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(54) **FABRIC COMPRISING FILAMENT-STAPLE FIBER COMPOSITE YARN WITH EXCELLENT EVENNESS**

(57) The present disclosure relates to a fabric comprising a filament-staple fiber composite yarn. The filament-staple fiber composite yarn comprises filaments and staple fibers, wherein the staple fibers are inserted

into the filaments, so that the filament-staple fiber composite yarn exhibits excellent evenness and a fabric manufactured therefrom has excellent processability and appearance.

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Description**Field**

5 **[0001]** The present disclosure relates to a fabric including a filament-staple fiber composite yarn, in which the filament-staple fiber composite yarn includes staple fibers and filaments and is configured such that the staple fibers are inserted into the filaments, so that evenness of the filament-staple fiber composite yarn is excellent, and a fabric manufactured using the same has excellent processability and appearance.

Background

10 **[0002]** Filament-staple fiber composite yarns are a category of composite yarns that incorporate both continuous filaments composed of long fibers and staple fibers made from shorter fibers. The development of these composite yarns has been propelled by technological advancements and the increasing diversity of industrial applications for fibers. As markets evolve and consumer preferences shift, the functionality of fibers has expanded significantly, leading to innovative solutions that cater to a wide array of demands and tastes.

15 **[0003]** Filament-staple fiber composite yarns offer advantages by leveraging the unique benefits of both filaments and staple fibers, thus enabling the creation of diverse structures, shapes, and manufacturing methods tailored to meet various applications. Ongoing research is focused on improving the design and production techniques for these composite yarns. Among the established methods for manufacturing filament-staple fiber composite yarns are the Sirospun and sirofil techniques. The Sirospun method is employed due to its capability to accommodate a wide range of fiber mixtures, allowing for the production of composite yarns with varied properties. However, this method has the drawback of lower fiber efficiency, as it can result in the physical clumping of fibers or inconsistencies in the manufacturing process. The sirofil method is also limited in its application to different fiber mixtures, which restricts its potential for producing a broader array of filament-staple fiber composite yarns.

20 **[0004]** The conventional techniques described above face several significant challenges related to the formability of composite yarns, often resulting in limitations regarding the types of fibers that can be utilized. These constraints are frequently dictated by several factors, including the specific shape of the composite yarns or the chosen manufacturing method. Notably, one important issue arises from the potential loss of staple fibers within filament-staple fiber composite yarns, which can adversely affect the overall performance and integrity of the resulting products. This loss not only diminishes the mechanical properties of the yarn but also impacts its functionality and usability in various applications.

25 **[0005]** Furthermore, in response to the growing demands of the eco-friendly recycling market, the utilization of fibers produced from recycled waste fabrics presents significant challenges. These recycled fibers tend to be shorter in length, which complicates the application of traditional ring spinning techniques for manufacturing composite yarns. The limitations imposed by the short length of recycled fibers hinder the effectiveness of existing production methods, rendering them less desirable for creating high-quality composite yarns.

30 **[0006]** Accordingly, there is a need to develop a filament-staple fiber composite yarn that are not hindered by the limitations of existing production methods.

Summary

35 **[0007]** The present disclosure has been made keeping in mind the problems encountered in the related art, and various aspects are to provide a fabric including a filament-staple fiber composite yarn and an article including the fabric.

40 **[0008]** The present disclosure solves the problems described above, and demonstrates the development of a filament-staple fiber composite yarn having a novel binding form, and comprises staple fibers that are firmly bound inside filaments and no loss thereof occurs, and a fabric manufactured using the same has excellent processability and appearance, thus culminating in the present disclosure.

45 **[0009]** Various aspects provide: a fabric including a filament-staple fiber composite yarn, in which the filament-staple fiber composite yarn includes a staple fiber portion including a plurality of staple fibers adjacent to each other and a filament portion including a plurality of filaments twisted on an outer surface of the staple fiber portion.

50 **[0010]** In embodiments, the staple fibers include one or more of vegetable fiber, animal fiber, mineral fiber, recycled fiber of vegetable fiber, recycled fiber of animal fiber or recycled fiber of mineral fiber.

55 **[0011]** In embodiments, the vegetable fiber include one or more of cotton fiber, cellulose fiber, hemp fiber, pineapple fiber, coffee bean fiber, banana fiber, ramie fiber, corn silk fiber or bamboo fiber, the animal fiber includes one or more of leather fiber, wool fiber, cashmere, camel hair fiber, mohair fiber, alpaca fiber or silk fiber, and the mineral fiber may include mica fiber or glass fiber.

[0012] In embodiments, the filaments include one or more of polyester-based fiber, polyamide-based fiber, polyurethane-based fiber, polyurea-based fiber, polyacryl-based fiber, polyvinyl alcohol-based fiber, polyvinyl chloride-based

fiber, polyvinylidene chloride-based fiber, polypropylene-based fiber, polyethylene-based fiber, polystyrene-based fiber, polyfluoroethylene-based fiber or biodegradable fiber.

[0013] In embodiments, the content of the staple fibers are 20 parts by weight to 50 parts by weight based on 100 parts by weight of the filament-staple fiber composite yarn.

[0014] In embodiments, the filament-staple fiber composite yarn has evenness U% of less than 2.

[0015] Various aspects provide: an article including the fabric described above.

[0016] In embodiments, the article includes automobile interiors, shoes, furniture, decorations, bags, clothing, mobile phone covers, electronic product covers, or car seats.

[0017] In embodiments, disclosed herein is a filament-staple fiber composite yarn that is utilized as a composite yarn because, despite containing staple fibers, the staple fibers are firmly bound inside filaments.

[0018] In embodiments, the composite yarn is configured such that staple fibers are inserted into the filaments, preventing loss of the staple fibers and exhibiting excellent evenness.

[0019] In embodiments, the composite yarn includes various types of staple fibers, making it possible to manufacture composite yarns having various feels and effects.

[0020] In embodiments, the composite yarn can has excellent tensile strength and elongation despite containing staple fibers, exhibiting excellent processability and appearance when applied to a fabric, and is widely used as a raw material for automobile interiors, shoe parts, or fabrics processed by lamination, such as the back of coated fabrics, nonwoven intermediates, etc.

Description of Drawings

[0021]

FIG. 1 shows a conceptual view showing a filament-staple fiber composite yarn according to an embodiment of the present disclosure;

FIG. 2 shows a weaving design table of a fabric according to an embodiment of the present disclosure;

FIG. 3 shows a photograph of woven fabric manufactured according to Example 1.

FIG. 4 shows a photograph of woven fabric manufactured according to Example 2.

FIG. 5 shows a photograph of woven fabric manufactured according to Example 3.

FIG. 6 shows a photograph of woven fabric manufactured according to Example 4.

FIG. 7 shows a photograph of woven fabric manufactured according to Example 5.

FIG. 8 shows a photograph of woven fabric manufactured according to Comparative Example 1.

FIG. 9 shows a photograph of woven fabric manufactured according to Comparative Example 2.

FIG. 10 shows a photograph of a knitted fabric manufactured according to Example 6.

[0022] Hereinafter, various aspects will be described in detail so that various aspects may be easily implemented by those skilled in the art. However, the present disclosure may be embodied in many different forms and is not limited to the embodiments described herein.

Detailed Description

Example 1. Manufacture of woven fabric using filament-staple fiber composite yarn

1. Manufacture of filament-staple fiber composite yarn

(1) Manufacture of weft

[0023] In order to manufacture a filament-staple fiber composite yarn for weft, recycled polyethylene terephthalate (PET) having fineness of 240 denier (D) was used as filaments and leather fibers having an average length of 1 mm were used as staple fibers.

[0024] The leather fibers were sprayed onto the filaments and bound to each other. The leather fibers were sprayed using a staple fiber spray device and the leather fibers were quantitatively supplied at a supply rate of 0.1 g/min/spindle to a cylinder at 1,000 rpm using a gear pump at 30 rpm. As such, by supplying air to the surface of the cylinder using a first air knife, the clumped leather fibers attached to the cylinder wire were removed, and the leather fibers were uniformly distributed on the filaments. The air pressure of the first air knife was 1.5 kgf/cm².

[0025] By passing the filaments on which the leather fibers were distributed through a second air knife, clumped leather fibers among leather fibers attached to the surface of the filaments were removed and uniform binding was achieved. The second air knife was designed to be located both above and below the filaments to which the leather fibers were bound, and

the air pressure was 1.5 kgf/cm².

[0026] The fibers were passed through a winder to twist the filament-staple fiber composite yarn followed by winding, yielding a filament-staple fiber composite yarn. The winding speed was 15 m/min, TPM (twist per meter) was 600, and the weight proportion of leather fibers contained in the filament-staple fiber composite yarn was 20 wt%.

(2) Manufacture of warp

[0027] In order to manufacture a filament-staple fiber composite yarn for warp, a filament-staple fiber composite yarn for warp was manufactured in the same manner as in (1) above, with the exception that recycled polyethylene terephthalate (PET) having fineness of 420 denier (D) was used as filaments and the weight proportion of leather fibers contained in the filament-staple fiber composite yarn was changed to 30 wt%.

[0028] The fineness of the manufactured filament-staple fiber composite yarn for warp was 600 denier (D), and the number of warp yarns was 8,200.

2. Manufacture of woven fabric

[0029] A woven fabric was manufactured with an Oxford weave as shown in FIG. 2 using the weft and warp yarns manufactured in (1) and (2) above, respectively. The fabric width was 70 inches.

Example 2. Manufacture of woven fabric using filament-staple fiber composite yarn

[0030] A woven fabric was manufactured in the same manner as in Example 1, with the exception that, in (1) of Example 1, recycled polyethylene terephthalate (PET) having fineness of 210 denier (D) was used as filaments, leather fibers were supplied at a supply rate of 0.15 g/min/spindle using a gear pump at 45 rpm, and the weight proportion of leather fibers contained in the filament-staple fiber composite yarn was changed to 30 wt%.

Example 3. Manufacture of woven fabric using filament-staple fiber composite yarn

[0031] A woven fabric was manufactured in the same manner as in Example 1, with the exception that, in (1) of Example 1, recycled polyethylene terephthalate (PET) having fineness of 420 denier (D) was used as filaments, leather fibers were quantitatively supplied at a supply rate of 0.3 g/min/spindle to a cylinder at 2,000 rpm using a gear pump at 90 rpm, and the weight proportion of leather fibers contained in the filament-staple fiber composite yarn was changed to 30 wt%.

Example 4. Manufacture of woven fabric using filament-staple fiber composite yarn

[0032] A woven fabric was manufactured in the same manner as in Example 1, with the exception that, in (1) of Example 1, recycled polyethylene terephthalate (PET) having fineness of 500 denier (D) was used as filaments, leather fibers were quantitatively supplied at a supply rate of 0.83 g/min/spindle to a cylinder at 2,500 rpm using a gear pump at 250 rpm, TPM (twist per meter) was set to 500, and the weight proportion of leather fibers contained in the filament-staple fiber composite yarn was changed to 50 wt%.

Example 5. Manufacture of woven fabric using filament-staple fiber composite yarn

[0033] A woven fabric was manufactured in the same manner as in Example 1, with the exception that, in (1) of Example 1, recycled polyethylene terephthalate (PET) having fineness of 750 denier (D) was used as filaments, leather fibers were quantitatively supplied at a supply rate of 2.5 g/min/spindle to a cylinder at 2,500 rpm using a gear pump at 375 rpm, TPM (twist per meter) was set to 400, and the weight proportion of leather fibers contained in the filament-staple fiber composite yarn was changed to 50 wt%.

Example 6. Manufacture of knitted fabric using filament-staple fiber composite yarn

[0034] A knitted fabric was manufactured using the filament-staple fiber composite yarn manufactured in (1) of Example 1. More specifically, 96 filament-staple fiber composite yarns were used, and a knitted fabric was manufactured through circular knitting using a Jacquard knitting machine under conditions of a width of 30 inches, a gauge of 16, and a feed rate of 48 m/min.

[0035] Table 1 below shows the conditions for manufacturing the filament-staple fiber composite yarns for weft according to Examples 1 to 5 and the filament-staple fiber composite yarn according to Example 6 and the processability for fabric weaving and circular knitting.

[Table 1]

		Example 1	Example 2	Example 3	Example 4	Example 5	Example 6
Filament	Type	Recycled PET					
	Fineness (D)	240	210	420	500	750	240
Staple fiber	Gear pump rotation rpm	30	45	90	250	375	30
	Cylinder rotation rpm	1,000	1,000	2,000	2,500	2,500	1,000
	Average length (mm)	1	1	1	1	1	1
	Supply rate (g/min/-spindle)*	0.1	0.15	0.3	0.83	2.5	0.1
Air knife	Air pressure (kgf/cm ²)	1.5	1.5	1.5	1.5	1.5	1.5
Winding	Winding speed (m/min)	15	15	15	15	15	15
	Twist per number (TPM)	600	600	600	500	400	600
Composite yarn	Fineness (D)	300	300	600	1,000	1,500	300
	Staple fiber content (wt%)	20	30	30	50	50	20
Woven fab- ric	Processability	Good	Good	Good	Good	Good	-
	Staple fiber loss	No	No	No	No	No	-
Circular knitted fab- ric	Processability	-	-	-	-	-	Good
	Staple fiber loss	-	-	-	-	-	No
* When manufacturing 1 composite yarn, for 12 spindles, filaments and staple fibers are fed in 12-fold contents.							

[0036] As shown in Table 1, in the manufacture of woven fabrics and knitted fabric using the filament-staple fiber composite yarns manufactured according to Examples of the present disclosure, processability was excellent and no staple fiber loss occurred.

Comparative Example 1. Manufacture of woven fabric using filament-staple fiber composite yarn

[0037] A woven fabric was manufactured in the same manner as in Example 1, with the exception that, in (1) of Example 1, recycled polyethylene terephthalate (PET) having fineness of 120 denier (D) was used as filaments, leather fibers were quantitatively supplied at a supply rate of 0.2 g/min/spindle to a cylinder at 2,000 rpm using a gear pump at 60 rpm, TPM (twist per meter) was set to 400, and the weight proportion of leather fibers contained in the filament-staple fiber composite yarn was changed to 60 wt%.

Comparative example 2. Manufacture of woven fabric using filament-staple fiber composite yarn

[0038] A woven fabric was manufactured in the same manner as in Example 1, with the exception that, in (1) of Example 1, recycled polyethylene terephthalate (PET) having fineness of 240 denier (D) was used as filaments, leather fibers were quantitatively supplied at a supply rate of 0.4 g/min/spindle to a cylinder at 2,000 rpm using a gear pump at 120 rpm, TPM (twist per meter) was set to 400, and the weight proportion of leather fibers contained in the filament-staple fiber composite yarn was changed to 60 wt%.

[0039] Table 2 below shows the conditions for manufacturing the filament-staple fiber composite yarns for weft according to Comparative Examples 1 and 2 and the processability for fabric weaving.

[Table 2]

Filament	Type	Comparative Example 1	Comparative Example 2
	Fineness (D)	120	240
Staple fiber	Gear pump rotation rpm	60	120
	Cylinder rotation rpm	2,000	2,000
	Average length (mm)	1	1
	Supply rate (g/min/spindle)*	0.2	0.4
Air knife	Air pressure (kgf/cm ²)	1.5	1.5
Winding	Winding speed (m/min)	15	15
	Twist per number (TPM)	400	400
Composite yarn	Fineness (D)	300	600
	Staple fiber content (wt%)	60	60

* When manufacturing 1 composite yarn, for 12 spindles, filaments and staple fibers are fed in 12-fold contents.

Test Example 1. Evaluation of evenness of filament-staple fiber composite yarn

[0040] The evenness (U%) of the filament-staple fiber composite yarns for weft manufactured in Examples 1 to 5 and Comparative Examples 1 and 2 was measured, and the results thereof are shown in Table 3 below. As such, the evenness (U%) was measured using an evenness tester from Keisokki, Japan (yarn speed: 100 m/min, measurement range: 25%, measurement time: 3 min). Meanwhile, the evenness (U%) shown in Table 3 below was judged to be good when the value was 1.2 or less, and was judged to be poor when the value was 2.0 or more.

[Table 3]

	Example 1	Example 2	Example 3	Example 4	Example 5	Comparative Example 1	Comparative Example 2
Evenness (U%)	0.8	1	0.9	1.2	1.2	2.1	2.3
Staple fiber loss	No	No	No	No	No	Yes	Yes

[0041] As shown in Table 3, in the filament-staple fiber composite yarns for weft manufactured according to Examples 1 to 5, evenness was excellent and there was no loss of staple fibers.

[0042] In contrast, in the filament-staple fiber composite yarns for weft manufactured in Comparative Examples 1 and 2, evenness was poor and also staple fiber loss occurred. This is deemed to be due to the high content of staple fibers contained in the filament-staple fiber composite yarn.

Test Example 2. Evaluation of properties of filament-staple fiber composite yarn

[0043] The properties of the filament-staple fiber composite yarns for weft manufactured in Examples 1 to 5 and Comparative Examples 1 and 2 were measured, and the results thereof are shown in Table 4 below.

[Table 4]

	Example 1	Example 2	Example 3	Example 4	Example 5	Comparative Example 1	Comparative Example 2
Tensile strength (g/d)	3.1	2.8	2.4	1.8	1.6	1.4	1.4
Elongation (%)	27	27	29	28	30	28	27

[0044] As shown in Table 4, the filament-staple fiber composite yarns for weft manufactured according to Examples of the present disclosure exhibited excellent tensile strength and tensile elongation, whereas the filament-staple fiber composite yarns for weft manufactured according to Comparative Examples exhibited reduced tensile strength.

5 **Test Example 3. Evaluation of appearance of woven fabric and knitted fabric**

[0045] The photographs of the woven fabrics manufactured in Examples 1 to 5 are shown in FIGs. 3 to 7, respectively. As shown in FIGs. 3 to 7, the woven fabrics manufactured according to Examples exhibited a neat appearance without exposure of the staple fibers.

10 **[0046]** In contrast, the photographs of the woven fabrics manufactured in Comparative Examples 1 and 2 are shown in FIGs. 8 and 9, respectively. As shown in FIGs. 8 and 9, exposure of the staple fibers occurred in the woven fabrics manufactured according to Comparative Examples.

[0047] Also, the photograph of the knitted fabric manufactured in Example 6 is shown in FIG. 10. As shown in FIG. 10, the knitted fabric manufactured according to Example 6 had an excellent appearance without exposure of the staple fibers.

15 **[0048]** Hereinafter, a detailed description will be given of various aspects. Various aspects may be implemented in many different forms and is not limited to the embodiments described herein, but rather various aspects are defined only by the claims set forth below.

[0049] The terms used herein are merely used to describe specific embodiments and are not intended to limit the present disclosure. The singular expression includes the plural expression unless the context clearly dictates otherwise. Throughout the specification of the present disclosure, "including" a component means that other components may be further included, rather than excluding other components, unless specifically stated otherwise.

20 **[0050]** The filament-staple fiber composite yarn may be referred to as a long-short fiber composite yarn because it includes both long filaments and short staple fibers. As such, the staple fiber may be a short fiber having a length of 150 mm or less (preferably 60 mm or less, more preferably 0.01 mm to 10 mm, even more preferably 1 mm to 5 mm), and a plurality of such staple fibers may be included. Also, the filament may be a fiber having a length exceeding 150 mm, namely a fiber longer than the staple fiber.

Various aspects provide:

30 **[0051]** a fabric including a filament-staple fiber composite yarn, in which the filament-staple fiber composite yarn includes a staple fiber portion composed of a plurality of staple fibers adjacent to each other and a filament portion composed of a plurality of filaments formed by twisting on an outer surface of the staple fiber portion.

[0052] Referring to FIG. 1, the filament-staple fiber composite yarn and fabric are specified below.

35 **[0053]** In various aspects, the fabric may be a woven fabric or a knitted fabric, and for a woven fabric, at least one of weft or warp may include the filament-staple fiber composite yarn. The knitted fabric may be a circular knit or a warp knit, and according to various aspects, may be a circular knit. The fabric is manufactured using the filament-staple fiber composite yarn, exhibiting excellent processability, and the staple fibers are firmly bound inside the filaments and no loss thereof occurs, so the fabric may have a neat appearance.

40 **[0054]** In various aspects, the filament-staple fiber composite yarn may include a staple fiber portion composed of a plurality of staple fibers adjacent to each other. The plurality of staple fibers is provided in a lumped form adjacent to each other, and may be collectively referred to as a staple fiber portion.

[0055] In various aspects, the staple fiber may be manufactured using fibers or may be obtained from waste fibers. The staple fiber may be a short fiber and a plurality of staple fibers is preferably included. The length of the fiber may be 150 mm or less, preferably 60 mm or less, more preferably 0.01 mm to less than 10 mm, and according to various aspects, the length thereof may be about 1 mm. If the length of the staple fiber is 10 mm or more, evenness of the manufactured filament-staple fiber composite yarn may decrease and loss of staple fibers may occur.

45 **[0056]** In various aspects, the staple fiber may be selected from vegetable fiber, animal fiber, mineral fiber, recycled fiber thereof, and combinations thereof.

50 **[0057]** In various aspects, the vegetable fiber may be fiber extracted or produced from the leaves, stems, husks, or seeds of plants, and may be selected from, for example, cotton fiber, cellulose fiber, flax fiber, pineapple fiber, coffee bean fiber, banana fiber, ramie fiber, corn silk fiber, bamboo fiber, and combinations thereof. When the staple fiber includes vegetable fiber, the filament-staple fiber composite yarn may be imparted with enhanced naturalness and absorbency, and an eco-friendly effect may be exhibited.

55 **[0058]** The vegetable fiber may be a staple fiber that is difficult to apply to ring spinning due to the short length thereof, and examples thereof may include those fiberized after drying and preserving wood powder made from ground waste wood, coffee grounds, tea grounds, etc.

[0059] In various aspects, the animal fiber may be fiber obtained or produced from the wool of an animal, and may be selected from, for example, leather fiber, wool fiber, cashmere, camel hair fiber, mohair fiber, alpaca fiber, silk fiber, and

combinations thereof. When the staple fiber includes animal fiber, the effects of soft feel, natural aesthetics, and heat retention may be exhibited. The leather fiber may indicate cowhide fiber.

[0060] In various aspects, the mineral fiber may be fiber extracted from natural minerals or minerals, and may be selected from among, for example, mica fiber and glass fiber. When the staple fiber includes mineral fiber, fire resistance, corrosion resistance, and heat and noise insulation effects may be exhibited.

[0061] The staple fiber may be recycled fiber, and it may be fiber obtained by recycling the staple fiber selected from vegetable fiber, animal fiber, mineral fiber, and combinations thereof. Specifically, the staple fiber may be fiber recycled from discarded fabrics or clothing, and for example, when short cotton staple fibers collected by re-carding underwear are used, the soft feel, absorbency, and breathability of cotton may be imparted.

[0062] In various aspects, the filament-staple fiber composite yarn may include a filament portion composed of a plurality of filaments formed by twisting on the outer surface of the staple fiber portion. The plurality of filaments is twisted in a certain orientation and is formed along the outer surface of the staple fiber portion, and may be collectively referred to as a filament portion. Since the staple fiber portion is provided to be inserted into the filament portion, loss of staple fibers may be completely prevented. The staple fibers, which are short, may not be twisted even when twisting is performed during the manufacturing process.

[0063] In various aspects, the filament may be polymer fiber, and long filaments may be used.

[0064] In various aspects, the filament may be in the form of a filament yarn, spun yarn, D.T.Y (draw textured yarn), or A.T.Y (air textured yarn).

[0065] In various aspects, the filament may include a fiber selected from polyester-based fiber, polyamide-based fiber, polyurethane-based fiber, polyurea-based fiber, polyacryl-based fiber, polyvinyl alcohol-based fiber, polyvinyl chloride-based fiber, polyvinylidene chloride-based fiber, polypropylene-based fiber, polyethylene-based fiber, polystyrene-based fiber, polyfluoroethylene-based fiber, biodegradable fiber, and combinations thereof. The filament may include a fiber selected from nylon, vinylon, acryl, polyvinyl alcohol (PVA), polyethylene (PE), polypropylene (PP), polyethylene terephthalate (PET), polytrimethylene terephthalate (PTT), polybutylene terephthalate (PBT), recycled polyethylene terephthalate (PET), polylactic acid (PLA), Tencel, chitosan, spider silk, and combinations thereof. Meanwhile, the filament preferably includes recycled polyethylene terephthalate (PET), polytrimethylene terephthalate (PTT), or polylactic acid (PLA).

[0066] In various aspects, in the filament-staple fiber composite yarn, the thickness of the filament may be 60 denier (D) or more, 100 denier (D) to 2,000 denier (D), 100 denier (D) to 1,000 denier (D), or 200 denier (D) to 800 denier (D). If the thickness of the filament is less than 100 denier (D), the thickness as a reference fiber may be too low, and a composite yarn including the same may not have sufficient properties, making it difficult to apply the same to a fabric. On the other hand, if it exceeds 2,000 denier (D), the thickness as a reference fiber may be too high, and a problem may occur in which the unique texture developed by including staple fibers is not well expressed.

[0067] In various aspects, in the filament-staple fiber composite yarn, the content of the staple fibers may be 10 parts by weight to 80 parts by weight, or 20 parts by weight to less than 60 parts by weight, based on 100 parts by weight of the composite yarn. According to various aspects, the content thereof may be 20 parts by weight to 50 parts by weight. If the content of the staple fibers is less than 10 parts by weight based on 100 parts by weight of the composite yarn, the content of the staple fibers is too small, and various feels and effects that are developed by including various types of staple fibers may not be well expressed. On the other hand, if the content thereof is 60 parts by weight or more, the relative content of the filaments is too small, and the properties of the composite yarn may deteriorate, the evenness may decrease, and staple fiber loss may occur.

[0068] In various aspects, the filament-staple fiber composite yarn is able to completely prevent loss of the staple fibers because the filaments are formed to wrap around the outside of the staple fibers. When a fabric is manufactured using the same, the appearance of the fabric may be very neat due to no loss of the staple fibers. The staple fibers may be collected through a re-separation process after use of the filament-staple fiber composite yarn.

[0069] In various aspects, the filament-staple fiber composite yarn may have evenness U% of less than 2, or 1.2 or less. Tensile strength may be 1.5 g/D to 3.5 g/D, and elongation may be 25% to 50%.

[0070] In various aspects, the filament-staple fiber composite yarn may be used to manufacture suede fabric, moquette fabric, knit fabric, or the like.

[0071] In various aspects, it is possible to manufacture an article using a fabric including the filament-staple fiber composite yarn. Examples of the article may include automobile interiors, shoe parts such as sneakers, furniture, decorations, accessories such as bags, clothing, mobile phone covers, electronic product covers, and car seats. The automobile interior may be a headliner, door trim, or floor carpet.

[0072] In various aspects, the article may have a surface of artificial leather by applying a coating onto one side of a woven fabric or knitted fabric manufactured from the filament-staple fiber composite yarn, and the coating may be a PU coating, a PVC coating, an RP coating, a pigment coating, a spray coating, an aqueous coating, or an oily coating. The fabric may be manufactured by applying leather fibers onto the woven fabric or knitted fabric followed by interlocking using a water jet or needle punch, and may have a smooth appearance by performing a brushing or buffing process on the woven

fabric or knitted fabric.

[0073] Below, a method of manufacturing a filament-staple fiber composite yarn is described in detail.

[0074] The method of manufacturing the filament-staple fiber composite yarn may include spraying staple fibers onto filaments.

[0075] In various aspects, spraying of the staple fibers may be performed using a staple fiber spray device, and the staple fiber spray device may continuously include a gear pump configured to quantitatively supply staple fibers and a cylinder configured to uniformly distribute and spray staple fibers onto the surface of filaments. The supply rate of staple fibers through the gear pump may be 0.1 g/min/spindle to 200 g/min/spindle, and may be about 0.1 g/min/spindle to 2.5 g/min/spindle. If the supply rate of the staple fibers is less than 0.1 g/min/spindle, the content of the staple fibers is too small, resulting in poor composite yarn formation, whereas if the supply rate of the staple fibers exceeds 2.5 g/min, the properties of the resulting filament-staple fiber composite yarn may become weak. Also, the rotation rpm of the gear pump may be 500 rpm or less, and the rotation rpm of the cylinder may be 3,000 rpm or less.

[0076] In various aspects, the staple fiber spray device may further include a first air knife configured to supply air to the cylinder. By supplying air to the cylinder, it is possible to remove clumped staple fibers attached to the cylinder wire and provide uniform distribution of staple fibers on filaments. The angle of the first air knife may be adjustable as needed, and the injected air pressure may be 3.0 kgf/cm² or less.

[0077] The method of manufacturing the filament-staple fiber composite yarn may include injecting air to the filaments onto which the staple fibers are sprayed.

[0078] In various aspects, air injection may be performed using a second air knife, and the second air knife may be located both above and below the filaments onto which the staple fibers are sprayed, and may serve to inject air. The angle of the second air knife may be adjustable as needed, and the injected air pressure may be 3.0 kgf/cm² or less.

[0079] In various aspects, by injecting air to the filaments onto which the staple fibers are sprayed, clumped staple fibers among the staple fibers attached to the surface of the filaments may be removed, and the staple fibers may be more uniformly bound thereto.

[0080] The method of manufacturing the filament-staple fiber composite yarn may include twisting the filaments onto which the staple fibers are sprayed.

[0081] In various aspects, the staple fibers may be inserted into the filaments by twisting the filaments onto which the staple fibers are sprayed. Accordingly, as shown in FIG. 1, the staple fibers may be firmly bound to the inside of the filaments without loss thereof. The twisting may be performed using a winder, and the twisting may be conducted through twisting and winding. Twisting allows the staple fibers to be more firmly bound inside the filaments. The twisting and winding speed may be 60 m/min or less, 10 m/min to 60 m/min, or 15 m/min to 50 m/min. If the speed is less than 10 m/min, economic efficiency may decrease, whereas if it exceeds 60 m/min, TPM (twist per meter) for composite yarn formation may be low, resulting in loss of staple fibers. The TPM level may be 800 or less, 100 to 800, or 800 or less but greater than 300. If the TPM level is 300 or less, loss of the staple fibers from the formed composite yarn may occur, whereas if it exceeds 800, excessive production speed reduction and excessive twisting may occur. When performing the twisting, the staple fibers, which are short, may not be twisted, and only the long filaments may be twisted in a certain orientation.

[0082] In various aspects, the filament-staple fiber composite yarn is manufactured under constant temperature and constant humidity conditions, or under room temperature and humidity conditions. The filament-staple fiber composite yarn may be manufactured at a constant temperature of about 20°C to 30°C and a constant relative humidity of 50% to 60%. If the conditions for manufacturing the filament-staple fiber composite yarn fall out of the above temperature and humidity ranges, a problem of static electricity being generated when supplying staple fibers may occur.

[0083] Hereinbefore, various aspects has been described in detail with reference to the drawings and preferred embodiments, but the scope of the technical idea of the various aspects are not limited to these drawings and embodiments. Accordingly, various modifications or equivalent embodiments may exist within the scope of the technical idea of the present disclosure. Therefore, the scope of the technical idea according to the present disclosure should be interpreted by the claims, and any technical idea within a range equivalent thereto should be interpreted as being within the scope of the present disclosure.

Non-Limiting Applicability

[0084] A filament-staple fiber composite yarn can be utilized as a composite yarn because, despite containing staple fibers, the staple fibers are firmly bound inside filaments.

[0085] The composite yarn is configured such that the staple fibers are inserted into the filaments, preventing loss of the staple fibers and exhibiting excellent evenness.

[0086] The composite yarn includes various types of staple fibers, making it possible to manufacture composite yarns having various feels and effects.

[0087] The composite yarn can have excellent tensile strength and elongation despite containing staple fibers, exhibiting excellent processability and appearance when applied to a fabric, and can be widely used as a raw material

for automobile interiors, shoe parts, or fabrics processed by lamination, such as the back of coated fabrics, nonwoven intermediates, etc.

Claims

1. A fabric comprising a filament-staple fiber composite yarn, wherein the filament-staple fiber composite yarn comprises:

a staple fiber portion comprising a plurality of staple fibers adjacent to each other; and
a filament portion comprising a plurality of filaments twisted on an outer surface of the staple fiber portion.

2. The fabric of claim 1, wherein the staple fibers comprise one or more of vegetable fiber, animal fiber, mineral fiber, recycled fiber of vegetable fiber, recycled fiber of animal fiber or recycled fiber of mineral fiber.

3. The fabric of claim 2, wherein:

the vegetable fiber comprises one or more of cotton fiber, cellulose fiber, flax fiber, pineapple fiber, coffee bean fiber, banana fiber, ramie fiber, corn silk fiber or bamboo fiber,
the animal fiber comprises one or more of leather fiber, wool fiber, cashmere, camel hair fiber, mohair fiber, alpaca fiber or silk fiber, and
the mineral fiber comprises mica fiber or glass fiber.

4. The fabric of claim 1, wherein the filaments comprise one or more of polyester-based fiber, polyamide-based fiber, polyurethane-based fiber, polyurea-based fiber, polyacryl-based fiber, polyvinyl alcohol-based fiber, polyvinyl chloride-based fiber, polyvinylidene chloride-based fiber, polypropylene-based fiber, polyethylene-based fiber, polystyrene-based fiber, polyfluoroethylene-based fiber or biodegradable fiber.

5. The fabric of claim 1, wherein a content of the staple fibers is 20 parts by weight to 50 parts by weight based on 100 parts by weight of the filament-staple fiber composite yarn.

6. The fabric of claim 1, wherein the filament-staple fiber composite yarn has evenness U% of less than 2.

7. An article comprising the fabric of claim 1.

8. The article of claim 7, wherein the article comprises automobile interiors, shoes, furniture, decorations, bags, clothing, mobile phone covers, electronic product covers, or car seats.

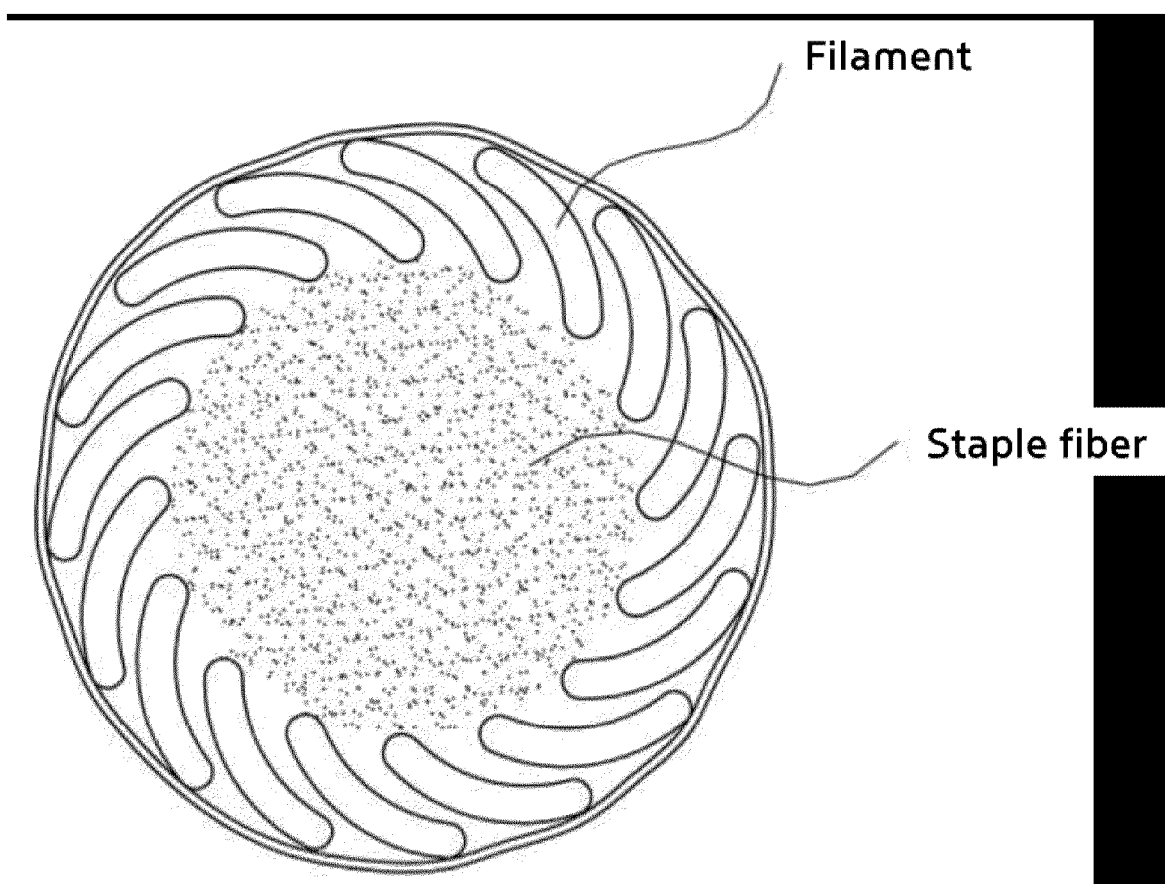


FIG. 1

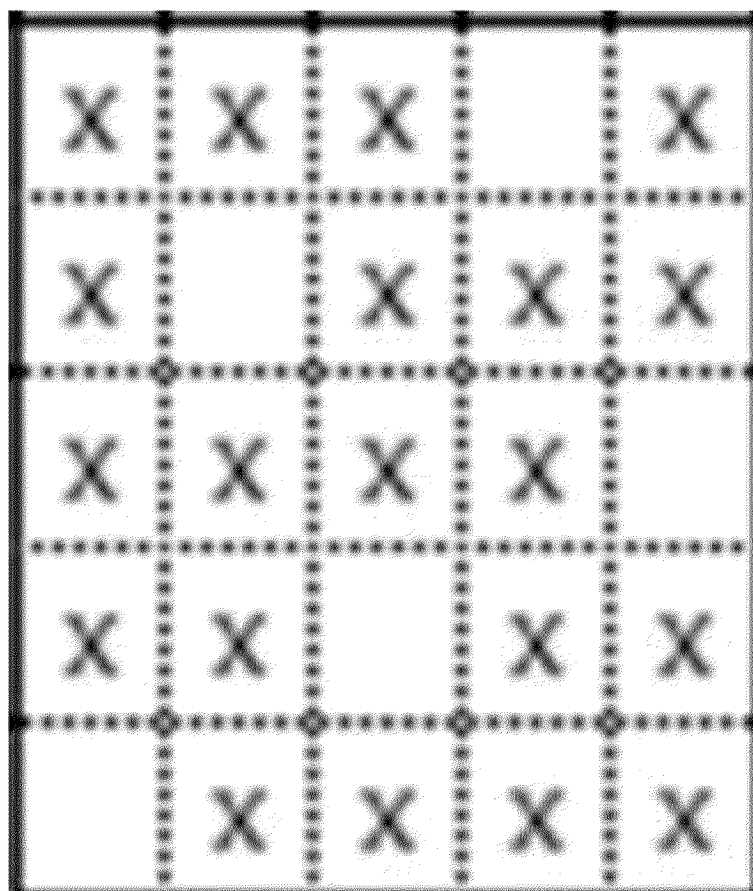


FIG. 2

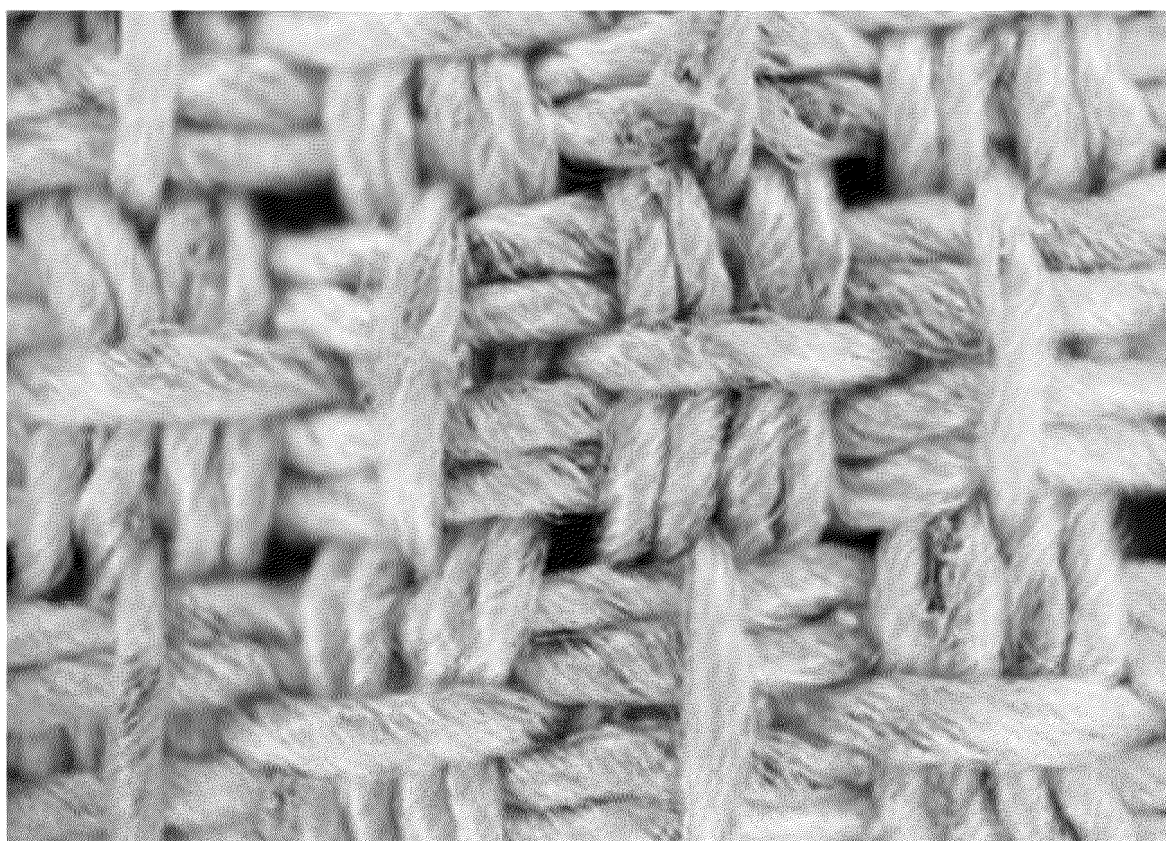


FIG. 3

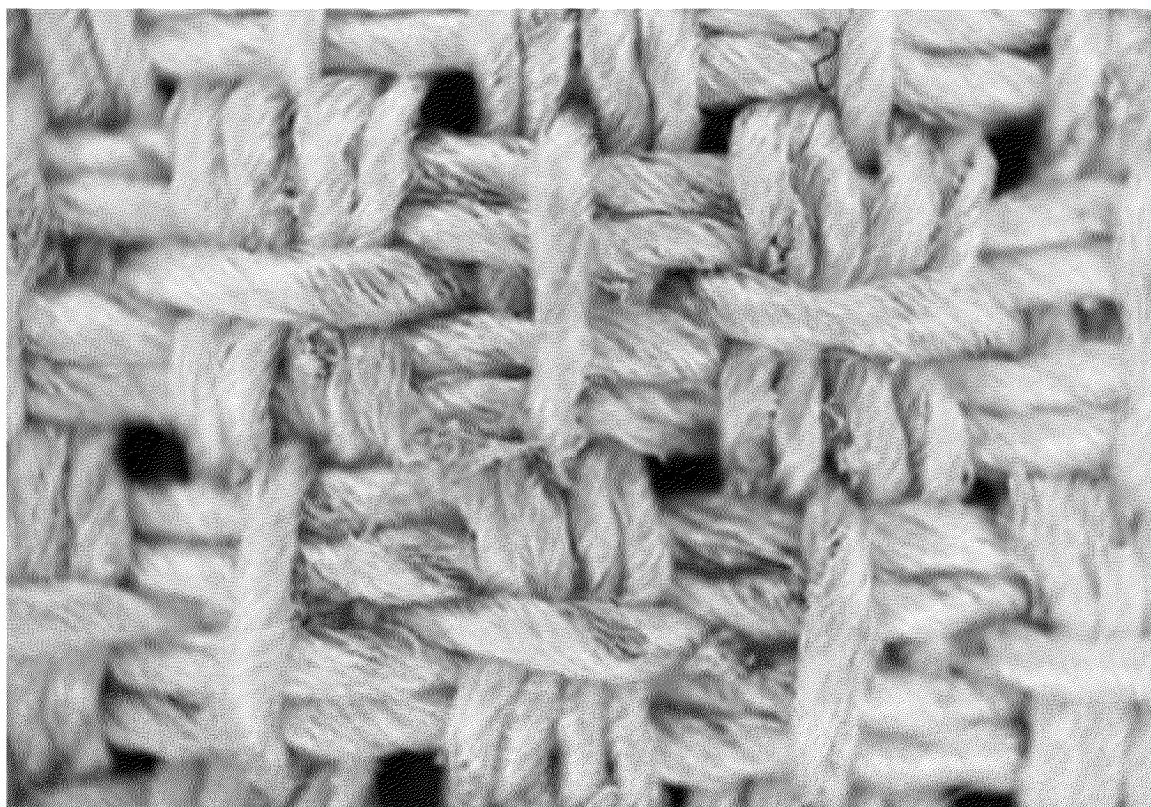


FIG. 4



FIG. 5



FIG. 6

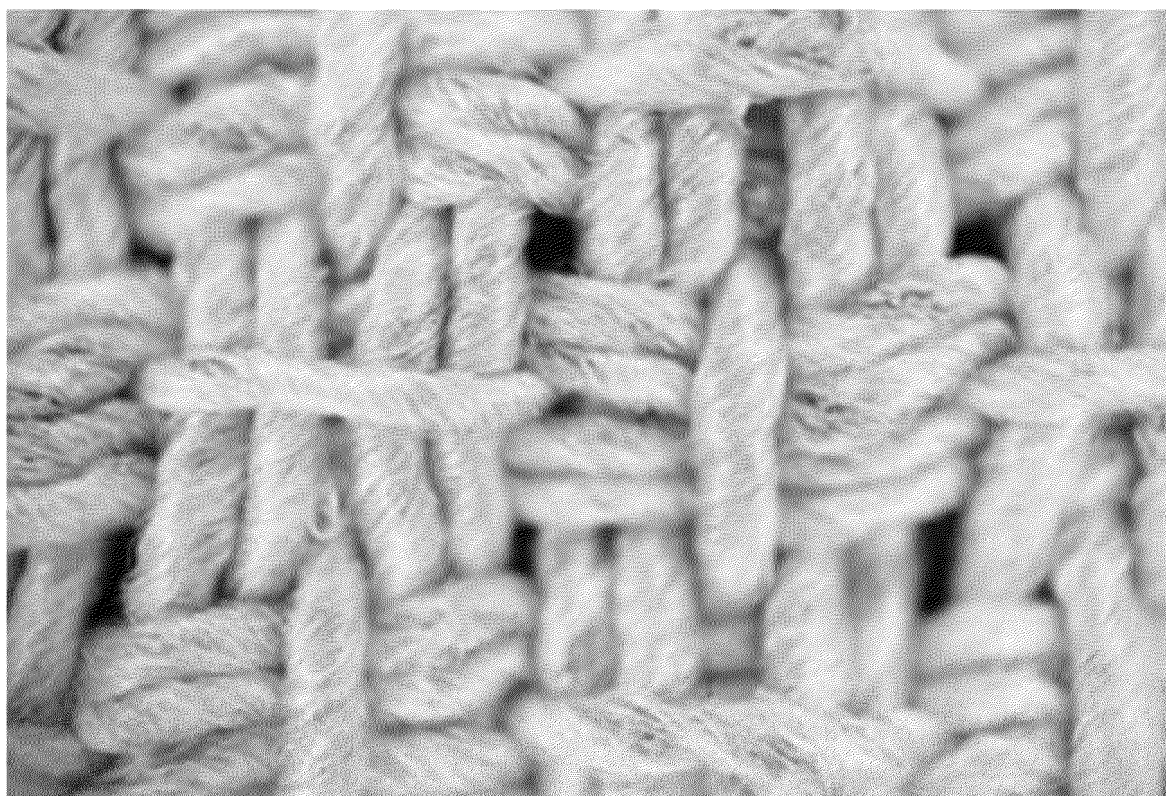


FIG. 7

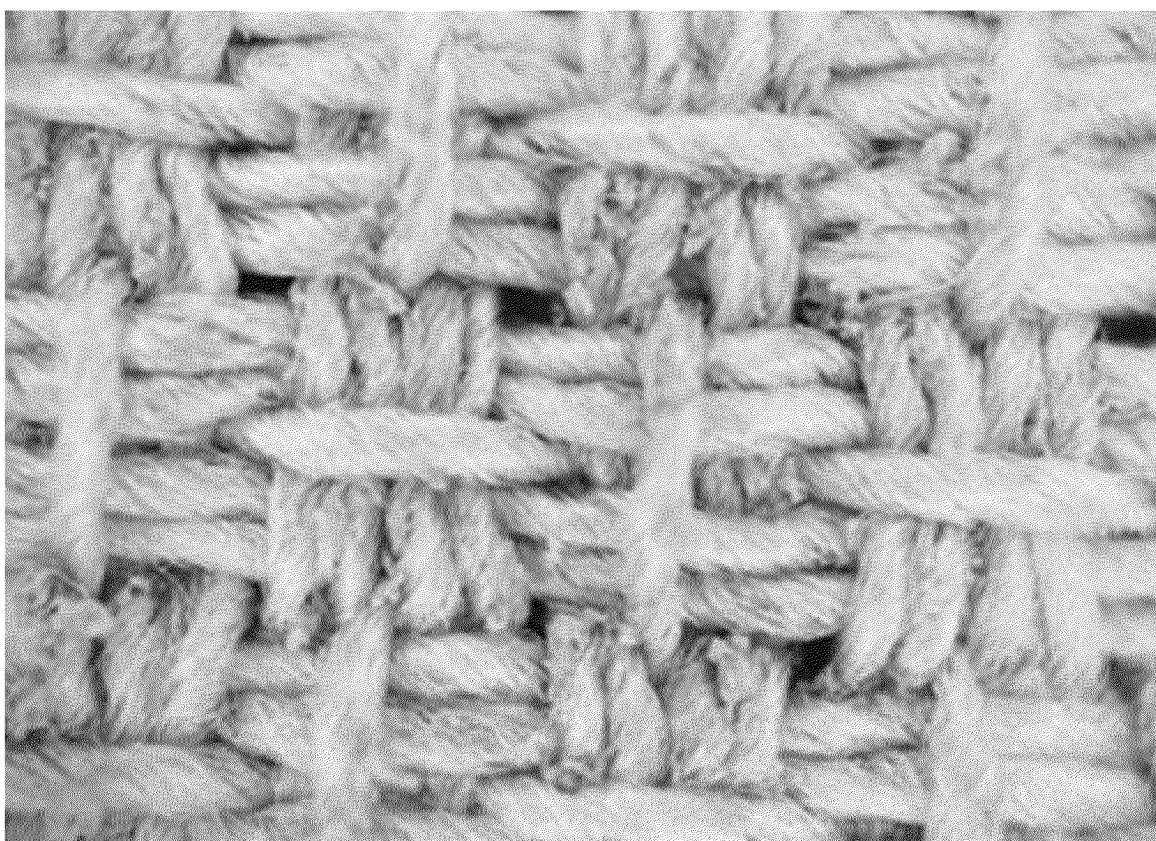


FIG. 8

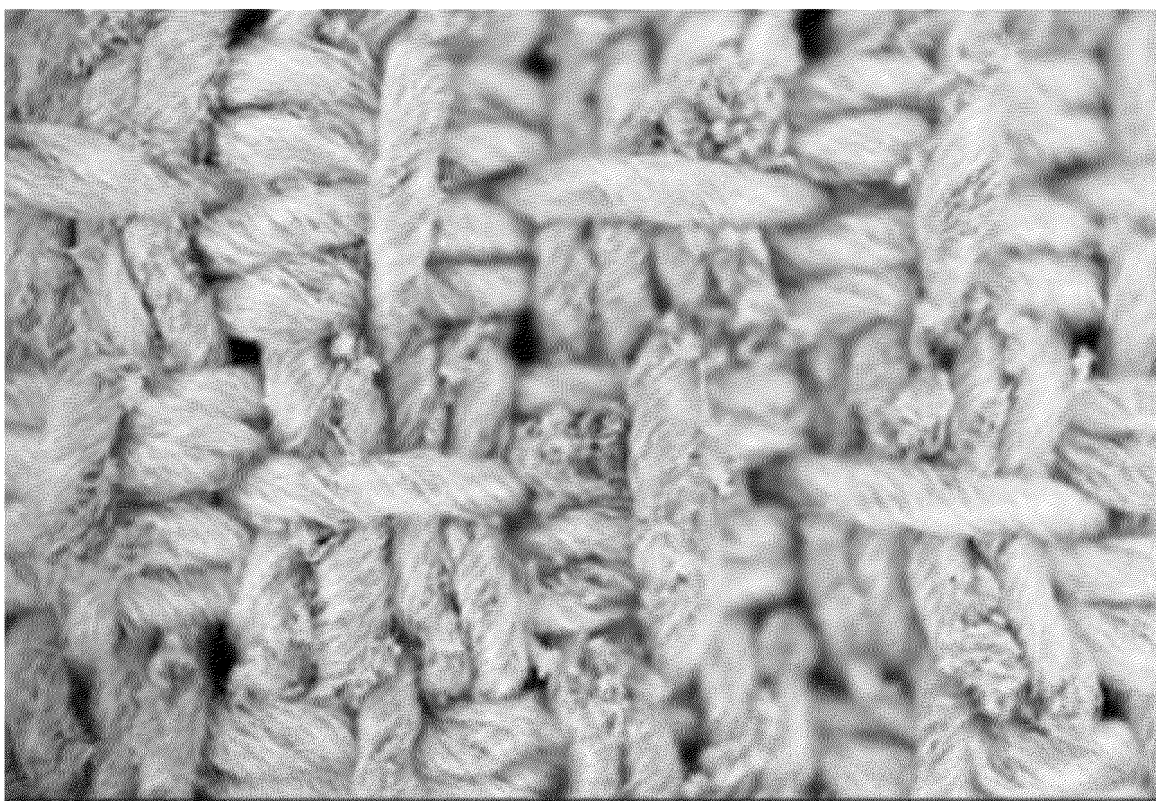


FIG. 9

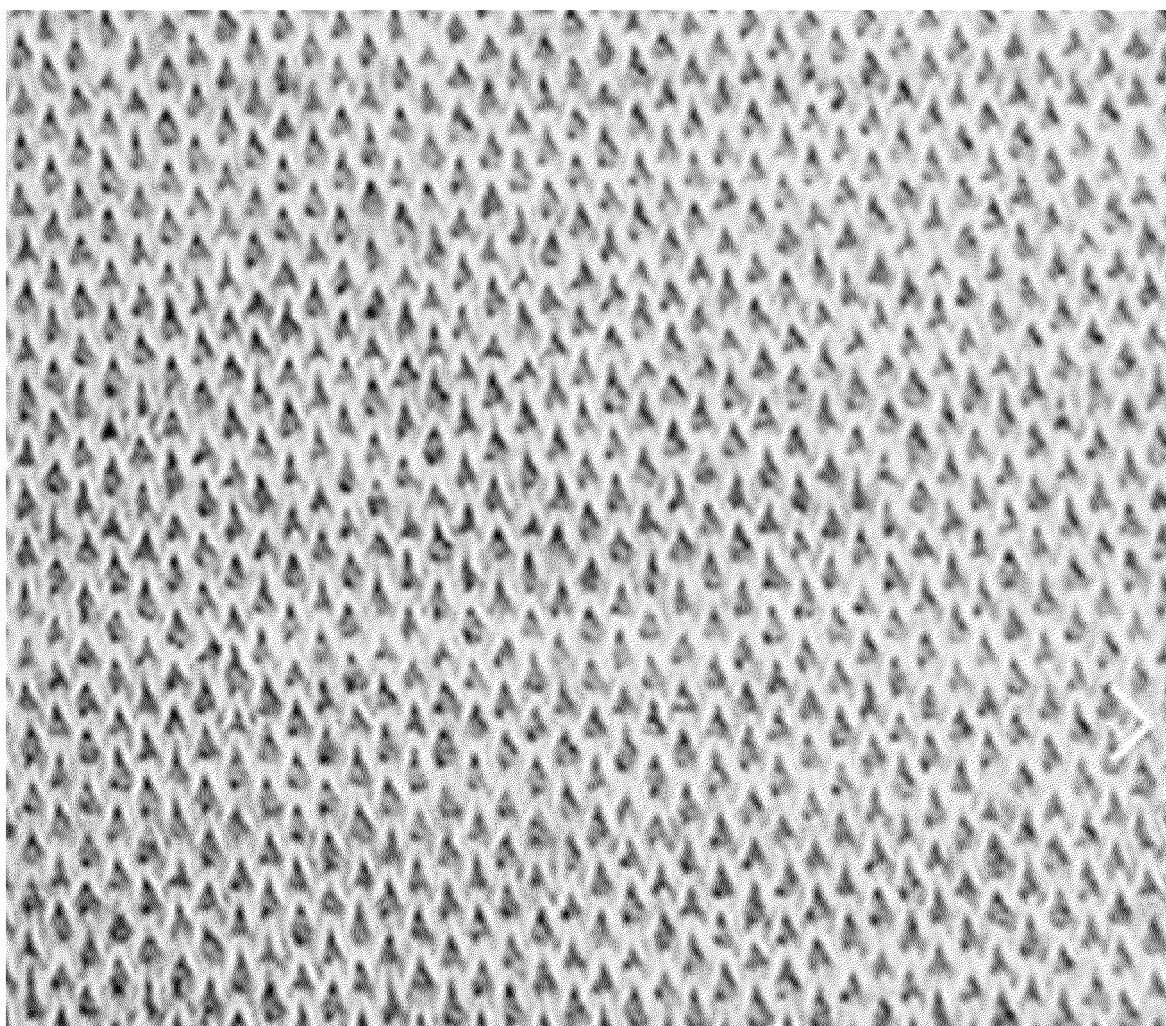


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2024/003248

A. CLASSIFICATION OF SUBJECT MATTER**D02G 3/04**(2006.01)i; **D01G 11/00**(2006.01)i; **D02G 3/38**(2006.01)i; **D02G 3/28**(2006.01)i; **D03D 15/20**(2021.01)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)

D02G 3/04(2006.01); B29C 70/28(2006.01); B29C 70/50(2006.01); D02G 1/16(2006.01); D02G 3/02(2006.01);
D02H 5/00(2006.01); D04B 35/10(2006.01)

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

Korean utility models and applications for utility models: IPC as above

Japanese utility models and applications for utility models: IPC as above

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

eKOMPASS (KIPO internal) & keywords: 원단(fabric), 트위스팅(twisting), 단섬유(staple fiber), 장섬유(filament)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2005-0122584 A (AHN, Bung Hoon) 29 December 2005 (2005-12-29) See abstract; paragraphs [0007]-[0043]; and figure 3.	1-8
A	KR 10-1694611 B1 (LARGE, CO., LTD.) 09 January 2017 (2017-01-09) See entire document.	1-8
A	KR 10-0932629 B1 (HWANG, Duk Yeol et al.) 17 December 2009 (2009-12-17) See entire document.	1-8
A	KR 10-2016-0059682 A (KOREA AEROSPACE RESEARCH INSTITUTE) 27 May 2016 (2016-05-27) See entire document.	1-8
A	KR 10-2019-0024524 A (SHINJUNG CO., LTD.) 08 March 2019 (2019-03-08) See entire document.	1-8

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

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Date of mailing of the international search report

21 June 2024

Name and mailing address of the ISA/KR

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Authorized officer

Telephone No.

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2024/003248

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KR	10-1694611	B1		09	January 2017	KR	10-2016-0116784	A	10 October 2016
KR	10-0932629	B1		17	December 2009	CN	102112674	A	29 June 2011
						CN	102112674	B	10 October 2012
						WO	2011-034257	A1	24 March 2011
KR	10-2016-0059682	A		27	May 2016	KR	10-1689730	B1	26 December 2016
KR	10-2019-0024524	A		08	March 2019	KR	10-1978458	B1	21 May 2019