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(54) ## PILE FABRIC AND METHOD FOR MANUFACTURING SAME

(57) The present invention relates to a pile fabric that includes: a ground structure; and pile fibers that are tangled with ground yarns constituting the ground structure and that stand on a front surface side of the ground structure. The pile fibers include acrylic fibers and/or modacrylic fibers and have a lower softening point than fibers constituting the ground structure. The pile fibers standing on the front surface side of the ground structure are not fused, whereas at least parts of the pile fibers located on a back surface side of the ground structure outside of the ground yarns constituting the ground structure are fused. 0.4 parts by weight or more of an organically-modified silicone-based softener is adhered with respect to 100 parts by weight of the pile fibers located on a back surface side of the pile fabric. The organically-modified silicone-based softener is at least one selected from the group consisting of amino-modified silicone-based softeners, epoxy-modified silicone-based softeners, and carboxyl-modified silicone-based softeners. The present invention provides a pile fabric having improved softness while preventing pile fiber loss, and a method for producing the same.

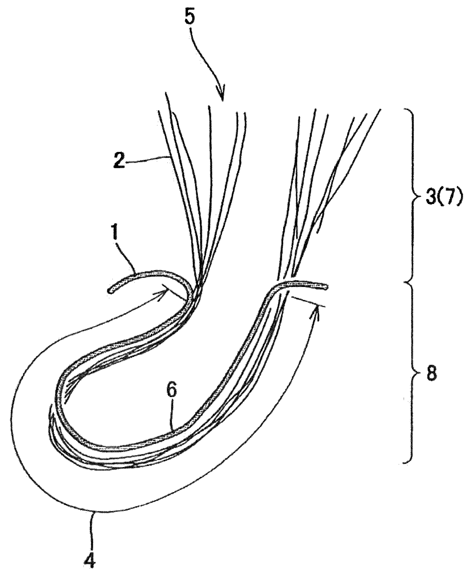

FIG. 1

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Description

Technical Field

[0001] The present invention relates to a pile fabric with high softness that prevents pile fibers from falling off, and a method for producing the same.

Background Art

[0002] Pile fabrics have been known as fabrics that are made to look like furs, and called imitation furs, fake furs, boas, etc. The pile fabrics are constituted by pile knitting or pile weave. Knitted piles are generally formed using seal-fraise knitting machines or sliver knitting machines (circular knitting machines), and in either cases pile fibers are cut. In the case of using double Russell machines (warp knitting machines), knitted piles are formed by making a double ground structure while tangling the double ground structure with binder yarns, and cutting the middle of the binder yarns. In weaving, velvet looms or moquette looms are used to tangle a pair of upper and lower ground structures and between the ground structures with binder yarns, and cut the middle of the upper and lower base fabrics with a knife to obtain two woven fabrics simultaneously. However, such woven and knitted fabrics, particularly knitted fabrics such as high pile fabrics, have a problem of a large amount of falling-off of fibers.

[0003] In order to prevent the falling-off of fibers of pile fabrics, there have been a proposal of mixing low-melting fibers into pile fibers (Patent Document 1), and a proposal of mixing low-melting fibers into ground yarns constituting a ground structure (Patent Documents 2-3). However, in these proposals, since the whole fabric is heated at a temperature equal to or higher than the melting point of the low-melting fibers, the entire ground structure or pile fibers are also fused, resulting in a coarse texture.

[0004] To cope with the above problem, Patent Document 4 proposes a pile fabric made from specific fibers, which can prevent pile fibers from falling off without impairing the texture of the piloerection surface by fusing only specific parts of the pile fibers on the back surface side of the pile fabric.

Prior Art Documents

Patent Documents

[0005]

Patent Document 1: JP H06(1994)-081248 A
Patent Document 2: JP 2000-314048 A
Patent Document 3: JP H07(1995)-048765 A
Patent Document 4: WO 2011/055455

Disclosure of Invention

Problem to be Solved by the Invention

[0006] However, in the pile fabric of Patent Document 4, the fusion of the pile fibers on the back surface side of the pile fabric sometimes hardens the back surface of the pile fabric, which accordingly hardens the pile fabric.

[0007] In order to solve the above problem, the present invention provides a pile fabric having improved softness while preventing pile fibers from falling off in a pile fabric in which at least parts of pile fibers located on the back surface side of the pile fabric are fused, and a method for producing the same.

Means for Solving Problem

[0008] The present invention relates to a pile fabric that includes: a ground structure; and pile fibers that are tangled with ground yarns constituting the ground structure and that stand on a front surface side of the ground structure. The pile fibers include at least one selected from the group consisting of acrylic fibers and modacrylic fibers and have a lower softening point than fibers constituting the ground structure. Among the pile fibers tangled with the ground yarns constituting the ground structure, the pile fibers standing on the front surface side of the ground structure are not fused, whereas at least parts of the pile fibers located on a back surface side of the ground structure outside of the ground yarns constituting the ground structure are fused. 0.4 parts by weight or more of an organically-modified silicone-based softener is adhered with respect to 100 parts by weight of the pile fibers located on a back surface side of the pile fabric.

The organically-modified silicone-based softener is at least one selected from the group consisting of amino-modified silicone-based softeners, epoxy-modified silicone-based softeners, and carboxyl-modified silicone-based softeners.

[0009] The present invention further relates to a method for producing the pile fabric described above. The pile fabric includes: a ground structure; and pile fibers that are tangled with ground yarns constituting the ground structure and that stand on a front surface side of the ground structure. The pile fibers include at least one selected from the group consisting of acrylic fibers and modacrylic fibers and have a lower softening point than fibers constituting the ground structure. 0.4 parts by weight or more of an organically-modified silicone-based softener is adhered with respect to 100 parts by weight of the pile fibers located on a back surface side of the pile fabric. The organically-modified silicone-based softener is at least one selected from the group consisting of amino-modified silicone-based softeners, epoxy-modified silicone-based softeners, and carboxyl-modified silicone-based softeners. The back surface side of the pile fabric is subjected to heat sensitive sealing at a temperature equal to or higher than the softening point of the pile fibers and lower than the softening point of the fibers constituting the ground structure, so that among the pile fibers tangled with the ground yarns constituting the ground structure, the pile fibers standing on the front surface side of the ground structure are not fused, whereas at least parts of the pile fibers located on a back surface side of the ground structure outside of the ground yarns constituting the ground structure are fused.

[0010] The organically-modified silicone-based softener is preferably an amino-modified silicone-based softener. The pile fibers are preferably modacrylic fibers. The ground yarns are preferably polyester fiber yarns. It is preferred that 0.4 to 2.5 parts by weight of the organically-modified silicone-based softener is adhered with respect to 100 parts by weight of the pile fibers located on the back surface side of the pile fabric.

Effect of the Invention

[0011] The present invention can provide a pile fabric having improved softness while preventing the falling-off of pile fibers (pile fiber loss). Moreover, the production method of the pile fabric of the present invention enables easy production of pile fabrics having improved softness while preventing the pile fiber loss.

Brief Description of Drawings

[0012]

[FIG. 1] FIG. 1 is a schematic view for explaining a positional relationship between ground yarns and pile fibers tangled with the ground yarns in high pile fabrics in one embodiment of the pile fabric of the present invention.

[FIG. 2] FIG. 2 illustrates a production process showing an exemplary method for producing the pile fabric of the present invention.

[FIG. 3] FIG. 3 is a schematic view for explaining a method for measuring the amount of the fiber loss of pile fabrics in embodiments of the present invention.

[FIG. 4] FIG. 4 is a schematic cross-sectional view for explaining a method for evaluating the softness of pile fabrics in embodiments of the present invention.

Description of the Invention

[0013] The present inventors repeatedly examined ways to improve the softness of pile fabrics while preventing the pile fiber loss in pile fabrics that include as pile fibers at least one selected from the group consisting of acrylic fibers and modacrylic fibers, wherein at least parts of the pile fibers among the pile fibers located on the back surface side of the pile fabric outside of the ground yarns are fused. As a result, the inventors found that it is possible to improve the softness of pile fabrics while preventing the pile fiber loss by adhering 0.4 parts by weight or more of an organically-modified silicone-based softener with respect to 100 parts by weight of the pile fibers on the back surface side of the pile fabric, the organically-modified silicone-based softener being at least one selected from the group consisting of amino-modified silicone-based softeners, epoxy-modified silicone-based softeners, and carboxyl-modified silicone-based softeners. Thus, the present invention is achieved. Softeners (also called soft finishing agents) generally impart softness and smoothness of fiber surfaces. In the present application, it was surprisingly found that it is possible to improve the softness of pile fabrics while preventing the pile fiber loss by adhering a given amount of a specific softener to the pile fibers located on the back surface side of the pile fabrics.

[0014] A pile fabric of the present invention is a pile fabric including: a ground structure; and pile fibers that are tangled with ground yarns constituting the ground structure and that stand on the front surface side of the ground structure. There is no particular limitation on the pile fabric, and examples thereof include high pile fabrics, boa fabrics, and tufted carpets. The pile fabric of the present invention is particularly suitable for high pile fabrics, which often cause the pile fiber loss. The high pile fabrics are not particularly limited, but they are preferably, e.g., fabrics with a pile fiber length of

15 to 100 mm at piloerection portion.

[0015] The high pile fabrics are pile knitted fabrics, and the ground structure is stockinette. Specifically, the high pile fabrics include: a stockinette ground structure; and pile fibers that are tangled with ground yarns constituting the ground structure while standing on a front surface side of the ground structure. Since the ground structure of the high pile fabrics is stockinette, the structure can have excellent stretchability. Stockinette is generally a fabric formed by making a loop with one or more yarns, hooking the loop to make a next new loop, and continuously making loops in a planar shape. The weft stockinette stitch, in which knitting proceeds in the weft direction, forms a planar fabric by making loops with yarns reciprocatingly from side to side, or forms a tubular fabric by making loops spirally. The warp stockinette stitch forms a fabric by making loops with a plurality of orderly arranged warp yarns while intermeshing the yarns with adjacent left and right warp yarns via loops. Examples of the weft stockinette stitch include plain stitch, rib stitch, and purl stitch. Examples of the warp stockinette stitch include Denbigh stitch, cord stitch, atlas stitch, and chain stitch. The stitch of the ground structure of the high pile fabrics is preferably weft stockinette stitch from the viewpoint of marketability and productivity.

[0016] In the present invention, the arrangement of the pile fibers with respect to the stockinette ground structure may be, e.g., an arrangement in which the pile fibers are tangled with all of the loops of the ground yarns constituting the stockinette ground structure, or an arrangement in which the pile fibers are not tangled with some of the loops of the ground yarns constituting the stockinette ground structure in the wale direction and/or course direction.

[0017] Any fibers having a higher softening point than the pile fibers can be used as the fibers constituting the ground structure, i.e., the fibers constituting the ground yarns. Examples of the fibers constituting the ground structure include polyester fibers and cellulose-based fibers. The polyester fibers may be, e.g., synthetic fibers obtained by spinning a resin composition containing a polyester resin such as polyethylene terephthalate. The cellulose-based fibers may be, e.g., cotton. The ground yarns are preferably polyester fiber yarns from the viewpoint of preventing the pile fiber loss while improving the softness of pile fabrics more effectively.

[0018] The pile fibers have a lower softening point than the fibers constituting the ground structure. Among the pile fibers tangled with the ground yarns, part or all of the pile fibers located on the back surface side of the ground structure outside of the ground yarns are fused, whereas the pile fibers standing on the front surface side of the ground structure are not fused. Thought there is no particular limitation on the means for fusing the pile fibers, it is preferable to subject the pile fabric to heat sensitive sealing from the back surface side of the pile fabric at a temperature equal to or higher than the softening point of the pile fibers and lower than the softening point of the fibers constituting the ground structure.

[0019] The pile fibers include acrylic fibers and/or modacrylic fibers, and thus a pile fabric with an excellent texture can be obtained. If the pile fibers are thermoplastic fibers, and a polishing process is performed at a temperature equal to or higher than the melting point or softening point of the thermoplastic fibers, generally, the pile fibers on the front surface side of the pile fabric burn or melt, and a pile fabric with a favorable appearance and texture cannot be obtained. If the polishing process is performed at a temperature equal to or lower than the glass transition point of the thermoplastic fibers, crimps of the pile fibers on the front surface side of the pile fabric are not straightened, and a pile fabric with a favorable appearance and texture cannot be obtained. On the other hand, crimps of acrylic fibers and modacrylic fibers can be straightened at temperatures lower than the melting point. The acrylic fibers and modacrylic fibers have a glass transition point of about 100°C and a softening point of about 150 to 230°C. If the pile fibers are acrylic fibers and/or modacrylic fibers, the polishing process can be performed at temperatures equal to or higher than the glass transition point and equal to or lower than the softening points, e.g., at temperatures of 100 to 150°C. Moreover, there is a tendency that crimps of the acrylic fibers and modacrylic fibers are straightened more easily than crimps of fibers of other materials, and thus a pile fabric with a favorable appearance and texture can be obtained.

[0020] The pile fibers may contain synthetic fibers that are produced by spinning a resin composition containing a polyester resin (e.g., polyethylene terephthalate, polytrimethylene terephthalate), or other fibers, as long as the effects of the present invention are not impaired.

[0021] The pile fibers are not particularly limited as long as the softening point is lower than the softening point of the fibers constituting the ground yarns. A difference between the softening point of the fibers constituting the ground yarns and the softening point of the pile fibers is preferably 10°C or more, more preferably 20°C or more, and particularly preferably 30°C or more. By setting the difference to be 10°C or more, it becomes easier to subject only part or all of the pile fibers located on the back surface side of the pile fabric outside of the ground yarns to heat sensitive sealing for fusion, and not to subject the pile fibers standing on the front surface side of the ground structure to heat sensitive sealing.

[0022] The pile fibers may be fibers that are all softened at a predetermined temperature, or mixed fibers including fibers softened at different temperatures. When the pile fibers are mixed fibers including fibers softened at different temperatures, it is preferable to mix fibers softened at a relatively low temperature in an amount of 20% by weight (wt%) or more, more preferably 50 wt% or more, and to subject the fibers softened at a relatively low temperature to heat sensitive sealing.

[0023] In embodiments of the present invention, the softening point means a softening temperature before fusion or decomposition. For example, the softening point of the acrylic fibers is 190 to 232°C, and the softening point of the modacrylic fibers is 150 to 220°C ("Encyclopaedia Chimica", page 727-729, published by Kyoritsu Shuppan Co., Ltd., June 1, 1993; hereinafter, referred to as "literature value").

[0024] In embodiments of the present invention, the acrylic fibers are fibers made up of a polymer obtained by polymerizing a composition containing acrylonitrile in an amount of 85 wt% or more and other copolymerizable monomers in an amount of 15 wt% or less. The modacrylic fibers are fibers made up of a polymer obtained by polymerizing a composition containing acrylonitrile in an amount of 35 wt% or more and less than 85 wt% and other copolymerizable monomers in an amount of more than 15 wt% and 65 wt% or less.

[0025] In embodiments of the present invention, there is no particular limitation on the copolymerizable monomers as long as they can be copolymerized with acrylonitrile. Examples of the copolymerizable monomers include: vinyl halides represented by vinyl chloride and vinyl bromide; vinylidene halides represented by vinylidene chloride and vinylidene bromide; sulfonic acid-containing monomers represented by allylsulfonic acid, methallylsulfonic acid, styrenesulfonic acid, isoprenesulfonic acid, 2-acrylamido-2-methylpropanesulfonic acid, and their metal salts and amine salts; lower alkyl esters of acrylic acid and methacrylic acid, N-alkyl substituted aminoalkyl esters, N,N-alkyl substituted aminoalkyl esters and glycidyl esters ; acrylamide, methacrylamide, and their N-alkyl substituted products and N,N-alkyl substituted products; anionic vinyl monomers such as carboxyl group-containing vinyl monomers represented by acrylic acid, methacrylic acid and itaconic acid and their sodium, potassium or ammonium salts; cationic vinyl monomers represented by quaternary aminoalkyl esters of acrylic acid and quaternary aminoalkyl esters of methacrylic acid; vinyl group-containing lower alkyl ethers; vinyl group-containing lower carboxylic acid esters represented by vinyl acetate; and styrene. These monomers may be used alone or in a combination of two or more kinds.

[0026] As the copolymerizable monomers, it is preferable to use one or more kinds of monomers selected from the group consisting of vinyl halides, vinylidene halides, and metal salts of sulfonic acid-containing monomers, and it is more preferable to use one or more kinds of monomers selected from the group consisting of vinyl chloride, vinylidene chloride, and sodium styrenesulfonate.

[0027] The pile fibers are preferably modacrylic fibers, more preferably modacrylic fibers obtained by polymerizing a composition containing acrylonitrile in an amount of 35 wt% or more and less than 85 wt%, and vinyl chloride and/or vinylidene chloride and other copolymerizable monomers in a total amount of more than 15 wt% and 65 wt% or less.

[0028] In embodiments of the present invention, there is no particular limitation on the combination of the fibers constituting the ground yarns and the pile fibers, as long as the above conditions are satisfied. The following describes specific examples of the combination.

[0029] When the fibers constituting the ground yarns are fibers of, e.g., polyethylene terephthalate (PET, softening point: about 258°C), the pile fibers are preferably modacrylic fibers or mixed fibers of modacrylic fibers and acrylic fibers. The following are favorably used as the modacrylic fibers.

(1) Vinyl chloride-aciylonitrile fiber (e.g., trade name " Kanekalon" manufactured by Kaneka Corporation, softening point: 150 to 220°C, literature value)
(2) Vinylidene chloride-acrylonitrile fiber (softening point: 150 to 220°C, literature value)

[0030] When the fibers constituting the ground yarns are fibers of, e.g., cotton (tree cotton, no softening point), the pile fibers are preferably acrylic fibers. An example of the acrylic fibers is "Exlan K691" (trade name) manufactured by Exlan Co., Ltd., (softening point: 190 to 232°C, literature value).

[0031] An organically-modified silicone-based softener that is at least one selected from the group consisting of amino-modified silicone-based softeners, epoxy-modified silicone-based softeners, and carboxyl-modified silicone-based softeners, is adhered to at least the pile fibers located on the back surface side of the pile fabric. The organically-modified silicone-based softener such as an amino-modified silicone-based softener may or may not be adhered to the pile fibers on the front surface side of the pile fabric. The adhesion amount of the organically-modified silicone-based softener such as an amino-modified silicone-based softener to the pile fibers located on the back surface side of the pile fabric is preferably larger than the adhesion amount of the organically-modified silicone-based softener such as an amino-modified silicone-based softener to the pile fibers located on the front surface side of the pile fabric, from the viewpoint of preventing the fiber loss while improving the softness of the pile fabric more effectively. Hereinafter, the "organically-modified silicone-based softener" refers to at least one selected from the group consisting of amino-modified silicone-based softeners, epoxy-modified silicone-based softeners, and carboxyl-modified silicone-based softeners unless otherwise specified. There is no particular limitation on the amino-modified silicone-based softeners as long as they are softeners containing as a main component a polysiloxane containing an amino functional group. There is no particular limitation on the epoxy-modified silicone-based softeners as long as they are softeners containing as a main component a polysiloxane containing an epoxy functional group. There is no particular limitation on the carboxyl-modified silicone-based softeners as long as they are softeners containing as a main component a polysiloxane containing an epoxy functional group. Here, the "main component" refers to a component contained in an amount of preferably 40 wt% or more, more preferably 50 wt% or more, further preferably 60 wt% or more, and still further preferably 70 wt% or more, with respect to the total weight of the solid content in the softener. Softeners other than the organically-modified silicone-based softener may be adhered to the pile fibers on the back surface side and/or the front surface side of the pile fabric, as long as the effects of the present invention are not impaired.

[0032] The organically-modified silicone-based softener is preferably an ammo-modified silicone-based softener from the viewpoint of preventing the pile fiber loss while improving the softness of the pile fabric more effectively. The amino-modified silicone-based softener is not particularly limited, and may be a solution in which an amino-modified polysiloxane, which is commonly used as a soft finishing agent for fibers, is dispersed by a method such as emulsification. In the ammo-modified polysiloxane to be used herein, amino functional groups may be attached to one or both terminals of the polysiloxane (main chain), or attached to the side chains, or attached to the terminals and the side chains. Though there is no particular limitation on the structure of the amino functional groups, the examples include a monoamine type, a diamine type, a triamine type, and a polyamine type. Though there is no particular limitation on the amino-modified silicone-based softener, it is possible to use marketed softeners such as "Matsumoto Silicone Softener N-20" manufactured by Matsumoto Yushi-Seiyaku Co., Ltd., "POLON-MF-14" manufactured by Shin-Etsu Chemical Co., Ltd., and "TSF4702" manufactured by Momentive Performance Materials Inc.

[0033] In the pile fabric in which at least parts of the pile fibers located on the back surface side of the pile fabric outside of the ground yarns are fused, generally, the softness of the back surface of the pile fabric is enhanced by adhering a backing resin such as an acrylic ester-based resin used for back coating of pile fabrics, to the back surface of the pile fabric. Meanwhile, in the present invention, the softness of the pile fabric is enhanced by adhering the organically-modified silicone-based softener such as an amino-modified silicone-based softener to the pile fibers located on the back surface side of the pile fabric without adhering a backing resin to the back surface of the pile fabric. Moreover, the touch (softness, low factional properties) of the back surface of the pile fabric improves by adhering the organically-modified silicone-based softener to the pile fibers located on the back surface side of the pile fabric without adhering a backing resin to the back surface of the pile fabric.

[0034] There is no particular limitation on the adhesion amount of the organically-modified silicone-based softener as long as 0.4 parts by weight or more of the organically-modified silicone-based softener is adhered with respect to 100 parts by weight of the pile fibers on the back surface side of the pile fabric. However, the adhesion amount of the organically-modified silicone-based softener is preferably 0.4 to 2.5 parts by weight, more preferably 0.4 to 2.0 parts by weight, and further preferably 0.4 to 1.5 parts by weight, with respect to 100 parts by weight of the pile fibers located on the back surface side of the pile fabric. Within the above range of the adhesion amount of the organically-modified silicone-based softener, it is possible to prevent the pile fiber loss while improving the softness of the pile fabric more effectively. The adhesion amount of the organically-modified silicone-based softener such as an amino-modified silicone-based softener in the pile fibers can be determined by, e.g., X-ray fluorescence analysis. For example, the adhesion amount of the amino-modified silicone-based softener can be determined by quantifying the Si element in accordance with X-ray fluorescence analysis using a wavelength dispersion type X-ray fluorescence analyzer, and creating the calibration curve. Specifically, with use of an X-ray fluorescence spectrometer RIX 3100 (manufactured by Rigaku Corporation), the Si element is analyzed under the following conditions: Rh tube (tube current: 50 mA- tube voltage: 50 kV), measurement diameter: 30 mmϕ, analyzing crystal: pentaerythritol (PET), and 2θ angle: 106 to 112°, and first, a calibration curve is created using a sample whose amino-modified silicone-based softener content is known. Next, the Si element of a measurement sample (thickness: 3 mm, diameter: 30 mm) is analyzed which is obtained by molding fibers to be measured (e.g., fibers on the back surface side of the pile fabric other than the ground yarns (i.e., pile files)) with pressure using a press (tablet molding machine). The adhesion amount of the amino-modified silicone-based softener can be calculated by substituting the obtained Si detection count into a calibration curve equation.

[0035] It is possible to use a backing resin as long as the effects of the present invention are not impaired. Any backing resin that is commonly used for back coating of pile fabrics can be used as the backing resin. Examples of the backing resin include acrylic ester-based resins and polyurethane-based resins. In the case of using the backing resin, it is preferable to impregnate the back surface of the pile fabric with the backing resin prior to a heat sensitive sealing step in the production method of the pile fabric to be described later. The impregnation of the backing resin can be performed using, e.g., latexes, emulsions, and dispersions of acrylic ester-based resins and polyurethane-based resins. The backing resin may be used alone or in a combination of two or more kinds.

[0036] Hereinafter, the pile fabric of the present invention will be described with reference to the drawings. FIG. 1 is a schematic view for explaining a positional relationship between ground yarns and pile fibers tangled with the ground yarns in a high pile fabric in one embodiment of the pile fabric of the present invention. As illustrated in FIG. 1, a high pile fabric 5 includes: ground yarns 1 constituting stockinette loops 6; and pile fibers 2 that are tangled with the loops 6 of the ground yarns 1 and that are opened on a front surface side 7 of a ground structure (high pile fabric 5), thereby forming raised piles 3. Further, at least parts of the pile fibers 2 located on the back surface side 8 of the ground structure (high pile fabric 5) outside of the ground yarns 1 are bonded to the ground yarns 1 by heat sensitive sealing, thereby forming a heat sensitive sealing part 4. An organically-modified silicone-based softener that is adhered to the back surface of the pile fabric is not illustrated. FIG. 1 substantially illustrates a schematic positional relationship in which the pile fibers 2 are placed under the ground yarns 1. The "outside of the ground yarns 1" in this drawing is substantially the portion under the ground yarns 1.

[0037] Hereinafter, a method for producing the pile fabric of the present invention will be described.

[0038] First, pile fibers including at least one selected from the group consisting of acrylic fibers and modacrylic fibers and ground yarns having a higher softening point than the pile fibers are used to produce, in an ordinary method, a pile fabric that includes: a ground structure; and pile fibers that are tangled with ground yarns constituting the ground structure and that stand on a front surface side of the ground structure. The pile fibers are preferably composed of acrylic fibers and/or modacrylic fibers. In this step, if pile fibers to which an organically-modified silicone-based softener is adhered are used as the pile fibers, it is possible to omit a step of adhering the organically-modified silicone-based softener such as an amino-modified silicone-based softener to the back surface of the pile fabric (described later), or it is possible to further apply an organically-modified silicone-based softener. A method for adhering the organically-modified silicone-based softener such as an amino-modified silicone-based softener to the pile fibers is not particularly limited, and any known method can be adopted appropriately. For example, the pile fibers may be impregnated with or sprayed with the organically-modified silicone-based softener. For simplifying the step, the adhesion of the organically-modified silicone-based softener to the pile fibers can be performed simultaneously with dyeing. Of course, the adhesion can be performed as a separate step from dyeing. In this case, it is preferable to perform the dyeing step first and then adhere the organically-modified silicone-based softener to the pile fibers, from the viewpoint of improving the softness of the pile fabric. The organically-modified silicone-based softener may be used alone or in a combination of two or more kinds. As a material of the pile fabric, marketed fibers to which an organically-modified silicone-based softener (e.g., amino-modified silicone-based softener) is adhered may be used. In the case of using such marketed fibers to which an organically-modified silicone-based softener is adhered as the pile fibers, an organically-modified silicone-based softener may be adhered further to the fibers before production of the pile fabric.

[0039] Next, the above organically-modified silicone-based softener such as an amino-modified silicone-based softener is adhered to the back surface of the pile fabric. Thereby, the organically-modified silicone-based softener is adhered to the pile fibers on the back surface side of the pile fabric. A method for adhering the organically-modified silicone-based softener such as an amino-modified silicone-based softener to the back surface of the pile fabric is not particularly limited, and any known method can be adopted appropriately. For example, the back surface of the pile fabric may be impregnated with or sprayed with the organically-modified silicone-based softener. The organically-modified silicone-based softener may be used alone or in a combination of two or more kinds.

[0040] Softeners generally impart softness and smoothness to fiber surfaces. In the present application, surprisingly, in the pile fabric that include as pile fibers at least one selected from the group consisting of acrylic fibers and modacrylic fibers, wherein at least parts of the pile fibers among the pile fibers located on the back surface side of the pile fabric outside of the ground yarns are fused, it is possible to improve the softness of the pile fabric while preventing the pile fiber loss by adhering 0.4 parts by weight or more of the above organically-modified silicone-based softener with respect to 100 parts by weight of the pile fibers on the back surface side of the pile fabric. The reason for this is uncertain, but the following are considered. By adhering the organically-modified silicone-based softener to the pile fibers on the back surface side of the pile fabric and subjecting the back surface side of the pile fabric to heat sensitive sealing at a temperature equal to or higher than the softening point of the pile fibers and lower than the softening point of the fibers constituting the ground structure (described later), functional groups such as terminal amino groups in the organically-modified silicone-based softener, which is adhered to the pile fibers on the back surface side of the pile fabric, are cross-linked. After production of the pile fabric using pile fibers to which an organically-modified silicone-based softener is not adhered or pile fibers to which an organically-modified silicone-based softener is adhered, preferably an organically-modified silicone-based softener is adhered to the back surface side of the pile fabric from the viewpoint of preventing the pile fiber loss while improving the softness of the pile fabric more effectively.

[0041] Next, the back surface side of the pile fabric is subjected to heat sensitive sealing at a temperature equal to or higher than the softening point of the pile fibers and lower than the softening point of the fibers constituting the ground structure. Thereby, the pile fibers standing on the front surface side of the ground structure are not fused, whereas part or all of the pile fibers located on the back surface side of the ground structure outside of the ground yarns constituting the ground structure are fused. The heat sensitive sealing can be performed, e.g., by arranging the back surface side of the pile fabric so as to come into contact with a heating roller or hot plate and applying pressure by a rubber roller. By using the heating roller or hot plate, the heat sensitive sealing can be performed in a short time, and at least parts of the pile fibers located on the back surface side of the ground structure outside of the ground yarns can be bonded by heat sensitive sealing. Further, since the pile fabric is not heated to the extent that the pile fibers on the front surface side of the pile fabric melt, the pile fibers standing on the front surface side of the ground structure do not melt.

[0042] During and/or after heat sensitive sealing from the back surface side of the pile fabric, preferably, a side of the pile fabric on which the pile fibers stand is cooled. Moreover, after heat sensitive sealing from the back surface side of the pile fabric, preferably, the back surface side of the pile fabric is cooled. As the cooling means, preferably, the front surface and/or the back surface of the pile fabric are cooled with a cooling roller in which water of 50°C or lower flows.

The temperature of the water flowing inside the cooling roller is preferably 10 to 40°C, more preferably 10 to 35°C, and further preferably 15 to 30°C, from the viewpoint of the cooling efficiency and productivity. Such cooling can maintain the dimensional stability of the pile fabric and reduce heat damage to the pile fibers.

[0043] The heat sensitive sealing in one example of the production method of the pile fabric of the present invention will be described more specifically with reference to the drawing.

[0044] FIG. 2 illustrates a production process schematically showing a heat sensitive sealing step of a pile fabric performed at a predetermined temperature from the back surface side of the pile fabric. The heat sensitive sealing, specifically, a processing device 10 to be used in the heat sensitive sealing, includes a heating roller 11 that is coated with a fluorocarbon resin such as polytetrafluoroethylene, a cooling rubber roller 12 in which cooling water of 30°C flows and that applies pressure to the heating roller 11, a metal cooling roller 13 in which cooling water of 30°C flows and that applies pressure to the cooling rubber roller 12, a metal cooling roller 14 in which cooling water of 30°C flows, and a guide roller 15. A raw pile fabric (a high pile fabric to which an organically-modified silicone-based softener is adhered) 18 is led out from a container 16 and supplied so that a back surface 18b of the fabric 18 comes into contact with the heating roller 11 and a front surface (piloerection side) 18a thereof comes into contact with the cooling rubber roller 12. After the heat sensitive sealing, the back surface 18b is cooled with the metal cooling roller 14. A pile fabric 19 after this processing is contained in a container 17. Note that the device for the heat sensitive sealing is not limited to the processing device shown in FIG. 2, and may be a device partially modified from the processing device shown in FIG. 2, a hot plate, or other devices. For example, a rubber roller not for cooling may be used instead of the cooling rubber roller 12. The metal cooling roller 13 may be omitted. In the heat sensitive sealing, the heating temperature is not particularly limited as long as it is equal to or higher than the softening point of the pile fibers and lower than the softening point of the fibers constituting the ground yarns. It is preferred that the pressure force is 0.01 to 100 Kgf/cm^2 (0.98 kPa to 9.8 MPa) in linear pressure, the supply rate of the raw pile fabric is 0.1 to 20 m/minute, and the contact time with heater (e.g., heating roller) is 1 to 60 seconds. It is more preferred that the pressure force is 2.0 to 50 Kgf/cm^2 (0.20 to 4.9 MPa) in linear pressure, and the contact time with the heater is 1 to 10 seconds, from the viewpoint of reducing damages on the front surface of the pile fabric.

[0045] In the case of the high pile fabric, the high pile fabric shrinks in a wale direction during the heat sensitive sealing. Therefore, the high pile fabric may be drawn in the wale direction after the heat sensitive sealing.

[0046] As the drawing, the high pile fabric is drawn in the wale direction by holding both ends (selvages) of the high pile fabric in the wale direction so that the draw ratio in the wale direction (length) will be preferably about 5 to 20%, more preferably about 7 to 15%, and further preferably about 8 to 12%. The draw ratio in the wale direction (length) is expressed by the formula below.

$$\text{Draw ratio in the wale direction (length) (\%)} = \{(\text{Length in the wale direction after drawing} - \text{Length in the wale direction before drawing}) / \text{Length in the wale direction before drawing}\} \times 100$$

[0047] When heat is applied during the drawing, the temperature of the drawing is preferably 90 to 150°C, more preferably 100 to 130°C, and further preferably 105 to 120°C.

[0048] Such drawing can be performed using known devices such as a tenter. The tenter, generally used for heat setting, heats fabrics at a predetermined temperature while holding both selvages of the fabrics to widen the fabrics to a predetermined width. However, the above heating is not essential in the present invention. Exemplary methods for holding the selvages of fabrics in the tentor include a clip tentor method and a pin tentor method, and both of them can be used. The pin tentor method is preferred from the viewpoint of step stability and/or productivity.

[0049] In the case of performing the drawing while heating the high pile fabric, it is preferable to set a minimum temperature and a minimum volume of air necessary for the drawing to prevent the surfaces of the high pile fabric from being damaged.

[0050] The pile fabric of the present invention can prevent the fiber loss. The average amount of the fiber loss measured in accordance with the method below is preferably 4.0 g/m^2 or less, more preferably 3.0 g/m^2 or less, and further preferably 2.0 g/m^2 or less. The maximum amount of the fiber loss measured in accordance with the method below is preferably 5.0 g/m^2 or less, more preferably 4.0 g/m^2 or less, and further preferably 3.0 g/m^2 or less.

[0051] A distance at 90° of the pile fabric of the present invention measured in accordance with the method below is preferably 50 mm or less, more preferably 45 mm or less, from the viewpoint of excellent softness.

Examples

[0052] Hereinafter, the present invention will be described more specifically by way of examples. Note that the present invention is not limited to the examples below.

<Measurement method>

1. Amount of fiber loss

[0053] As illustrated in FIG. 3, a pile fabric 21 (length: 280 mm, width: 210 mm) was placed on an inclined surface of a metal plate 22 so that the pile direction of the fabric would be oriented toward the upper side of the inclined surface. The metal plate 22 arranged obliquely had an inclination angle a of 30°. An adhesive tape 23 (Scotch No. 850 manufactured by 3M company, width: 25 mm) cut in a length of 100 mm was stuck on the surface of the pile fabric 21, to which a load of 1.5 g/cm^2 was applied for one minute from the top of the adhesive tape 23 (not illustrated). Then, the adhesive tape 23 was continuously peeled off from the pile fabric 21 from an end of the tape 23 located at the upper part of the inclined surface. The weight (g) of the fibers attached to the adhesive tape was measured, and the weight of the fibers per area of the adhesive tape (g/m^2) was calculated to determine the amount of the fiber loss. The amounts of the fiber loss at any of three sections in the pile fabric were measured and calculated as described above to determine the average amount of the fiber loss and the maximum amount of the fiber loss.

2. Evaluation of fiber loss

[0054] The fiber loss of the pile fabric was ranked into the following four grades based on the amount of the fiber loss. The evaluations of S, A, and B mean pass, and the evaluation of C means fail.

S: The average amount of the fiber loss is 2.0 g/m^2 or less, and the maximum amount of the fiber loss is 3.0 g/m^2 or less.
A: The average amount of the fiber loss is more than 2.0 g/m^2 and 3.0 g/m^2 or less, and the maximum amount of the fiber loss is more than 3.0 g/m^2 and 4.0 g/m^2 or less.
B: The average amount of the fiber loss is more than 3.0 g/m^2 and 4.0 g/m^2 or less, and the maximum amount of the fiber loss is more than 4.0 g/m^2 and 5.0 g/m^2 or less.
C: The average amount of the fiber loss is more than 4.0 g/m^2, and the maximum amount of the fiber loss is more than 5.0 g/m^2 (failure level)

(Softness of pile fabric)

[0055]

(1) The pile fabric was cut in the warp direction into a width of 20 mm to obtain a cloth piece having a length of 200 mm and a width of 20 mm.
(2) As illustrate in FIG. 4A, the cloth piece 31 of the pile fabric was arranged on a horizontal board 32 (width: 600 mm, length: 600 mm) made from melamine resin. Next, the cloth piece 31 of the pile fabric was gradually slid out of the horizontal board 32 along the pile direction of the pile fabric.
(3) As illustrated in FIG. 4B, the cloth piece 31 of the pile fabric was slid until a tangent 41 and the horizontal board 32 formed an angle a of 90°. The tangent 41 was drawn to the tip of the cloth piece 31 of the pile fabric extending out of the horizontal board 32.
(4) A distance L (distance at 90°) of the cloth piece 31 of the pile fabric sliding out from the horizontal board 32 was measured to evaluate the softness of the pile fabric in accordance with the following criteria.

A: The distance at 90° is less than 50 mm (the pile fabric is very soft).
B: The distance at 90° is 50 mm or more and 55 mm or less (the pile fabric is soft).
C: The distance at 90° exceeds 55 mm (the pile fabric is hard).

<Fibers>

1. Pile fibers

[0056]

(1) Trade name "Kanekalon (registered trademark) ELP" (manufactured by Kaneka Corporation): modacrylic fiber (vinyl chloride-acrylonitrile fiber), softening point: 180 to 190°C, fineness: 27 dtex, cut length: 102 mm (hereinafter, referred to as ELP simply), with no adhesion of an amino-modified silicone-based softener

(2) Trade name "Kanekalon (registered trademark) AH" (manufactured by Kaneka Corporation): modacrylic fiber (vinyl chloride-acrylonitrile fiber), softening point: 180 to 190°C, fineness: 7.8 dtex, cut length: 76 mm (hereinafter, referred to as AH7.8 simply), with adhesion of 0.3 parts by weight of an amino-modified silicone-based softener to 100 parts by weight of fibers (analysis value calculated from X-ray fluorescence analysis)
(3) Trade name "Kanekalon (registered trademark) AH" (manufactured by Kaneka Corporation): modacrylic fiber (vinyl chloride-acrylonitrile fiber), softening point: 180 to 190°C, fineness: 5.6 dtex, cut length: 51 mm (hereinafter, referred to as AH5.6 simply), with adhesion of 0.3 parts by weight of an amino-modified silicone-based softener to 100 parts by weight of fibers (analysis value calculated from X-ray fluorescence analysis)
(4) Trade name "Kanekalon (registered trademark) MCS" (manufactured by Kaneka Corporation): modacrylic fiber (vinyl chloride-acrylonitrile fiber), softening point: 180 to 190°C, fineness: 4.4 dtex, cut length: 32 mm (hereinafter, referred to as MCS simply), with no adhesion of an amino-modified silicone-based softener

[0057] In the above, the adhesion amount of the amino-modified silicone-based softener in the modacrylic fibers was determined by quantifying the Si element in accordance with X-ray fluorescence analysis using a wavelength dispersion type X-ray fluorescence analyzer, and creating the calibration curve. Specifically, with use of an X-ray fluorescence spectrometer RIX 3100 (manufactured by Rigaku Corporation), the Si element was analyzed under the following conditions: Rh tube (tube current: 50 mA - tube voltage: 50 kV), measurement diameter: 30 mmϕ, analyzing crystal: pentaerythritol (PET), and 2θ angle: 106 to 112°, and first, a calibration curve was created using a sample whose amino-modified silicone-based softener content was known. Next, the Si element of a measurement sample (thickness: 3 mm, diameter: 30 mm) was analyzed which was obtained by molding fibers to be measured with pressure using a press (tablet molding machine). The adhesion amount of the amino-modified silicone-based softener was calculated by substituting the obtained Si detection count into a calibration curve equation.

2. Ground structure constituent fibers (ground yarns)

[0058] A multifilament with a total fineness of 334 dtex (a fiber yarn composed of two filaments, each filament having a fineness of 167 dtex and composed of 50 polyester single fibers) was used. The softening point was 258°C.
[0059] The softening point of the fibers is a temperature determined in the following manner. 1g of fibers is opened, placed on a hot plate heated to a predetermined temperature, and pressurized with a pressure roller at 0.07 Kgf/cm^2 (nip pressure) for 3 seconds. The temperature at which the surfaces of single fibers in contact with the hot plate are soften and bonded to each other into a plate shape is defined as the softening point of the fibers.

(Example 1)

[0060] With use of a sliver knitting machine (circular knitting machine) for production of fake furs and the above polyester fiber yarns as the ground yarns, a high pile fabric of Example 1 was knitted by supplying a pile fiber sliver (10 to 14 g) composed of ELP, AH7.8 andAH5.6 mixed uniformly in a ratio of ELP/AH7.8/AH5.6 = 15/35/50 (wt%). The number of loops in the wale of the ground structure was 16 to 17/inch, and the number of loops in the course of the ground structure was 22 to 33/inch. Next, the pile fibers on the piloerection surface side of the high pile fabric were aligned by polishing and shearing. Specifically, first, the pile fibers were polished twice at 120°C, and then sheared twice.
[0061] An aqueous solution of an amino-modified silicone-based softener (trade name "Matsumoto Silicone Softener N-20" manufactured by Matsumoto Yushi-Seiyaku Co., Ltd., solid content: 20 wt%) was sprayed on the back surface of the obtained high pile fabric so that 0.2 parts by weight of the amino-modified silicone-based softener (solid content) would be adhered to 100 parts by weight of the pile fibers on the back surface side. Thereafter, the high pile fabric was dried for 3 minutes using a pin tentor drier at an inner drier temperature of 125°C while drawing the width to 160 cm, followed by cooling to 80°C or lower with the width being held at 160 cm.
[0062] The heat sensitive sealing was performed with respect to the back surface of the high pile fabric (width: 160 cm) with a heat sensitive sealing device shown in FIG. 2 under the following conditions: the temperature of the heating roller: 215°C, the contact time between the heating roller and the high pile fabric: 3 seconds, the nip pressure of the heating roller and the cooling rubber roller: 50 Kgf/cm^2 (4.9 MPa). At this time, the width of the high pile fabric shrank to 135 cm. Thereafter, the high pile fabric was dried for 3 minutes using a pin tentor drier at an inner drier temperature of 125°C while drawing the width to 160 cm, followed by cooling to 80°C or lower with the width being held at 160 cm.
[0063] In the high pile fabric obtained, the pile fibers on the front surface side of the pile fabric were aligned by polishing, brushing, and shearing. Specifically, first, the pile fibers were brushed twice, polished once at each of 155°C, 150°C, 145°C, 130°C and 120°C, then sheared twice, and lastly polished twice at 100°C. Consequently, a high pile fabric with a weight per unit area of 700 g/m^2 and a pile fiber length at piloerection portion of 20 mm was obtained.

(Example 2)

[0064] A high pile fabric of Example 2 was produced in the same manner as in Example 1 except that the aqueous solution of the ammo-modified silicone-based softener was sprayed on the back surface of the high pile fabric so that 1 part by weight of the amino-modified silicone-based softener (solid content) would be adhered to 100 parts by weight of the pile fibers on the back surface side of the pile fabric.

(Comparative Example 1)

[0065] A high pile fabric of Comparative Example 1 was produced in the same manner as in Example 1 except that an unmodified silicone-based softener (trade name "Dimethyl Silicone K" manufactured by Matsumoto Yushi-Seiyaku Co., Ltd., the solid content: 20 wt%) was used in place of the amino-modified silicone-based softener.

(Comparative Example 2)

[0066] A high pile fabric of Comparative Example 2 was produced in the same manner as in Example 2 except that an unmodified silicone-based softener (trade name "Dimethyl Silicone K" manufactured by Matsumoto Yushi-Seiyaku Co., Ltd., the solid content: 20 wt%) was used in place of the amino-modified silicone-based softener.

(Comparative Example 3)

[0067] A high pile fabric of Comparative Example 3 was produced in the same manner as in Example 1 except that a fatty acid-based softener ("PK-608" manufactured by Yancheng Jiaye Textile Materials Co., Ltd., the solid content: 20 wt%) was used in place of the amino-modified silicone-based softener.

(Comparative Example 4)

[0068] A high pile fabric of Comparative Example 4 was produced in the same manner as in Example 2 except that a fatty acid-based softener ("PK-608" manufactured by Yancheng Jiaye Textile Materials Co., Ltd., the solid content: 20 wt%) was used in place of the ammo-modified silicone-based softener.

(Comparative Example 5)

[0069] A high pile fabric of Comparative Example 5 was produced in the same manner as in Example 1 except that the heat sensitive sealing was performed without adhering a softener to the pile fibers on the back surface side of the pile fabric.

(Comparative Example 6)

[0070] A high pile fabric of Comparative Example 6 was produced in the same manner as in Example 1 except that a sliver (10 to 14 g) composed of 100 wt% ofAH7.8 was used as the pile fiber sliver.

(Comparative Example 7)

[0071] A high pile fabric of Comparative Example 7 was produced in the same manner as in Example 1 except that a sliver (10 to 14 g) composed of ELP and MCS mixed uniformly in a ratio of ELP/MCS = 20/80 (wt%) was used as the pile fiber sliver.

[0072] The fiber loss and the softness of the high pile fabrics obtained in Examples 1 to 2 and Comparative Examples 1 to 7 were measured and evaluated by the methods described above. Table 1 below shows the results. In Table 1, Adhesion amount of softener is a weight ratio of the softener with respect to 100 parts by weight of the pile fibers on the back surface side of the pile fabric. Specifically, in Example 1, the adhesion amount of the softener is the sum of the amount of the softener adhered to the fibers used as the material of the pile fibers and the amount of the softener of the same kind additionally adhered to the pile fibers on the back surface side of the pile fabric in the production step of the pile fabric, and calculated in the following manner. In Example 2 and Comparative Examples 1 to 7, the adhesion amounts of the respective softeners were calculated in the same manner as in Example 1. Example 1: The amount of the amino-modified silicone-based softener adhered with respect to 100 parts by weight of the fibers used as the material of the pile fibers = AH7.8 and AH5.6 derivatives = 3 (parts by weight) $\times$ 85 (wt%) = 0.255 parts by weight The amount of the amino-modified silicone-based softener additionally adhered with respect to 100 parts by weight of the pile fibers on the back surface side of the pile fabric in the production step of the pile fabric = 0.2 parts by weight The adhesion amount of the amino-modified silicone-based softener to 100 parts by weight of the pile fibers on the back surface side of the pile fabric = 0.255 + 0.2 (parts by weight) = 0.455 parts by weight

[Table 1]

	Adhesion amount of softener (parts by weight)			Fiber loss			Softness	
	Amino-modified silicone-based softener	Unmodified silicone-based softener	Fatty acid-based softener	Amount of fiber loss		Evaluation	Distance at 90° (mm)	Evaluation
				Average (g/m^2)	Maximum (g/m^2)			
Ex. 1	0.455	/	/	1.49	1.81	S	44	A
Ex. 2	1.255	/	/	2.28	2.92	A	40	A
Comp. Ex. 1	0.255	0.2	/	4.24	5.74	C	39	A
Comp. Ex. 2	0.255	1	/	4.72	5.36	C	37	A
Comp. Ex. 3	0.255	/	0.2	4.33	5.55	C	41	A
Comp. Ex. 4	0.255	/	1	4.85	5.61	C	41	A
Comp. Ex. 5	0.255	/	/	2.29	2.55	A	56	C
Comp. Ex. 6	0.3	/	/	3.12	3.35	B	63	C
Comp. Ex. 7	/	/	/	2.37	2.89	A	61	C
*Example: Ex. Comparative Example: Comp. Ex.								

[0073] As can be seen from the results of Table 1 above, the pile fabrics of Examples 1 and 2, in which 0.4 parts by weight or more of the amino-modified silicone-based softener was adhered with respect to 100 parts by weight of the pile fibers on the back surface side of the pile fabric, resulted in high softness and reduced pile fiber loss.

[0074] Meanwhile, the pile fabrics of Comparative Examples 1 and 2, in which the total adhesion amount of the amino-modified silicone-based softener and the unmodified silicone-based softener to the pile fibers on the back surface side of the pile fabrics was 0.4 parts by weight or more with respect to 100 parts by weight of the pile fibers on the back surface side but the adhesion amount of the amino-modified silicone-based softener with respect to 100 parts by weight of the pile fibers on the back surface side was less than 0.4 parts by weight, resulted in favorable softness but a large amount of pile fiber loss. Moreover, the pile fabrics of Comparative Examples 3 and 4, in which the total adhesion amount of the amino-modified silicone-based softener and the fatty acid-based softener to the pile fibers on the back surface side of the pile fabrics was 0.4 parts by weight or more with respect to 100 parts by weight of the pile fibers on the back surface side but the adhesion amount of the amino-modified silicone-based softener with respect to 100 parts by weight of the pile fibers on the back surface side was less than 0.4 parts by weight, resulted in favorable softness but a large amount of pile fiber loss. Moreover, the pile fabrics of Comparative Examples 5 and 6, in which the adhesion amount of the amino-modified silicone-based softener to the pile fibers on the back surface side of the pile fabrics was less than 0.4 parts by weight with respect to 100 parts by weight of the pile fibers on the back surface side, and the pile fabric of Comparative Example 7, in which the amino-modified silicone-based softener was not adhered to the pile fibers on the back surface side of the pile fabric, resulted in reduced pile fiber loss but hard texture.

Description of Reference Numerals

[0075]

1 ground yarn
2 pile fiber
3 raised pile
4 heat sensitive sealing part
5 high pile fabric
6 loop
7 front surface side
8 back surface side
10 processing device
11 heating roller
12 cooling rubber roller
13,14 metal cooling roller
15 guide roller
16,17 container
18 raw pile fabric
18a front surface side of raw pile fabric
18b back surface side of raw pile fabric
19, 21 pile fabric
22 metal plate
23 adhesive tape
31 cloth piece of pile fabric
32 horizontal board
41 tangent drawn to the tip of the cloth piece of pile fabric

Claims

1. A pile fabric, comprising:

   a ground structure; and
   pile fibers that are tangled with ground yarns constituting the ground structure and that stand on a front surface side of the ground structure, the pile fibers comprising at least one selected from the group consisting of acrylic fibers and modacrylic fibers and having a lower softening point than fibers constituting the ground structure,
   wherein among the pile fibers tangled with the ground yarns constituting the ground structure, the pile fibers standing on the front surface side of the ground structure are not fused, whereas at least parts of the pile fibers located on a back surface side of the ground structure outside of the ground yarns constituting the ground structure are fused, and
   wherein 0.4 parts by weight or more of an organically-modified silicone-based softener is adhered with respect to 100 parts by weight of the pile fibers located on a back surface side of the pile fabric, the organically-modified silicone-based softener being at least one selected from the group consisting of amino-modified silicone-based softeners, epoxy-modified silicone-based softeners, and carboxyl-modified silicone-based softeners.

2. The pile fabric according to claim 1, wherein the organically-modified silicone-based softener is an amino-modified silicone-based softener.

3. The pile fabric according to claim 1 or 2, wherein the pile fibers are modacrylic fibers.

4. The pile fabric according to any one of claims 1 to 3, wherein the ground yams are polyester fiber yarns.

5. The pile fabric according to any one of claims 1 to 4, wherein 0.4 to 2.5 parts by weight of the organically-modified silicone-based softener is adhered with respect to 100 parts by weight of the pile fibers located on the back surface side of the pile fabric.

6. A method for producing the pile fabric according to any one of claims 1 to 5, the pile fabric, comprising:

   a ground structure; and
   pile fibers that are tangled with ground yarns constituting the ground structure and that stand on a front surface side of the ground structure, the pile fibers comprising at least one selected from the group consisting of acrylic

fibers and modacrylic fibers and having a lower softening point than fibers constituting the ground structure, wherein 0.4 parts by weight or more of an organically-modified silicone-based softener is adhered with respect to 100 parts by weight of the pile fibers located on a back surface side of the pile fabric, the organically-modified silicone-based softener being at least one selected from the group consisting of amino-modified silicone-based softeners, epoxy-modified silicone-based softeners, and carboxyl-modified silicone-based softeners, and wherein the back surface side of the pile fabric is subjected to heat sensitive sealing at a temperature equal to or higher than the softening point of the pile fibers and lower than the softening point of the fibers constituting the ground structure, so that among the pile fibers tangled with the ground yarns constituting the ground structure, the pile fibers standing on the front surface side of the ground structure are not fused, whereas at least parts of the pile fibers located on a back surface side of the ground structure outside of the ground yarns constituting the ground structure are fused.

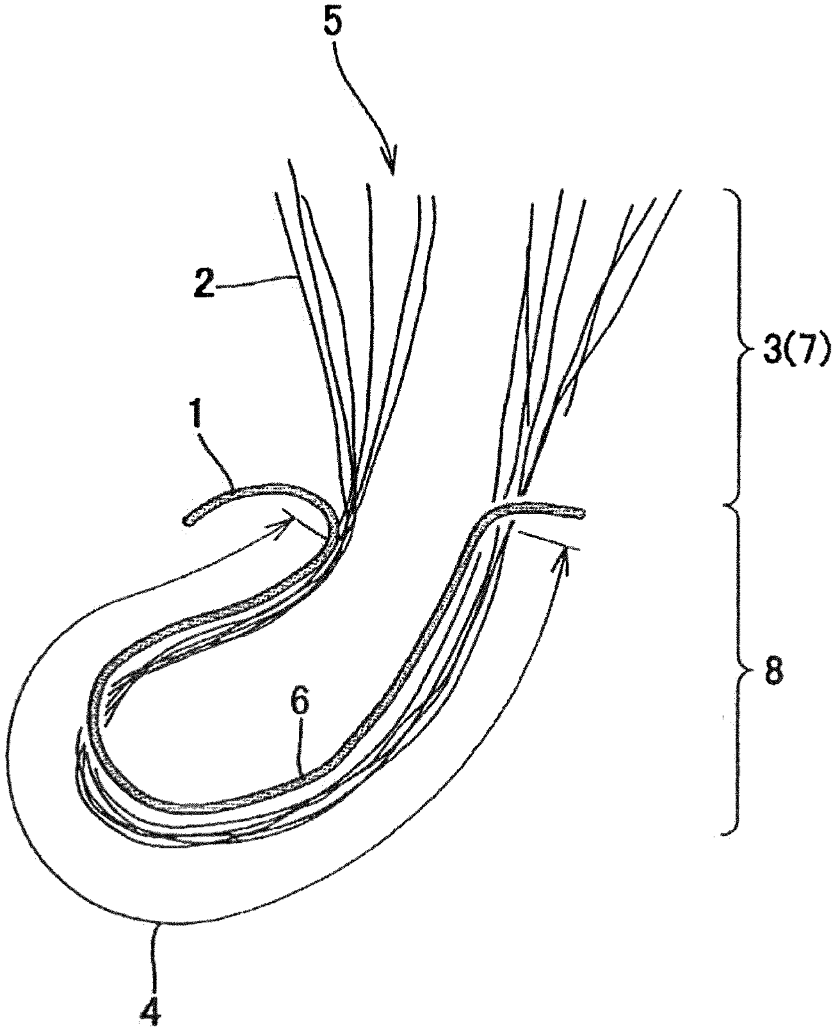

FIG. 1

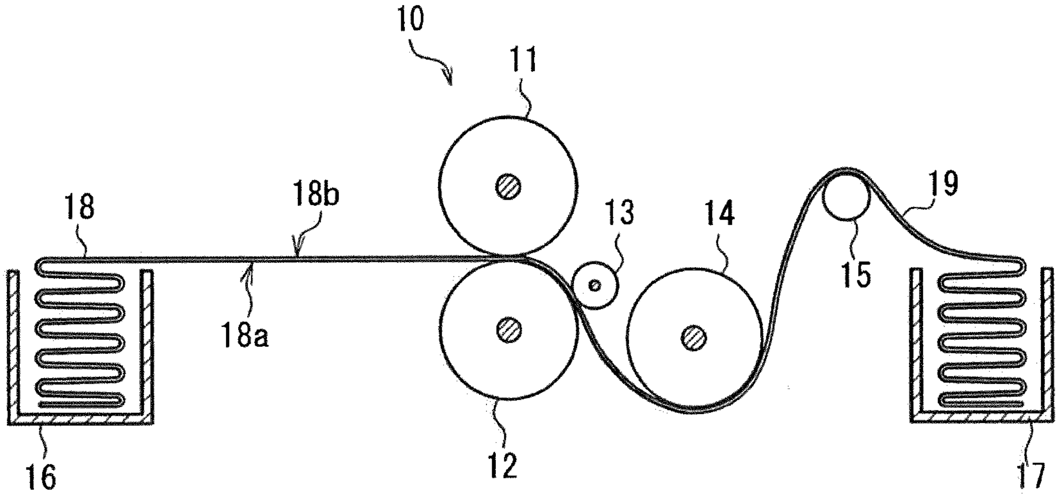

FIG. 2

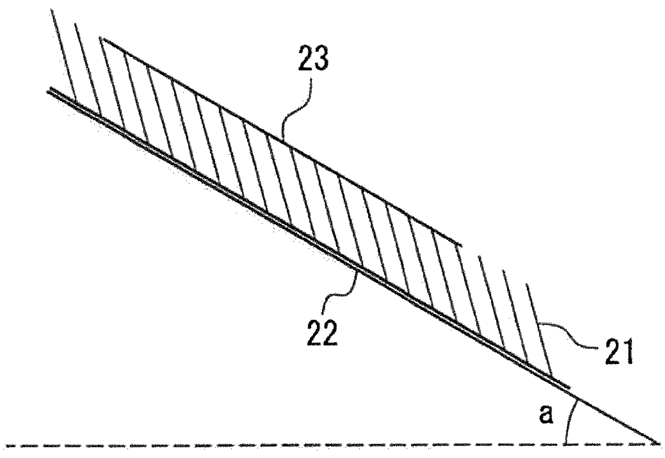

FIG. 3

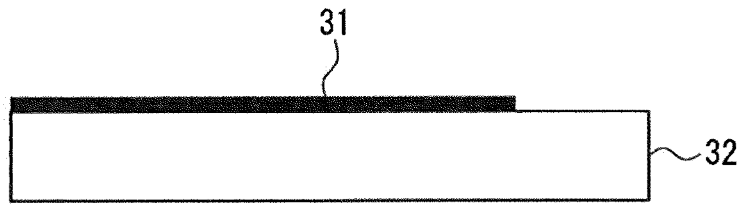

FIG. 4A

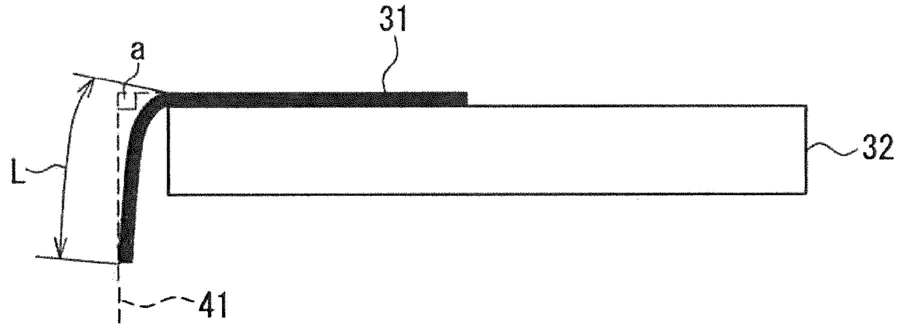

FIG. 4B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/072178

A. CLASSIFICATION OF SUBJECT MATTER
D06M15/643(2006.01)i, *D04B1/16*(2006.01)i, *D06M101/28*(2006.01)n

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)
D06M13/00-15/715, D04B1/00-1/28, 21/00-21/20

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

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Japio-GPG/FX, JSTPlus/JST7580/JSTChina(JDreamIII)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2014/054543 A1 (Kaneka Corp.), 10 April 2014 (10.04.2014), & JP 2015-232184 A	1-6
A	WO 2006/008933 A1 (Kaneka Corp.), 26 January 2006 (26.01.2006), & EP 1775363 A1 & CN 1985041 A & KR 10-2007-0051853 A	1-6
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Date of the actual completion of the international search	Date of mailing of the international search report
17 October 2016 (17.10.16)	25 October 2016 (25.10.16)

Name and mailing address of the ISA/	Authorized officer
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	JP 63-282379 A (Kanebo, Ltd.), 18 November 1988 (18.11.1988), (Family: none)	1-6

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REFERENCES CITED IN THE DESCRIPTION

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