed, followed by laminating the thermal adhesive non-woven fabric obtained in the above mentioned Example 3 to the same place where the front surface material had been placed. Moreover, the thermal adhesive non-woven fabric and the remaining non-woven fabric which was located near the leg portions were thermally adhered. Further, the remaining thermal adhesive non-woven fabric was cut off with scissors and removed, to thus produce a disposable diaper in which thermal adhesive non-woven fabric was laminated as a front surface material. This diaper had a great strength in the lateral direction (opposite to the longitudinal direction) of the non-woven fabric, a high bulkiness and soft hand feeling, and was usable for a preferable disposable diaper.

Table 1

	Denier d/f	Fiber Length mm	Specific Volume cm ³ /g	Number of Fiber Lumps Lumps/20g	Crimps shape	Number of Crimps Crimps/2.5 4cm	Hand Feeling Appearance
Example 1	3	5	143	2.1	spiral	7	good
	1.5	5			zig-zag	12	
Example 2	3	5	185	1.2	spiral	7	good
Example 3	3	10	176	1.9	spiral	8	good
Example 4	3	15	170	3.8	spiral	7	good
Example 5	2	5	137	2.2	spiral	6	good
	2	5			zig-zag	14	good
Example 6	2	5	181	1.3	spiral	7	good
Example 7	18	5	156	0.5	spiral	6	good
Example 8	2	10	79	4.5	zig-zag	14	good
Example 9	32	3	45	3.6	zig-zag	12	good
Example 10	100	25	58	2.4	zig-zag	10	good
Example 11	1.5	5	163	1.8	wave	9	good
Example 12	2	10	130	1.4	spiral	8	good
Example 13	2	10	101	2.6	zig-zag	5	good
Comparative Example 1	3	38	36	0.9	spiral	7	good
Comparative Example 2	3	30	110	8.5	spiral	7	bad

[0116] As is apparent from Table 1, by selecting the denier, the fiber length, the shape of crimps and the number of crimps of the present invention the non-woven fabric having a high bulkiness well contributed to the fibers and little generation of fiber lumps, and having good surface properties can be obtained. In addition, the fiber length of the fiber used for the thermal adhesive non-woven fabric of the present invention was shorter than that of the non-woven fabrics pro-

duced by the carding method. Consequently, as the number of fibers constituting fabric increases, uneven dispersion of the fibers was prevented to thus produce a uniform non-woven fabric. Moreover, since the non-woven fabric of the present invention is produced by fibers being fallen with dispersing to accumulate, the non-woven fabric of the present invention has smaller density and greater ventilation degree as compared with the non-woven fabric produced by the carding process in which fibers are combed and oriented in one direction.

[0117] The non-woven fabric comprising staple fibers of the present invention is produced by short fibers being dropped while being dispersed to be accumulated. As a result, this non-woven fabric overcomes the defects: the non-woven fabric produced by the carding process lose the bulkiness because fibers are drawn, to thus provide the non-woven fabric having a high bulkiness and softness.

[0118] In addition, the non-woven fabric comprising staple fibers of the present invention has shorter fiber length than the non-woven fabric produced by the carding process, so that fibers are laminated in a random dispersion state. As a result, the uniform non-woven fabric having little non-uniformity in the density can be obtained. Moreover, the non-woven fabrics are produced by fibers which are dropped with dispersion in the three dimensional direction to be accumulated, so that it has a smaller density, higher ventilation, more excellent soft feeling and touch as compared with the non-woven fabric produced by the carding process in which fibers are carded and oriented.

INDUSTRIAL APPLICABILITY

[0119] As the effects mentioned above, the non-woven fabric of the present invention has a soft feeling and is particularly suitable for such application as directly contacts with users' skin, for example, absorbent articles for disposable diapers, sanitary napkins, incontinence pads, nursing pads or the like. Moreover, since the non-woven fabric of the present invention has a high specific volume, high bulkiness and an excellent cushioning property, it is preferably used for applications that require an excellent cushioning property, for example, bandage or eye bandage, or table linen, cooking towel, packing materials for glass ceramics, packing materials for fruits and vegetables and flowers, packing materials for instruments and furniture etc. The non-woven fabric having a density inclination in the thickness direction produced by the above mentioned method can be used as non-woven fabric materials for filters, such as a liquid filter, an air filter etc.

Claims

1. A non-woven fabric comprising staple fibers, which comprises at least one kind of staple fiber having a fiber length of 3 to 25 mm and a single fiber fineness of 1 to 100 denier, and is produced by said fibers being dropped while being dispersed to be accumulated and adhered at the intersection point of the staple fibers; said non-woven fabric has a specific volume of 40 to 200 cm³/g, a number of fiber lumps having a volume of not less than 1 mm³ is not more than 5 lumps per 20 g of said non-woven fabric.
2. The non-woven fabric comprising staple fibers according to claim 1, wherein the fiber length of the staple fiber is in the range of 5 to 10 mm.
3. The non-woven fabric comprising staple fibers according to claim 1, wherein at least one kind of staple fiber is a staple fibers having 3 to 20 crimps / inch (2.54 cm) of spiral type crimps.
4. The non-woven fabric comprising staple fibers according to claim 1, wherein at least one kind of staple fiber in the fabric is a thermoplastic fiber.
5. The non-woven fabric comprising staple fibers according to claim 1, wherein at least one kind of staple fiber is olefin thermoplastic fiber or polyester thermoplastic fiber.
6. The non-woven fabric comprising staple fibers according to claim 1, wherein at least one kind of staple fiber is a thermoplastic conjugated staple fiber having a component which is capable of a thermal adhesion to said fiber.
7. The non-woven fabric comprising staple fibers according to claim 1, wherein at least one staple fiber is a staple fiber having an eccentric core and sheath type structure comprising high crystalline polypropylene as a core component and high density polyethylene as a sheath component.
8. An absorbent article using a non-woven fabric comprising staple fibers according to any one of claims 1 to 7.

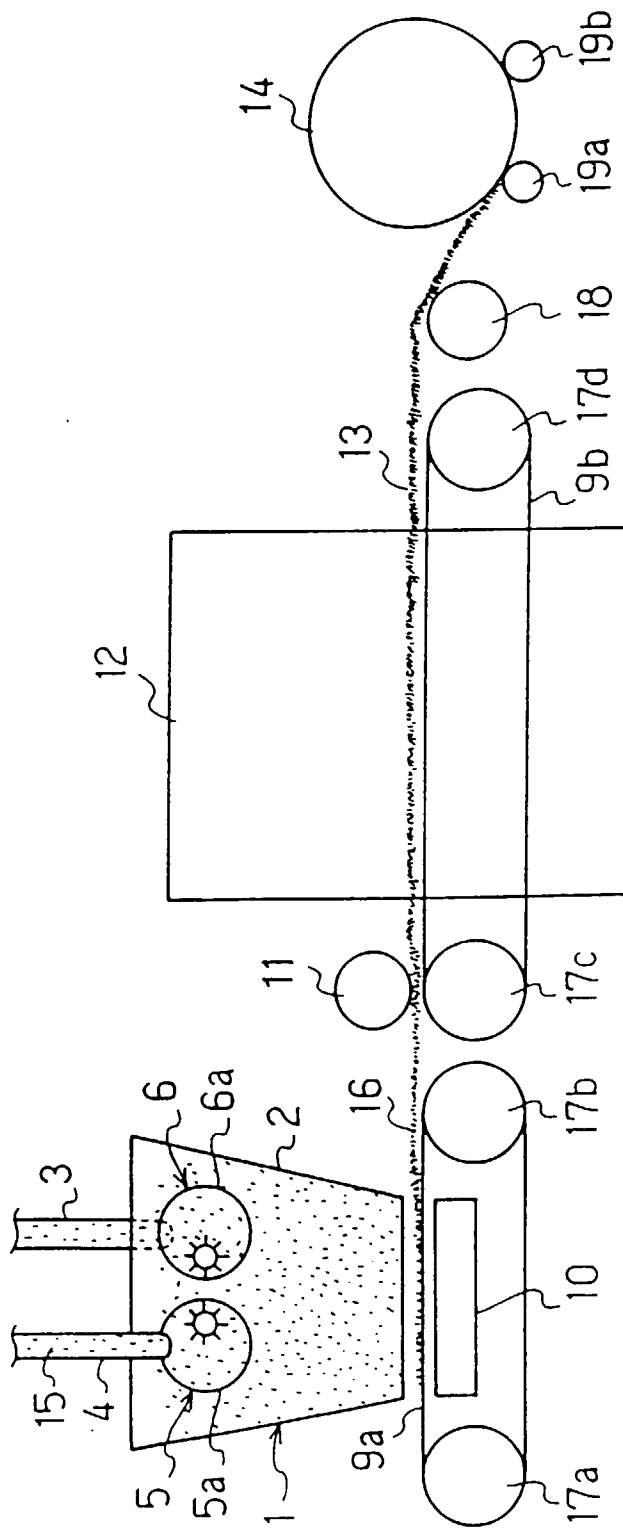


FIG. 1

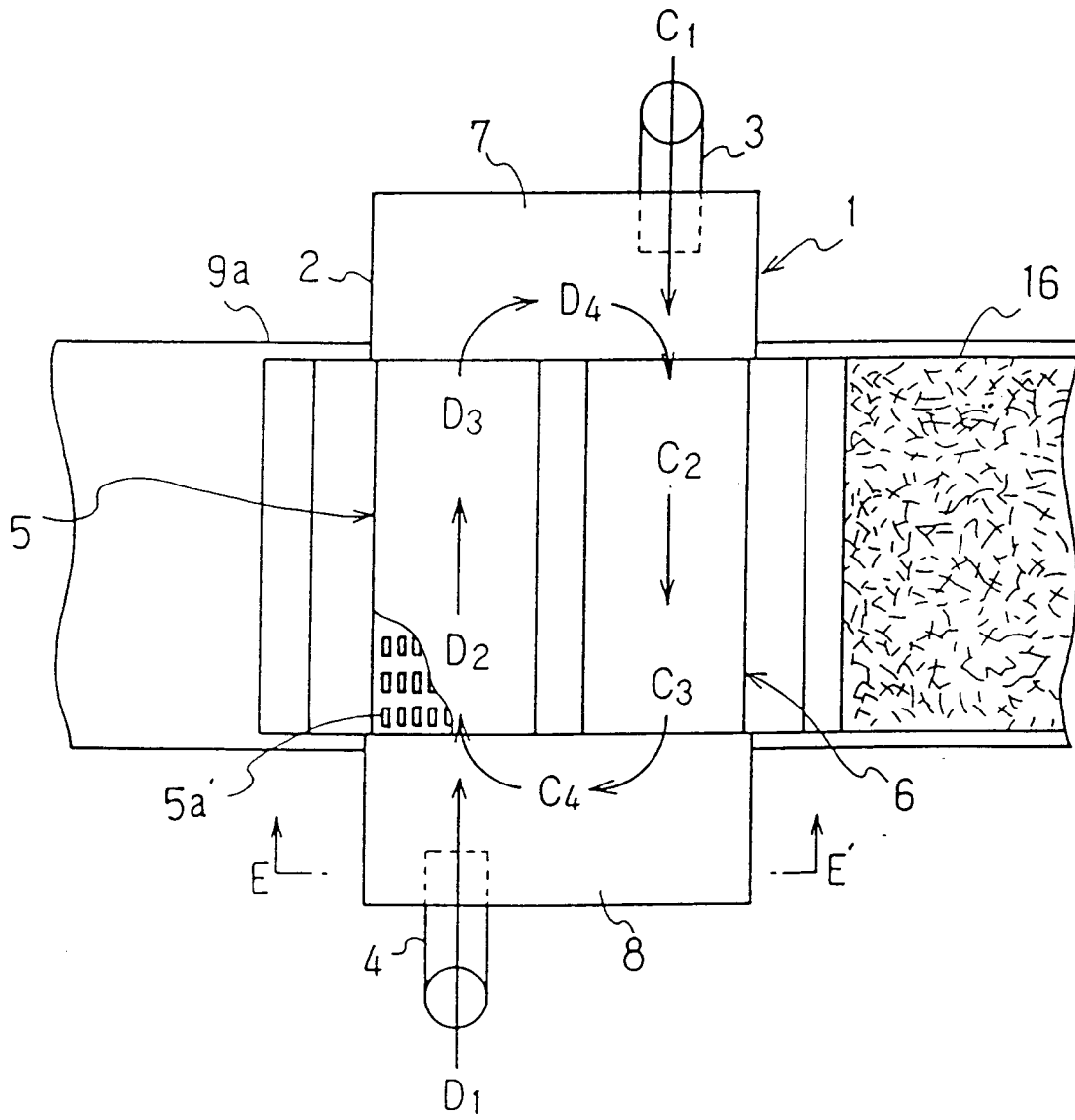


FIG. 2

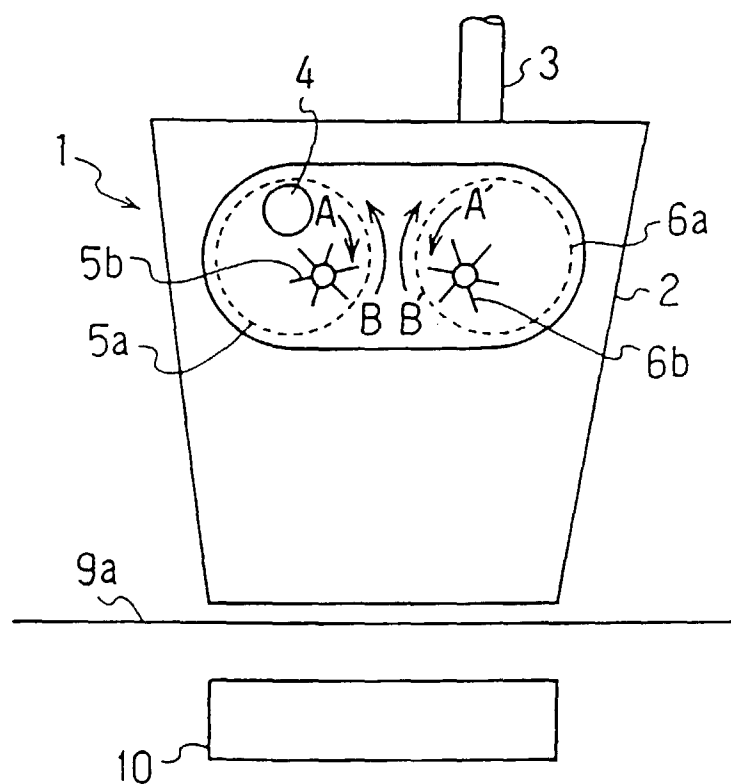


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP97/02073

A. CLASSIFICATION OF SUBJECT MATTER		
Int. Cl ⁶ D04H1/54		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
Int. Cl ⁶ D04H1/00-5/08		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Jitsuyo Shinan Koho 1926 - 1997 Kokai Jitsuyo Shinan Koho 1971 - 1996 Toroku Jitsuyo Shinan Koho 1994 - 1997		
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.
A	JP, 08-60441, A (Chisso Corp.), March 5, 1996 (05. 03. 96) (Family: none)	1 - 8
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "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) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search September 9, 1997 (09. 09. 97)		Date of mailing of the international search report September 30, 1997 (30. 09. 97)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.		Authorized officer Telephone No.

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