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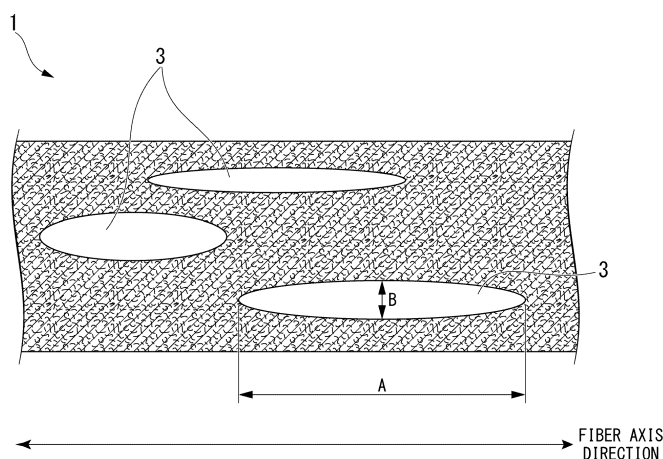
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(54) **FIBER AND WADDING**

(57) Provided is a fiber having superior bulkiness despite being a synthetic fiber, and wadding. The fiber contains inorganic particles having an average particle diameter of 1 μm to 20 μm within the fiber and fiber pores having a maximum width of 0.1 μm to 5 μm and maximum length of 1 μm to 50 μm are formed in fiber cross-sections

in the axial direction of the fiber. The wadding contains a fiber A, and the content of fiber A in the wadding (100% by weight) is 50% by weight to 100% by weight, down power is 270 cm^3/g to 400 cm^3/g , and the fiber A contains inorganic particles having an average particle diameter of 1 μm to 20 μm within the fiber.

FIG. 1



DescriptionTECHNICAL FIELD

5 **[0001]** The present invention relates to a fiber and wadding.

[0002] The present application claims priority on the basis of Japanese Patent Application No. 2016-204936 filed in Japan on October 19, 2016, the contents of which are incorporated herein by reference.

BACKGROUND ART

10 **[0003]** Various types of fibers such as acrylic fibers, nylon fibers or polyester fibers have their respective characteristics such as a soft texture, heat retention, shape stability, weather resistance or dyeability, and are frequently used in the fields of bedding, clothing and interior.

15 **[0004]** In recent years, in response to the rising price of down, applications using chemical fibers as batting are being deployed in the clothing and bedding fields as an alternative to down. Down, which has been mainly used as wadding of bedding or down jackets and the like, is known to demonstrate rich texture, light weight, heat retention and bulkiness while also demonstrating a high recovery rate after being compressed. However, since it is necessary to breed large numbers of waterfowl in order to obtain down, not only does this require a large amount of feed, but also results in problems such as water contamination caused by waterfowl excrement or the manifestation of infectious diseases and the proliferation thereof. In addition, in order to make it possible to use down as wadding, numerous processes are required such as feather collection, sorting, disinfection and defatting. Moreover, work becomes excessively complex due to the feathers being blown around during processing, and as a result thereof, bedding using down as wadding is expensive.

20 **[0005]** On the other hand, in the field of clothing, since synthetic fibers have a lower standard moisture content in comparison with natural fibers and lack the ability to absorb and release moisture, the wearer feels hot and sweaty at high temperatures or causes the generation of static electricity at low temperatures during the winter in the case of using synthetic fibers as clothing, thereby preventing these fibers from being considered as preferable materials in terms of wear comfort.

25 **[0006]** In order to eliminate these shortcomings, Patent Document 1, for example, proposes hollow polyester fibers having fineness of 4 dtex to 18 dtex. However, since the fibers have thick fineness in order to exhibit bulkiness, heat retention is not that high.

30 **[0007]** Although Patent Document 2 proposes polyester fibers to which have been added inorganic particles such as those of calcium hydroxide or magnesium hydroxide having superior hydrophilicity, while Patent Documents 3 and 4 propose polyester fibers to which have been added silica-based inorganic particles, these particles are added for the purpose of improving moisture absorption, and do not contain descriptions relating to improvement of bulkiness.

35 **[0008]** Moreover, Patent Document 5 proposes fibers for use as moisture-absorbent, heat-generating fibers in which inorganic particles have been adhered to the surface thereof with binder.

Prior Art Documents

40 Patent Documents

[0009]

Patent Document 1: Japanese Unexamined Patent Application, First Publication No. H8-188918

45 Patent Document 2: Japanese Unexamined Patent Application, First Publication No. 2001-192935

Patent Document 3: Japanese Unexamined Patent Application, First Publication No. 2001-348733

Patent Document 4: Japanese Unexamined Patent Application, First Publication No. 2002-363824

Patent Document 5: Japanese Unexamined Patent Application, First Publication No. 2002-180375

DISCLOSURE OF THE INVENTIONProblems to be Solved by the Invention

55 **[0010]** An object of the present invention is to provide wadding that uses fibers in which fiber pores of a specific shape are formed and demonstrates superior bulkiness despite using synthetic fibers, and fibers in which fiber pores of a specific shape are formed for use in wadding having superior bulkiness.

Means for Solving the Problems

[0011]

[1] A fiber containing inorganic particles having an average particle diameter of 1 μm to 20 μm within the fiber, wherein fiber pores having a maximum width of 0.1 μm to 5 μm and maximum length of 1 μm to 50 μm are formed in fiber cross-sections in the axial direction of the fiber.

[2] The fiber described in [1], wherein the content of the inorganic particles in the fiber (100% by weight) is 1% by weight to 15% by weight.

[3] The fiber described in [1] or [2], wherein the inter-fiber coefficient of static friction μ_s is 0.33 to 0.45.

[4] The fiber described in any of [1] to [3], wherein the fiber is an acrylic fiber.

[5] The fiber described in any of [1] to [4], wherein a plurality of pores are formed in the inorganic particles, the pore volume of the inorganic particles is 0.3 mL/g to 2.0 mL/g, and the specific surface area of the inorganic particles is 200 m^2/g to 800 m^2/g .

[6] The fiber described in any of [1] to [5], wherein single fiber fineness is 0.5 dtex to 20 dtex, single fiber strength is 1.8 cN/dtex to 3.0 cN/dtex, and single fiber elongation is 10% to 50%.

[7] The fiber described in any of [1] to [6], wherein down power is 270 cm^3/g to 400 cm^3/g and Clo value is 3 to 5.

[8] The fiber described in any of [1] to [7], wherein maximum attainable fiber temperature when changed from an environment at a temperature of 20°C and humidity of 40% RH to an environment at a temperature of 20°C and humidity of 90% RH is 24°C or higher.

[9] Wadding using the fiber described in any of [1] to [8].

[10] Wadding containing a fiber A, wherein the content of fiber A in the wadding (100% by weight) is 50% by weight to 100% by weight and down power is 270 cm^3/g to 400 cm^3/g , and the fiber A contains inorganic particles having an average particle diameter of 1 μm to 20 μm within the fiber.

[11] The wadding described in [10], wherein fiber pores having a maximum width of 0.1 μm to 5 μm and maximum length of 1 μm to 50 μm are formed in fiber cross-sections in the axial direction of the fiber.

[12] The wadding described in [10] or [11], wherein the Clo value is 3 to 5.

[13] The wadding described in any of [10] to [12], wherein the content of the inorganic particles in the fiber A (100% by weight) is 1% by weight to 15% by weight.

[14] The wadding described in any of [10] to [13], wherein the fiber A is an acrylic fiber.

[15] The wadding described in any of [10] to [14], wherein the pore volume of the inorganic particles is 0.3 mL/g to 2.0 mL/g and the specific surface area of the inorganic particles is 200 m^2/g to 800 m^2/g .

[16] The wadding described in any of [10] to [15], wherein the inter-fiber coefficient of static friction μ_s of the fiber A is 0.33 to 0.45, single fiber fineness of the fiber A is 0.5 dtex to 20 dtex, single fiber strength of the fiber A is 1.8 cN/dtex to 3.0 cN/dtex, and single fiber elongation of the fiber A is 10% to 50%.

[17] The wadding described in any of [10] to [16], further containing a chemical fiber differing from the fiber A, and the single fiber fineness of the chemical fiber is 0.5 dtex to 2.2 dtex.

[18] The wadding described in any of [10] to [17], further containing thermal bonding short fibers, wherein the content of the thermal bonding short fibers in the wadding (100% by weight) is 5% by weight to 30% by weight, and at least a portion of the thermal bonding short fibers are bonded to the fiber A.

Effects of the Invention

[0012] According to the present invention, fiber pores of a specific shape can be formed in a fiber and a fiber having superior bulkiness can be obtained by kneading inorganic particles having an average particle diameter of 1 μm to 20 μm into the fiber, and wadding having superior bulkiness can be obtained using that fiber.

[0013] The fiber of the present invention is provided with moisture retention and moisture-absorbent heat-generation in addition to superior bulkiness.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. 1 indicates a fiber cross-sectional view in the axial direction of the fiber of the present invention. In FIG. 1, the direction of the arrow indicates the axial direction of the fiber.

BEST MODE FOR CARRYING OUT THE INVENTION

[Fiber]

[0015] The fiber of the present invention contains inorganic particles having an average particle diameter of 1 μm to 20 μm within the fiber and fiber pores having a maximum width of 0.1 μm to 5 μm and maximum length of 1 μm to 50 μm are formed in cross-sections of the fiber in the axial direction thereof.

[0016] The average particle diameter of the inorganic particles contained in the fiber of the present invention is 1 μm to 20 μm .

[0017] An average particle diameter of the inorganic particles of 1 μm or more facilitates the presence of fiber pores in the axial direction of the fiber, while an average particle diameter of 20 μm or less facilitates favorable spinnability. From these viewpoints, the average particle diameter of the inorganic particles is more preferably 1 μm to 10 μm and even more preferably 2 μm to 5 μm .

[0018] In the fiber of the present invention, the maximum width of fiber pores formed in cross-sections of the fiber in the axial direction thereof is 0.1 μm to 5 μm .

[0019] A maximum width of fiber pores of 0.1 μm or more facilitates high bulkiness, while a maximum width of 5 μm or less facilitates a reduction in fiber breakage. From these viewpoints, the maximum width of the fiber pores is more preferably 1 μm to 4 μm and even more preferably 2 μm to 3 μm .

[0020] In the fiber of the present invention, maximum width of the fiber pores refers to the width of the portion formed in cross-sections in the axial direction of the fiber that demonstrates the maximum value in the direction of the minor axis of a certain single fiber pore cross-section. In FIG. 1, the maximum width of the fiber pores is indicated with "B".

[0021] In the fiber of the present invention, the maximum length of fiber pores formed in cross-sections of the fiber in the axial direction thereof is 1 μm to 50 μm .

[0022] A maximum length of the fiber pores of 1 μm or more facilitates high bulkiness, while a maximum length of 50 μm or less facilitates a reduction in fiber breakage. From these viewpoints, the maximum length of the fiber pores is more preferably 10 μm to 45 μm and even more preferably 20 μm to 40 μm .

[0023] In the fiber of the present invention, maximum length of the fiber pores refers to the length of the portion formed in cross-sections in the axial direction of the fiber that demonstrates the maximum value in the direction of the major axis of a certain single fiber pore cross-section. In FIG. 1, the maximum length of the fiber pores is indicated with "A".

[0024] The content of inorganic particles contained in the fiber of the present invention (100% by weight) is preferably 1% by weight to 15% by weight.

[0025] A content of inorganic particles of 1% by weight or more facilitates high down powder of wadding, while an inorganic particle content of 15% by weight or less facilitates a reduction in fiber breakage during spinning and favorable spinnability. From these viewpoints, the content of inorganic particles is more preferably 1% by weight to 10% by weight and even more preferably 3% by weight to 8% by weight.

[0026] The inorganic particles contained in the fiber of the present invention are preferably silica-based inorganic particles.

[0027] More specifically, it is preferable that 50% by weight or more of the inorganic particles (100% by weight) are inorganic particles composed of SiO_2 , and the content of SiO_2 in the inorganic particles (100% by weight) is more preferably 95% by weight or more. The SiO_2 is preferably wet silica from the viewpoints of having a large pore volume and large specific surface area and making it possible to increase the size of fiber pores in the fiber, and specific examples thereof include white carbon, silica sol, silica gel and synthetic silica.

[0028] The inter-fiber static coefficient of friction μ_s of the fiber of the present invention is preferably 0.33 to 0.45.

[0029] A static coefficient of friction μ_s of 0.33 or more facilitates maintaining the shape of the wadding and high bulkiness, while a static coefficient of friction μ_s of 0.45 or less facilitates favorable resiliency of the wadding. From these viewpoints, the static coefficient of friction μ_s is more preferably 0.34 to 0.42.

[0030] The fiber of the present invention is preferably acrylic fiber.

[0031] The use of acrylic fiber facilitates the formation of fiber pores within the fiber.

[0032] In the case the fiber of the present invention is acrylic fiber, the acrylonitrile-based copolymer having an acrylonitrile unit for the main constituent unit thereof used in acrylic fiber is composed of 80% by weight or more of the acrylonitrile unit, and any other monomers capable of copolymerizing with acrylonitrile can also be used in combination therewith. Examples thereof include a copolymer obtained by copolymerization of 80% by weight or more of acrylonitrile and 20% by weight or less of any other monomers, e.g., selected from alkyl acrylates such as methyl acrylate or ethyl acrylate, neutral monomers such as styrene, vinyl acetate, vinyl chloride, vinylidene chloride, vinyl ethyl ether or methacrylonitrile, acidic monomers such as acrylic acid, methacrylic acid, allylsulfonic acid, methallylsulfonic acid, styrenesulfonic acid or 2-acrylamido-2-methylpropanesulfonic acid, an ammonium salt or alkaline metal salt thereof. This acrylonitrile-based copolymer may be produced by any method such as suspension polymerization, solution polymerization or emulsion polymerization.

[0033] The inorganic particles contained in the fiber of the present invention preferably have a plurality of pores formed therein.

[0034] The pore volume of the inorganic particles in the case of having a plurality of pores formed therein is preferably 0.3 mL/g to 2.0 mL/g.

[0035] A pore volume of the inorganic particles of 0.3 mL/g or more facilitates increasing down power when using in wadding, while a pore volume of 2.0 mL/g or more makes viscosity of a liquid having the inorganic particles dispersed therein not too high while also enabling industrial production. From these viewpoints, the pore volume of the inorganic particles is more preferably 0.5 mL/g to 2.0 mL/g and even more preferably 1.0 mL/g to 2.0 mL/g.

[0036] Pore volume was measured according to JIS Z 8831-2 (2010) [ISO15901-2 (2006)].

[0037] In addition, the specific surface area of the inorganic particles contained in the fiber of the present invention is preferably 200 m²/g to 800 m²/g.

[0038] A specific surface area of the inorganic particles of 200 m²/g or more facilitates increasing down power when used in wadding, while specific surface area of 800 m²/g or less facilitates sufficient pore volume required for forming the fiber pores of the fiber. From these viewpoints, the specific surface area of the inorganic particles is more preferably 200 m²/g to 800 m²/g and even more preferably 300 m²/g to 600 m²/g.

[0039] Specific surface area was measured according to the BET method of JIS Z 8830 (2013) [ISO9277 (2010)].

[0040] In addition, as one embodiment thereof, the inorganic particles contained in the fiber of the present invention may have a plurality of pores formed therein, the pore volume of the inorganic particles is 0.3 mL/g to 2.0 mL/g, and the specific surface area of the inorganic particles contained in the fiber of the present invention is 200 m²/g to 800 m²/g.

[0041] The fiber of the present invention preferably has a single fiber fineness of 0.5 dtex to 20 dtex.

[0042] A single fiber fineness of 0.5 dtex or more makes it difficult for the fiber to break during spinning resulting in favorable spinnability, while single fiber fineness of 20 dtex or less facilitates increased down power and Clo value in the case of using in wadding. From these viewpoints, single fiber fineness is more preferably 0.8 dtex to 10 dtex and even more preferably 1.0 dtex to 7.8 dtex.

[0043] The fiber of the present invention preferably has single fiber strength of 1.8 cN/dtex to 3.0 cN/dtex.

[0044] Single fiber strength of 1.8 cN/dtex or more facilitates a reduction in the amount of fiber waste generated due to cutting of single fibers in the carding process when producing wadding, while single fiber strength of 3.0 cN/dtex facilitates the obtaining of adequate strength. From these viewpoints, single fiber strength is more preferably 2.0 cN/dtex to 2.8 cN/dtex.

[0045] The fiber of the present invention preferably has single fiber elongation of 10% to 50%.

[0046] Single fiber elongation of 10% or more makes it difficult for fiber waste to be generated in the spinning and cotton opening processes, while single fiber elongation of 50% or less facilitates favorable passage in the spinning and cotton opening processes. From these viewpoints, single fiber elongation is more preferably 20% to 40%.

[0047] In addition, as one embodiment thereof, the fiber of the present invention may have single fiber fineness of 0.5 dtex to 20 dtex, single fiber strength of 1.8 cN/dtex to 3.0 cN/dtex, and single fiber elongation of 10% to 50%.

[0048] The fiber of the present invention preferably has down power of 270 cm³/g to 400 cm³/g.

[0049] Fiber down power of 270 cm³/g or more facilitates high bulkiness in the case of using as wadding and enables the amount of cotton used to be reduced, while down power of 400 cm³/g or less facilitates a compact size when compressed in the case of using as wadding of a finished product. From these viewpoints, down power of the fiber is more preferably 270 cm³/g to 380 cm³/g and even more preferably 300 cm³/g to 350 cm³/g.

[0050] The fiber of the present invention preferably has a Clo value of 3 to 5.

[0051] A Clo value of the fiber of the present invention of 3 or more facilitates the obtaining of a heat retention effect even if used in small amounts in the case of using as wadding, while a Clo value of 5 or less makes it difficult to become excessively thick in the case of using as a finished product. From these viewpoints, the Clo value is more preferably 3.5 to 4.5.

[0052] In addition, as one bulkiness thereof, the fiber of the present invention may have down power of 270 cm³/g to 400 cm³/g and a Clo value of 3 to 5.

[0053] The fiber of the present invention preferably has a maximum attainable fiber temperature of 24°C or higher when changed from an environment at a temperature of 20°C and humidity of 40% RH to an environment at a temperature of 20°C and humidity of 90% RH.

[0054] A maximum attainable fiber temperature of 24°C or higher under the aforementioned conditions facilitates a sensation of warmth when touched by a person.

[Wadding]

[0055] One embodiment of the wadding of the present invention is wadding that uses the fiber of the present invention.

[0056] Use of the fiber of the present invention makes it possible to obtain wadding having superior bulkiness.

[0057] Another embodiment of the wadding of the present invention is wadding in which the content of a fiber A

contained in the wadding (100% by weight) is 50% by weight to 100% by weight and the wadding has down power of 270 cm³/g to 400 cm³/g, wherein the fiber A is a fiber containing inorganic particles having an average particle diameter of 1 μm to 20 μm within the fiber.

[0058] A content of fiber A in the wadding of 50% by weight or more facilitates high bulkiness of the wadding, while a fiber A content of 100% or less facilitates the obtaining of a desired bulkiness. From these viewpoints, the content of fiber A is preferably 60% by weight or more and even more preferably 70% by weight or more.

[0059] The obtaining of a desired bulkiness makes it possible to mix in other fibers.

[0060] Examples of other fibers include fibers having a function such as antibacterial activity or deodorizing activity, natural fibers such as wool and thermal bonding fibers, and down is included in the present invention.

[0061] Down power of the wadding of 270 cm³/g or more facilitates a reduction in the amount of cotton used when used as wadding, while down power of 400 cm³/g or less facilitates a compact size when compressed in the case of using as wadding of a finished product. From these viewpoints, down power of the wadding is preferably 280 cm³/g to 380 cm³/g and more preferably 300 cm³/g to 350 cm³/g.

[0062] In the wadding of the present invention, the fiber A is preferably a fiber in which fiber pores having a maximum width of 0.1 μm to 5 μm and maximum length of 1 μm to 50 μm are formed in a fiber cross-section in the axial direction of the fiber.

[0063] A maximum width of the fiber pores of 0.1 μm or more facilitates increased down power of the wadding, while a maximum width of 5 μm or less results in resistance to decreases in fiber strength and makes it difficult for the fiber to break. From these viewpoints, the maximum width of the fiber pores is more preferably 1 μm to 4 μm.

[0064] A maximum length of the fiber pores of 1 μm or more facilitates increased down power of the wadding, while a maximum length of 50 μm or less results in resistance to decreases in fiber strength and makes it difficult for the fiber to break. From these viewpoints, the maximum length of the fiber pores is more preferably 10 μm to 45 μm.

[0065] The wadding of the present invention preferably has a Clo value of 3 to 5.

[0066] A Clo value of 3 or more facilitates the obtaining of a heat retention effect even in small amounts, while a Clo value of 5 or less makes it difficult for the product from becoming excessively thick in the case of a finished product. From these viewpoints, the Clo value is more preferably 3.5 to 4.5.

[0067] In the wadding of the present invention, the content of inorganic particles contained in the fiber A (100% by weight) is preferably 1% by weight to 15% by weight.

[0068] An inorganic particle content of 1% by weight or more facilitates an increase in size of the fiber pores and facilitates increased down power of the wadding when used in a wadding, while an inorganic particle content of 15% by weight or less, facilitates a reduction in breakage of the fiber A and makes it easy to maintain bulkiness. From these viewpoints, the content of inorganic particles contained in the fiber A is more preferably 1% by weight to 10% by weight and even more preferably 3% by weight to 8% by weight.

[0069] In the wadding of the present invention, the fiber A is preferably acrylic fiber.

[0070] The use of acrylic fiber facilitates the formation of fiber pores within the fiber as well as increased bulkiness.

[0071] In the wadding of the present invention, the inorganic particles contained in the fiber A preferably have a plurality of pores formed therein.

[0072] Pore diameter of the inorganic particles in the case of a plurality of pores being formed in the inorganic particles is preferably 0.3 mL/g to 2.0 mL/g.

[0073] A pore diameter of the inorganic particles of 0.3 mL/g or more facilitates increased down power of the wadding, while a pore diameter of 2.0 mL/g or less facilitates a reduction in breakage of the fiber A in an article. From these viewpoints, pore volume of the inorganic particles is more preferably 0.5 mL/g to 2.0 mL/g and even more preferably 1.0 mL/g to 2.0 mL/g.

[0074] In the wadding of the present invention, the specific surface area of the inorganic particles contained in the fiber A is preferably 200 m²/g to 800 m²/g.

[0075] A specific surface area of the inorganic particles of 200 m²/g or more results in larger fiber pores in the fiber and facilitates increased down power of the wadding, while specific surface area of 800 m²/g or less facilitates the acquisition the required pore volume for forming the fiber pores of the fiber A. From these viewpoints, specific surface area of the inorganic particles is more preferably 200 m²/g to 800 m²/g and even more preferably 300 m²/g to 600 m²/g.

[0076] In addition, in one embodiment thereof, the wadding of the present invention may have a plurality of pores formed in the inorganic particles contained in the fiber A, the pore volume of the inorganic particles may be 0.3 mL/g to 2 mL/g, and the specific surface area of the inorganic particles contained in the fiber A may be 200 m²/g to 800 m²/g.

[0077] In the wadding of the present invention, the inter-fiber coefficient of static friction μ_s of the fiber A is preferably 0.33 to 0.45.

[0078] An inter-fiber coefficient of static friction μ_s of 0.33 or more makes it easy to maintain the shape of the wadding and facilitates increased bulkiness, while an inter-fiber coefficient of static friction μ_s of 0.45 or less facilitates favorable resiliency of the wadding.

[0079] In the wadding of the present invention, the single fiber fineness of the fiber A is preferably 0.5 dtex to 20 dtex.

[0080] Single fiber fineness of 0.5 dtex or more facilitates a reduction in breakage of the fiber A in an article, while single fiber fineness of 20 dtex or less facilitates increased bulkiness of the wadding. From these viewpoints, single fiber fineness is more preferably 0.8 dtex to 10 dtex and even more preferably 1.0 dtex to 7.8 dtex.

[0081] In the wadding of the present invention, single fiber strength of the fiber A is preferably 1.8 cN/dtex to 3.0 cN/dtex.

[0082] Single fiber strength of 1.8 cN/dtex or more facilitates reduced breakage of the wadding in an article, while single fiber strength of 3.0 cN/dtex or more facilitates adequate strength. From these viewpoints, single fiber strength is more preferably 2.0 cN/dtex or more and even more preferably 2.2 cN/dtex or more.

[0083] In the wadding of the present invention, single fiber elongation of the fiber A is preferably 10% to 50%.

[0084] Single fiber elongation of 10% or more facilitates reduced fiber rigidity and a soft texture, while single fiber elongation of 50% or less facilitates favorable compression recovery. From these viewpoints, single fiber elongation is more preferably 20% to 40%.

[0085] In addition, in one embodiment thereof, the wadding of the present invention may have an inter-fiber coefficient of static friction μ_s of the fiber A of 0.33 to 0.45, single fiber fineness of the fiber A may be 0.5 dtex to 20 dtex, single fiber strength of the fiber A may be 1.8 cN/dtex to 3.0 cN/dtex, and single fiber elongation of the fiber A may be 10% to 50%.

[0086] The wadding of the present invention may further contain chemical fiber other than the fiber A in which single fiber fineness is 0.5 dtex to 2.2 dtex.

[0087] Containing a chemical fiber differing from the fiber A and having a specific single fiber fineness facilitates the imparting of functions such as antibacterial activity or deodorizing activity.

[0088] Single fiber fineness of the chemical fiber differing from fiber A of 0.5 dtex or more facilitates a reduction in breakage of the fiber A in an article, while single fiber fineness of 2.2 dtex or less facilitates improvement of heat retention. From these viewpoints, the single fiber fineness of the chemical fiber differing from fiber A is more preferably 0.6 dtex to 2.0 dtex and even more preferably 0.7 dtex to 1.5 dtex.

[0089] The chemical fibers include synthetic fibers, semi-synthetic fibers, recycled fibers and inorganic fibers, and in the present invention, refer to fibers described in JIS L 0204-2.

[0090] The wadding of the present invention may further contain thermal bonding short fibers, the content of thermal bonding short fibers contained in the wadding (100% by weight) may be 5% by weight to 30% by weight, and at least a portion of the thermal bonding short fibers may be bonded to the fiber A.

[0091] A thermal bonding short fiber content of 5% by weight or more facilitates the obtaining of the effect of preventing offset of the wadding, while a thermal bonding short fiber content of 30% by weight or less facilitates inhibition of decreases in bulkiness and heat retention. From these viewpoints, thermal bonding short fiber content is more preferably 6% by weight to 25% by weight and even more preferably 7% by weight to 20% by weight.

[0092] In addition, having at least a portion of the thermal bonding short fibers bound to the fiber A facilitates the maintaining of high bulkiness.

[Fiber Production Method]

[0093] Although the fiber of the present invention can be obtained by a wet spinning method or dry-wet spinning method, a wet spinning method is preferably from the viewpoints of productivity and cost.

[0094] For example, in the case the fiber of the present invention is acrylic fiber, the fiber production method of the present invention is characterized by mixing a mixture, obtained by uniformly mixing 10% by weight to 20% by weight of inorganic particles having an average particle diameter of 1 μm to 20 μm into a solution obtained by dissolving the aforementioned acrylonitrile-based copolymer in a solvent, with a solution obtained by dissolving the acrylonitrile-based copolymer in a solvent to prepare a spinning dope followed by the spinning thereof.

[0095] Any solvent capable of dissolving the acrylonitrile-based copolymer may be used for the solvent. Examples thereof include organic solvents such as dimethylformamide, dimethylacetamide, dimethylsulfoxide or acetone, and among these, dimethylacetamide is preferable from the viewpoints of productivity of fiber production and physical properties of the resulting acrylic fiber.

[0096] A dispersion having the inorganic particles dispersed therein may be added to mix the inorganic particles into the solution obtained by dissolving the acrylonitrile-based copolymer in a solvent.

[0097] The dispersion is preferably composed of 3% by weight to 10% by weight of the acrylonitrile-based copolymer, 3% by weight to 30% by weight of the inorganic particles, and 60% by weight to 90% by weight of solvent. An inorganic particle concentration in the dispersion of 3 parts by weight to 30 parts by weight facilitates the obtaining of a favorable dispersed state and preferable spinnability, thereby making this preferable. From these viewpoints, the inorganic particle concentration in the dispersion is more preferably 5 parts by weight to 20 parts by weight.

[0098] The spinning dope is preferably composed of 15 parts by weight to 30 parts by weight, and preferably 18 parts by weight to 25 parts by weight, of the acrylonitrile-based copolymer, 1.5 parts by weight to 6 parts by weight of the inorganic particles, and 70 parts by weight to 85 parts by weight of solvent. A content of acrylonitrile-based copolymer in the spinning dope that is within the aforementioned ranges facilitates favorable spinnability in terms of yarn breakage

and productivity.

[0099] The dissolution temperature at which the acrylonitrile-based polymer dissolves in a solvent is preferably 40°C to 95°C. A dissolution temperature of 40°C or higher reduces undissolved copolymer, enables the service life of the filter material in a filter press or other filtration equipment to be correspondingly lengthened, and eliminates a loss of thread formability, thereby making this preferable. On the other hand, a dissolution temperature of 95°C or lower increases resistance to discoloration of the copolymer, thereby making this preferable.

[0100] In addition, the temperature of the spinning dope after having dissolved the acrylonitrile-based polymer in a solvent is preferably 40°C to 95°C. A spinning dope temperature within the aforementioned range facilitates thread formability of the spinning dope, prevention of increased nozzle pressure due to low viscosity and gelation of the spinning dope, thereby resulting in favorable spinnability.

[0101] Next, the spinning dope is discharged from spinning nozzles having a plurality of discharge holes into a solution having a solvent concentration of 40% by weight to 60% by weight and at a temperature of 35°C to 50°C to obtain coagulated fiber bundles.

[0102] A solvent concentration and temperature within the aforementioned ranges prevents coagulation from occurring excessively rapidly and enables the production of fibers having favorable passage in the carding process.

[0103] The jet stretch during discharge from the discharge holes of the spinning nozzles is preferably 0.4 to 2.2. Jet stretch refers to the value obtained by dividing the take-up speed of the coagulated fibers by discharge linear velocity.

[0104] Jet stretch of 0.4 or more makes it difficult for nozzle pressure to rise and prolongs continuous production time, thereby making this preferable, while jet stretch of 2.2 or less facilitates a reduction in thread breakage in the coagulation bath and results in favorable spinnability. From these viewpoints, jet stretch is more preferably 0.6 to 2.0.

[0105] Jet stretch can be calculated by dividing the take-up speed when leaving the coagulation bath by discharge linear velocity.

[0106] Moreover, the coagulated fiber bundles are stretched in hot water by a draw ratio of 2 times to 6 times, imparted with an oily agent and dried.

[0107] A draw ratio in hot water of 2 times or more facilitates the obtaining of single fiber strength and single fiber elongation required in the spinning and cotton opening processes, while a draw ratio of 6 times or less facilitates a reduction in yarn breakage caused by spinning.

[0108] The temperature of the hot water during stretching in hot water is preferably 80°C to 98°C. A temperature within this range facilitates prevention of fiber breakage during stretching in hot water.

[0109] The degree of swelling of the fibers stretched in hot water is preferably within the range of 80% to 250%. A degree of swelling within this range facilitates favorable drying and productivity.

[0110] The dried fiber bundles are crimped and housed in a container.

[0111] Subsequently, the fibers housed in the container are subjected to thermal relaxation treatment so as to shrink by 5% to 40% and obtain fibers.

[0112] Thermal relaxation conditions are defined by the degree of heat shrinkage of the fibers, and fiber heat shrinkage of 5% to 40% is preferable from the viewpoints of single fiber strength and single fiber elongation required in the spinning and cotton opening processes.

[0113] Heat shrinkage refers to the ratio at which the fiber bundles shrink before and after thermal relaxation treatment.

[0114] The temperature during thermal relaxation is 120°C to 145°C. A thermal relaxation temperature of 120°C or higher facilitates the obtaining of single fiber strength and single fiber elongation having favorable passage in the carding process during spinning, while a thermal relaxation temperature of 145°C or lower facilitates the obtaining of single fibers having favorable fiber texture.

[0115] In the case the fiber of the present invention is a fiber other than acrylic fiber, a fiber of the present invention other than acrylic fiber can be produced in accordance with a method self-evident among one of ordinary skill in the art or the aforementioned acrylic fiber production method.

Examples

[0116] Although the following provides a detailed explanation of the present invention by indicating examples and comparative examples, the present invention is not limited to these examples.

(Measurement of Specific Surface Area and Pore Volume)

[0117] Specific surface area and pore volume were measured according to the nitrogen adsorption method of JIS Z 8830 and JIS Z 8831-2:2010, specific surface area was analyzed with the BET method and pore volume was analyzed with the BJH method.

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(Measurement of Maximum Width and Maximum Length of Fiber Pores in Fiber Axial Direction)

[0118] A small amount of fiber was sampled from acquired raw cotton followed by uniformly arranging the fiber and embedding with UV-cured acrylic syrup in the form of a flat sheet. A longitudinal cross-section of the fiber was cut out with a microtome equipped with a glass knife. The test piece was then affixed to an SEM sample stand and fixed in position by adhering with carbon paste. The test piece was coated with Pt for 20 seconds with a turbo sputtering system (Emitech, K575XD Sputter Coater) under conditions of an ion current of 20 mA (coating thickness: approx. 5 nm). The JSM-6060A manufactured by JEOL Ltd. was used for the SEM, the accelerating voltage was 10 kV, the probe current was 30 and measurements were made at magnification factors of 3000X and 5000X. The SEM images were enlarged to A3 size and printed out followed by measuring and converting maximum values in the directions of the long axis and short axis of fiber pore cross-sections formed in the fiber cross-section with a scale.

(Measurement of Average Particle Diameter)

[0119] Average particle diameter was measured in compliance with JIS Z 8825 (2013) .

(Measurement of Single Fiber Fineness, Strength and Elongation and Static Coefficient of Friction)

[0120] These parameters were measured in compliance with JIS L 1015 (2010).

(Measurement of Down Power)

[0121] Down power was measured in compliance with JIS L 1903. Pretreatment consisted of steaming.

(Measurement of Clo Value)

[0122] Heat retention rate was measured using the Thermo Labo II dry contact method.

1. A sample is prepared by inserting 10 g of wadding into a cushion cover (material: 100% cotton) measuring 20 cm on a side.
2. The prepared sample is placed on a hot plate set to 20°C using the KES-F7 Thermo Labo II Tester manufactured by Kato Tech Co., Ltd.
3. The quantity of heat (a) radiated through the sample is determined under conditions of blowing air at the rate of 30 cm/sec.
4. The quantity of heat (b) radiated without placing the sample in the tester is determined and Clo value is calculated according to Equation 1.

$$\text{Clo value} = 0.645 \times [1/(a-b)]$$

[0123] A higher Clo value indicates superior heat retention.

(Measurement of Moisture Absorption)

[0124] Moisture absorption was measured according to Moisture Absorption test Method BQE A 035-2011 drafted by the Boken Quality Evaluation Institute.

[0125] 5 g of sample are sampled and placed in a polyester mesh-like net followed by treating for 4 hours with a dryer and allowing to stand overnight in a desiccator containing silica gel. Following treatment, a thermocouple temperature sensor was attached to the center of the sample for use as a test body. After treating the test body for 2 hours in an environment at 20°C and 40% RH using a constant temperature and constant humidity chamber, the temperature of the test body when the settings of the constant temperature and constant humidity chamber were changed to 20°C and 90% RH was measured for 15 minutes at 1 minute intervals followed by confirming the maximum attainable temperature.

(Example 1)

[0126] An acrylonitrile-based copolymer consisting of 93% by weight of an acrylonitrile unit and 7% by weight of a vinyl acetate unit was dissolved in dimethylacetamide to obtain an acrylonitrile-based copolymer solution having a copolymer concentration of 24.3% by weight and viscosity at 50°C of 400 poise.

[0127] Moreover, a mixture (1), composed of 6% by weight of an acrylonitrile-based copolymer consisting of 93% by weight of an acrylonitrile unit and 7% by weight of a vinyl acetate unit, 12% by weight of silica-based inorganic microparticles (Fuji Silysia Chemical, Sylsilia 310P, pore volume: 1.6 mL/g, specific surface area: 300 m²/g, average particle diameter: 2.7 μm), obtained by dissolving the acrylonitrile-based polymer in dimethylacetamide, and in which the silica-based inorganic microparticles were uniformly mixed, was obtained.

[0128] This acrylonitrile-based polymer solution and mixture (1) were uniformly mixed so that the amount of silica-based inorganic microparticles relative to the combined amount of acrylonitrile-based copolymer solution and silica-based inorganic microparticles was 5% by weight to prepare a spinning dope.

[0129] This spinning dope was discharged from a plurality of discharge holes having a hole diameter of 0.060 mm into an aqueous solution having a dimethylacetamide concentration of 56% by weight and temperature of 41°C to obtain fiber bundles followed by stretching by 5.5 times while washing off the solvent with hot water at 98°C. Continuing, an oily agent was adhered followed by drying with a plurality of heated rollers set to a surface temperature of 150°C, crimping, and shaking off into a container.

[0130] Moreover, the fiber bundles were subjected to thermal relaxation treatment so as to shrink by 20% followed by cutting into short fibers to obtain acrylic fiber having a single fiber fineness of 2.0 dtex and fiber length of 38 mm. The fiber properties are shown in Table 1.

(Example 2)

[0131] Acrylic fiber was obtained by spinning in the same manner as Example 1 with the exception of changing the mixing ratio of the acrylonitrile-based polymer solution and mixture (1) so that the content of silica-based inorganic microparticles in the fiber was 3% by weight. The fiber properties are shown in Table 1.

(Example 3)

[0132] Acrylic fiber was obtained by spinning in the same manner as Example 1 with the exception of changing the hole diameter of the discharge holes to 0.100 mm so that the single fiber fineness was 6 dtex. The fiber properties are shown in Table 1.

(Comparative Example 1)

[0133] Acrylic fiber was obtained by spinning in the same manner as Example 1 with the exception of spinning by using only the acrylonitrile-based polymer solution and not mixing in the mixture (1) containing the silica-based inorganic microparticles at the time of spinning. The fiber properties are shown in Table 1.

(Comparative Example 2)

[0134] Acrylic fiber was obtained by spinning in the same manner as Example 1 with the exception of spinning by using only the acrylonitrile-based polymer solution and not mixing in the mixture (1) containing the silica-based inorganic microparticles at the time of spinning, and discharging from a plurality of discharge holes having a hole diameter of 0.100 mm so that the single fiber fineness was 6 dtex. The fiber properties are shown in Table 1.

(Example 4)

[0135] Wadding was obtained by opening up 100% by weight of the acrylic fiber obtained in Example 1 with a carding machine. The results of measuring down power and Clo value of the wadding are shown in Table 2.

(Example 5)

[0136] Wadding was obtained by opening up 100% by weight of the acrylic fiber obtained in Example 2 with a carding machine. The results of measuring down power and Clo value of the wadding are shown in Table 2.

(Example 6)

[0137] Wadding was obtained by blending 50% by weight of the acrylic fiber obtained in Example 1 with 50% by weight of acrylic fiber A not containing porous silica (Mitsubishi Chemical Corp., product no.: S616, single fiber fineness: 0.8 dtex, fiber length: 38 mm) followed by opening up with a carding machine to obtain wadding. The results of measuring down power and Clo value of the wadding are shown in Table 2.

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[0138] The wadding demonstrated superior bulkiness of 286 cm³/g.

(Example 7)

[0139] Wadding was obtained by blending 50% by weight of the acrylic fiber obtained in Example 2 with 50% by weight of an acrylic fiber A not containing porous silica followed by opening up with a carding machine to obtain wadding. The results of measuring down power and Clo value of the wadding are shown in Table 2.

[0140] The wadding demonstrated superior bulkiness of 277 cm³/g.

(Example 8)

[0141] Wadding was obtained by blending 70% by weight of the acrylic fiber obtained in Example 1 with 30% by weight of an acrylic fiber A not containing porous silica followed by opening up with a carding machine to obtain wadding. The results of measuring down power of the wadding are shown in Table 2.

[0142] The wadding demonstrated superior bulkiness of 301 cm³/g.

(Example 9)

[0143] Wadding was obtained by blending 70% by weight of the acrylic fiber obtained in Example 2 with 30% by weight of an acrylic fiber A not containing porous silica followed by opening up with a carding machine to obtain wadding. The results of measuring down power and Clo value of the wadding are shown in Table 2.

[0144] The wadding demonstrated superior bulkiness of 279 cm³/g.

(Comparative Example 3)

[0145] Wadding was obtained by opening up 100% by weight of an acrylic fiber A not containing porous silica with a carding machine. The results of measuring down power and Clo value of the wadding are shown in Table 2.

[0146] The wadding demonstrated inferior bulkiness of 275 cm³/g.

[0147] Furthermore, hyphens "-" in the table indicate that that value was not measured.

[Table 1]

		Examples			Comparative Examples	
		1	2	3	1	2
Inorganic particle content	wt%	5.02	2.99	4.98	0	0
Fineness	dtex	2	2.2	5.86	1.9	5.93
Strength	cN/dtex	2.5	2.32	2.06	2.9	2.52
Elongation	%	32.4	32.5	31.2	36.1	37.1
Coefficient of static friction		0.403	-	0.348	0.301	0.38
Fiber pore maximum width	μm	3	3	-		
Fiber pore maximum length	μm	40	40	-		
Moisture absorption maximum temperature	°C	24.9	-	-	23.6	-

[Table 2]

		Examples						Comp. Ex.
		4	5	6	7	8	9	3
Down power	cm ³ /g	312	297	286	277	301	279	275
Clo value		3.01	3.14	3.29	3.22	-	3.14	3.34

BRIEF DESCRIPTION OF THE REFERENCE SYMBOLS**[0148]**

- 5 1 Fiber
- 3 Fiber pore
- A Maximum length of fiber pore
- 10 B Maximum width of fiber pore

Claims

- 15 1. A fiber containing inorganic particles having an average particle diameter of 1 μm to 20 μm within the fiber, wherein fiber pores having a maximum width of 0.1 μm to 5 μm and maximum length of 1 μm to 50 μm are formed in fiber cross-sections in the axial direction of the fiber.
- 20 2. The fiber according to claim 1, wherein the content of the inorganic particles in the fiber (100% by weight) is 1% by weight to 15% by weight.
3. The fiber according to claim 1 or 2, wherein the inter-fiber coefficient of static friction μ_s is 0.33 to 0.45.
- 25 4. The fiber according to any of claims 1 to 3, wherein the fiber is an acrylic fiber.
5. The fiber according to any of claims 1 to 4, wherein a plurality of pores are formed in the inorganic particles, the pore volume of the inorganic particles is 0.3 mL/g to 2.0 mL/g, and the specific surface area of the inorganic particles is 200 m^2/g to 800 m^2/g .
- 30 6. The fiber according to any of claims 1 to 5, wherein single fiber fineness is 0.5 dtex to 20 dtex, single fiber strength is 1.8 cN/dtex to 3.0 cN/dtex, and single fiber elongation is 10% to 50%.
7. The fiber according to any of claims 1 to 6, wherein down power is 270 cm^3/g to 400 cm^3/g and Clo value is 3 to 5.
- 35 8. The fiber according to any of claims 1 to 7, wherein maximum attainable fiber temperature when changed from an environment at a temperature of 20°C and humidity of 40% RH to an environment at a temperature of 20°C and humidity of 90% RH is 24°C or higher.
- 40 9. Wadding using the fiber according to any of claims 1 to 8.
10. Wadding containing a fiber A, wherein the content of fiber A in the wadding (100% by weight) is 50% by weight to 100% by weight and down power is 270 cm^3/g to 400 cm^3/g , and the fiber A contains inorganic particles having an average particle diameter of 1 μm to 20 μm within the fiber.
- 45 11. The wadding according to claim 10, wherein fiber pores having a maximum width of 0.1 μm to 5 μm and maximum length of 1 μm to 50 μm are formed in fiber cross-sections in the axial direction of the fiber.
12. The wadding according to claim 10 or 11, wherein the Clo value is 3 to 5.
- 50 13. The wadding according to any of claims 10 to 12, wherein the content of the inorganic particles in the fiber A (100% by weight) is 1% by weight to 15% by weight.
14. The wadding according to any of claims 10 to 13, wherein the fiber A is an acrylic fiber.
- 55 15. The wadding according to any of claims 10 to 14, wherein the pore volume of the inorganic particles is 0.3 mL/g to 2.0 mL/g and the specific surface area of the inorganic particles is 200 m^2/g to 800 m^2/g .

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16. The wadding according to any of claims 10 to 15, wherein the inter-fiber coefficient of static friction μ_s of the fiber A is 0.33 to 0.45, single fiber fineness of the fiber A is 0.5 dtex to 20 dtex, single fiber strength of the fiber A is 1.8 cN/dtex to 3.0 cN/dtex, and single fiber elongation of the fiber A is 10% to 50%.

5 17. The wadding according to any of claims 10 to 16, further containing a chemical fiber differing from the fiber A, and the single fiber fineness of the chemical fiber is 0.5 dtex to 2.2 dtex.

10 18. The wadding according to any of claims 10 to 17, further containing thermal bonding short fibers, wherein the content of the thermal bonding short fibers in the wadding (100% by weight) is 5% by weight to 30% by weight, and at least a portion of the thermal bonding short fibers are bonded to the fiber A.

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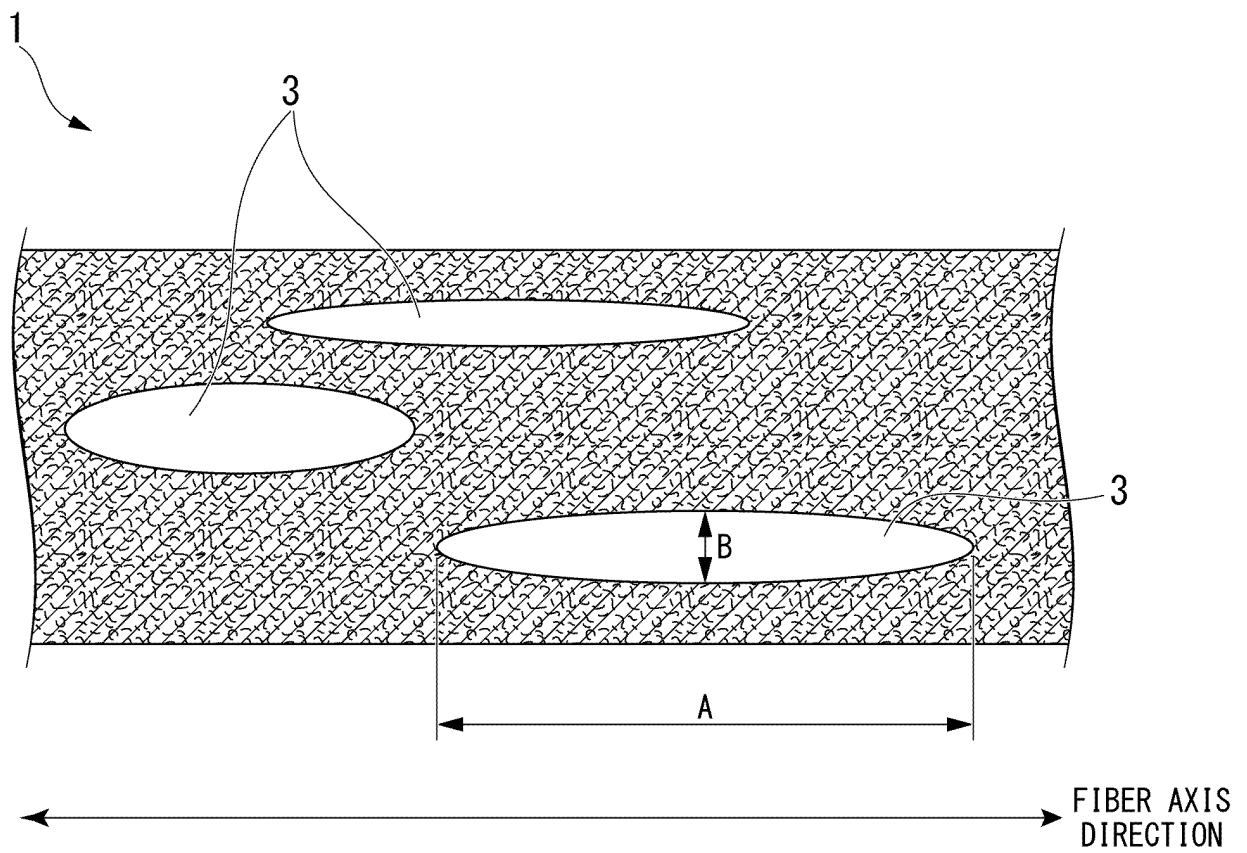
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FIG. 1



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2017/037828

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. D01F6/54 (2006.01) i, D04H1/02 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int. Cl. D01F1/00-6/96, D04H1/00-18/04

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

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2017

Registered utility model specifications of Japan 1996-2017

Published registered utility model applications of Japan 1994-2017

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 2001-348733 A (TORAY INDUSTRIES, INC.) 21 December 2001, claims 1, paragraph [0052], embodiments & US 2003/0088012 A1, claim 1, paragraph [0017], examples & WO 2001/090455 A1 & EP 1288350 A1 & DE 60122508 D & DE 60122508 T & CA 2378455 A & TW 550313 B & AT 337421 T & CN 1380917 A	1-3, 5-18 4
X A	JP 2002-363824 A (TORAY INDUSTRIES, INC.) 18 December 2002, claims 1, paragraph [0048], embodiments (Family: none)	1-3, 5-18 4



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

Date of mailing of the international search report

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Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2017/037828

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 3-270734 A (JAPAN VILENE CO., LTD.) 02 December 1991, claim 1, page 2, upper right column, line 19 to lower left column, line 12, page 2, lower right column, lines 2-5 (Family: none)	1-2, 4 3, 5-18
X A	JP 57-25410 A (ASAHI CHEMICAL INDUSTRY CO., LTD.) 10 February 1982, claims, page 2, lower right column, lines 3-9 (Family: none)	1-2, 4 3, 5-18
X A	JP 60-112656 A (ASAHI CHEMICAL INDUSTRY CO., LTD.) 19 June 1985, claim 1, page 3, upper right column, lines 12-17, embodiments (Family: none)	1, 4 2-3, 5-18
A	JP 2008-274448 A (ES FIBERVISIONS CO., LTD.) 13 November 2008, paragraphs [0026]-[0027] & US 2010/0143717 A1, [0028]-[0029] & WO 2008/133348 A1 & EP 2140048 A4 & KR 10-2009-0127363 A & CN 101680128 A & TW 200944630 A & BR PIO810693 A	1-18
A	JP 47-14418 A (THE NIPPON CHEMICAL INDUSTRIAL CO., LTD.) 09 August 1972, claims (Family: none)	1-18

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2016204936 A [0002]
- JP H8188918 B [0009]
- JP 2001192935 A [0009]
- JP 2001348733 A [0009]
- JP 2002363824 A [0009]
- JP 2002180375 A [0009]