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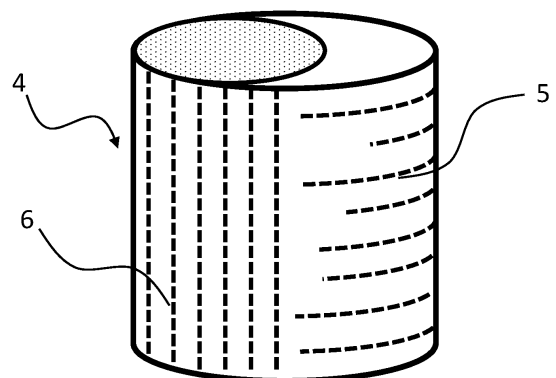
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(54) **FALSE-TWIST TEXTURED YARN, AND CLOTHES, WOVEN KNITTED PRODUCT, TWIST YARN, AND COMPOSITE FALSE-TWIST TEXTURED YARN INCLUDING SAME**

(57) To provide a false-twist textured yarn that exhibits high sensitiveness of worsted-wool feeling having natural appearance with glare suppressed while having feelings such as dryness and resilience, and high grainy feeling, and functionality such as stretchability, and a composite false-twist textured yarn, a twist yarn, a woven or knitted fabric, and clothing including the false-twist textured yarn, the false-twist textured yarn of the present invention includes a polyester-based thermoplastic resin A and a polyester-based thermoplastic resin B and satisfies the following requirements: (1) a difference ($M_A - M_B$) between a weight-average molecular weight M_A of the polyester-based thermoplastic resin A and a weight-average molecular weight M_B of the polyester-based thermoplastic resin B is 2000 to 15000; (2) The polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B are eccentrically joined; (3) An apparent thick-to-thin ratio (D_{thick}/D_{thin}) of the false-twist textured yarn is 1.05 to 3.00; and (4) The false-twist textured yarn has a slit in a fiber axis direction and a crack in a direction substantially orthogonal to the fiber axis direction on a surface of the false-twist textured yarn.

[Fig. 3]



Description

TECHNICAL FIELD

- 5 **[0001]** The present invention relates to a false-twist textured yarn, and clothing, a woven or knitted fabric, a twist yarn, and a composite false-twist textured yarn including the same.

BACKGROUND ART

- 10 **[0002]** Conventionally, among wool materials, worsted-wool feeling fabric has been demanded having softness, feelings such as dryness and resilience, and both high sensitiveness of worsted-wool feeling such as natural appearance and functionality such as stretchability.
- [0003]** As a wool touch fabric, for example, as disclosed in Patent Document 1, a fiber having thick-to-thin unevenness in a fiber axis direction of a single fiber constituting a multifilament obtained by joining two types of polyester polymers having different melt viscosities, and a woven or knitted fabric using the fiber have been proposed. In addition, Patent Document 2 proposes a polyester composite false twist yarn including a polyester yarn having latent crimping performance and another polyester yarn.
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PRIOR ART DOCUMENTS

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PATENT DOCUMENTS

[0004]

- 25 Patent Document 1: Japanese Patent Laid-open Publication No. 2004-124271
Patent Document 2: Japanese Patent Laid-open Publication No. 2017-214698

SUMMARY OF THE INVENTION

- 30 PROBLEMS TO BE SOLVED BY THE INVENTION

- [0005]** As one of means for obtaining natural appearance and stretchability of a worsted-wool feeling, means for performing draw for imparting thick-to-thin unevenness to a composite fiber having a crimp (crimpiness) structure found in wool is conceivable. However, the technique as disclosed in Patent Document 1 has crimps and thick-to-thin unevenness, but has a problem that natural appearance and dryness cannot be obtained because the cross-sectional shape of the single fiber constituting the multifilament is constant.
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- [0006]** In addition, in the technique disclosed in Patent Document 2, false-twist texturing is performed, but there is a problem that the surface of the single yarn becomes smooth because the multifilaments have a close-packed structure in the false-twist texturing step, and thus natural appearance cannot be obtained. That is, it was not possible to simultaneously satisfy the feelings such as dryness and resilience, the high sensitiveness of worsted-wool feeling such as natural appearance, and the functionality such as stretchability.
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- [0007]** The present invention has been made in view of the above circumstances, and an object of the present invention is to provide a false-twist textured yarn that exhibits high sensitiveness of worsted-wool feeling having natural appearance with glare suppressed while having feelings such as dryness and resilience, and high grainy feeling, and functionality such as stretchability, and a composite false-twist textured yarn, a twist yarn, a woven or knitted fabric, and clothing including the false-twist textured yarn.
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SOLUTIONS TO THE PROBLEMS

- 50 **[0008]** The present invention has the following structures.
[0009]

[1] A false-twist textured yarn including a polyester-based thermoplastic resin A and a polyester-based thermoplastic resin B, the false-twist textured yarn satisfying following requirements.

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- (1) a difference ($M_A - M_B$) between a weight-average molecular weight M_A of the polyester-based thermoplastic resin A and a weight-average molecular weight M_B of the polyester-based thermoplastic resin B is 2000 to 15000;
(2) The polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B are eccentrically

joined.

(3) An apparent thick-to-thin ratio ($D_{\text{thick}}/D_{\text{thin}}$) of the false-twist textured yarn is 1.05 to 3.00.

(4) The false-twist textured yarn has a slit in a fiber axis direction and a crack in a direction substantially orthogonal to the fiber axis direction on a surface of the false-twist textured yarn.

[2] The false-twist textured yarn according to [1], having a single yarn fineness of 3.0 dtex or more.

[3] The false-twist textured yarn according to [1] or [2], having a stretch recovery rate (CR) of 25.0% or more.

[4] A composite false-twist textured yarn including the false-twist textured yarn according to any one of [1] to [3] and at least one kind of another thread.

[5] The composite false-twist textured yarn according to [4], in which the other thread is an explicit crimping yarn.

[6] A twist yarn including any one of the false-twist textured yarn according to any one of [1] to [3], and the composite false-twist textured yarn according to [4] or [5], the twist yarn having a twist coefficient of 1200 to 6000.

[7] A woven or knitted fabric including any one of the false-twist textured yarn according to any one of [1] to [3], the composite false-twist textured yarn according to [4] or [5], and the twist yarn according to [6] in at least a part of the woven or knitted fabric.

[8] Clothing comprising the woven or knitted fabric according to [7] in at least a part of the clothing.

EFFECTS OF THE INVENTION

[0010] According to the present invention, it is possible to obtain a false-twist textured yarn having high sensitiveness of worsted-wool feeling having natural appearance with glare suppressed while having feelings such as dryness and resilience, and high grainy feeling, and functionality such as stretchability. In particular, the composite false-twist textured yarn, the twist yarn, the woven or knitted fabric, and the clothing using the false-twist textured yarn of the present invention may be suitably used for an item in the field of outerwear worn as a women's or men's wear, for example, clothing such as a jacket, a suit, or a lower garment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Fig. 1 is a cross-sectional view illustrating an example of an existence form of a polyester-based thermoplastic resin A and a polyester-based thermoplastic resin B of a false-twist textured yarn of the present invention.

Fig. 2 is a cross-sectional view illustrating another example of an existence form of the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B of the false-twist textured yarn of the present invention.

Fig. 3 is a perspective view illustrating one embodiment of a surface of the false-twist textured yarn of the present invention.

Fig. 4 is a schematic view of a false-twist texturing device used in production of the false-twist textured yarn of the present invention.

Fig. 5 is a schematic view of a final distribution plate according to Example 1 of the false-twist textured yarn of the present invention.

Fig. 6 is a schematic view of a final distribution plate according to Comparative Example 8 of the false-twist textured yarn of the present invention.

EMBODIMENTS OF THE INVENTION

[0012] The false-twist textured yarn of the present invention includes the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B, and satisfies the following requirements.

(1) a difference ($M_A - M_B$) between a weight-average molecular weight M_A of the polyester-based thermoplastic resin A and a weight-average molecular weight M_B of the polyester-based thermoplastic resin B is 2000 to 15000;

(2) The polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B are eccentrically joined.

(3) An apparent thick-to-thin ratio ($D_{\text{thick}}/D_{\text{thin}}$) of the false-twist textured yarn is 1.05 to 3.00.

(4) The false-twist textured yarn has a slit in a fiber axis direction and a crack in a direction substantially orthogonal to the fiber axis direction on a surface of the false-twist textured yarn.

[0013] Hereinafter, the present invention will be described in detail, but the present invention is not limited to the scope described below at all as long as the gist thereof is not exceeded.

[Polyester-Based Thermoplastic Resin A, Polyester-Based Thermoplastic Resin B]

[0014] The false-twist textured yarn of the present invention is obtained by performing false-twist texturing on the composite fiber including the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B. Since a random crimped form is obtained for each single yarn by performing false-twist texturing, dryness, stretchability, and resilience can be obtained.

[0015] Therefore, the false-twist textured yarn of the present invention includes the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B.

[0016] As a specific example of the polyester-based resin to be used for the false-twist textured yarn of the present invention, it is preferable to use a polyethylene terephthalate-based resin with a main repeat unit of ethylene terephthalate, a polytrimethylene terephthalate-based resin with a main repeat unit of trimethylene terephthalate, or a polybutylene terephthalate-based resin with a main repeat unit of butylene terephthalate. More preferably, both the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B have a main repeat unit of ethylene terephthalate. Here, the phrase "the main repeating unit is ethylene terephthalate" means that the proportion of a structure derived from ethylene terephthalate contained in the repeating unit is 60 mol% or more. The same applies hereinafter.

[0017] The polyethylene terephthalate-based resin, the polytrimethylene terephthalate-based resin, and the polybutylene terephthalate-based resin described above may have a small amount (usually less than 30 mol% (amount with respect to the total amount 100 mol% of acid components, diol components)) of copolymerization components as necessary. When the copolymerization components of the polyester-based thermoplastic resin A are 8 mol% or less, the strength is maintained even after alkali weight reduction, so that softness is easily obtained, which is preferable. Furthermore, when the copolymerization components are 8 mol% or less, a molecular orientation in the false-twist textured yarn can be maintained even after dyeing processing, so that dimensional stability is improved. In addition, preferably, the copolymerization components are 5 mol% or less in both the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B, and more preferably, both of the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B are polyethylene terephthalate resins that contain no copolymerization component. By using polyethylene terephthalate containing no copolymerization component, the boiling water shrinkage rate of the false-twist textured yarn can be easily reduced, so that crimps are easily exhibited in the woven or knitted fabric, and stretchability and resilience are easily obtained, and further, recycling of the fibers to fibers is also facilitated.

[0018] In the present invention, after false-twist texturing, the boiling water shrinkage rate of the false-twist textured yarn before crack formation (hereinafter referred to as the false-twist textured yarn before crack formation) is preferably 10.0% or less. When the boiling water shrinkage rate is 10.0% or less, the fibers are not bound in the woven or knitted fabric, and the stretchability is further improved.

[0019] The polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B in the present invention may contain one kind or two or more kinds of a micropore forming agent, a cationic dyeable agent, a coloring inhibitor, a heat stabilizer, a flame retardant, a fluorescent brightener, a delusterant, a colorant, an antistatic agent, a moisture absorbent, an antibacterial agent, inorganic fine particles, and the like as necessary within a range in which the object of the present invention is not impaired.

[0020] In the false-twist textured yarn of the present invention, the difference ($M_A - M_B$, hereinafter may be simply referred to as "difference in weight-average molecular weight") between the weight-average molecular weight M_A of the polyester-based thermoplastic resin A and the weight-average molecular weight M_B of the polyester-based thermoplastic resin B is 2,000 to 15,000. When the difference in weight-average molecular weight is less than 2000, the stretchability of the false-twist textured yarn is lowered, and the effect of suppressing glare becomes insufficient. The difference in weight-average molecular weight is preferably 5000 or more. On the other hand, when the difference in weight-average molecular weight is more than 15000, the strength of the raw yarn decreases, and spinning becomes unstable. The difference in weight-average molecular weight is preferably 13000 or less.

[0021] In addition, a value of the weight-average molecular weight M_A of the polyester-based thermoplastic resin A is preferably in a range of 20000 to 28000, and a value of the weight-average molecular weight M_B of the polyester-based thermoplastic resin B is preferably in a range of 12000 to 20000. Within these ranges, functionality and durability of the false-twist textured yarn are improved, and step stability in spinning the composite fiber is also improved.

[0022] The weight-average molecular weight in the present invention is measured by the method described in Examples.

[False-Twist Textured Yarn]

[0023] In the false-twist textured yarn of the present invention, the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B are eccentrically joined. In this way, a coil-shaped structure is obtained due to the difference in shrinkage between the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B, and thus the stretchability of the obtained woven fabric is improved. Here, the term "eccentrically joined" refers to a state in

which the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B are present in a joined state without being substantially separated in a cross section substantially perpendicular to the fiber axis of the false-twist textured yarn, and the position of the center of gravity of each of the polyester-based thermoplastic resins is shifted. Examples of the structure eccentrically joined include a side-by-side type structure and an eccentric core-sheath type structure, and a structure in which a part of the polyester-based thermoplastic resin A (1) is exposed from the polyester-based thermoplastic resin B (2) as illustrated in the cross-sectional shape of the false-twist textured yarn in Fig. 1.

[0024] At this time, in the case where the false-twist textured yarn is of a side-by-side type, it is necessary to form a slit parallel to the fiber axis direction in the polyester-based thermoplastic resin B at the time of the composite fiber before being subjected to false-twist texturing.

[0025] In the case where the false-twist textured yarn is of an eccentric core-sheath type, as illustrated in Fig. 2, the cross-sectional structure has a shape in which the polyester-based thermoplastic resin A (1) is covered with the polyester-based thermoplastic resin B (2).

[0026] The false-twist textured yarn having the cross-sectional structure illustrated in Fig. 1 can be obtained, for example, by obtaining an eccentric core-sheath type composite fiber and then exposing a part of the polyester-based thermoplastic resin A by alkali weight reduction. At this time, by forming an eccentric core-sheath type composite fiber using the polyester-based thermoplastic resins having a difference in the weight-average molecular weight described above, fine unevenness may be stably formed at the joint interface between the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B. By exposing a part of the polyester-based thermoplastic resin A, the unevenness is exposed to form a slit to be described later.

[0027] In the case where the composite fiber is of an eccentric core-sheath type, the ratio ($t_{\min}/D$) of the minimum value $t_{\min}$ of the thickness t (3) of the polyester-based thermoplastic resin B (2) covering the polyester-based thermoplastic resin A (1) to the fiber diameter D of the composite fiber is preferably 0.01 to 0.10. When ($t_{\min}/D$) is 0.01 or more, fabric quality is improved in that generation of fuzz is suppressed, and slit formability is improved. Preferably, ($t_{\min}/D$) is 0.02 or more. On the other hand, when ($t_{\min}/D$) is 0.10 or less, the stretchability is further improved by sufficient crimp exhibit ability. Preferably, ($t_{\min}/D$) is 0.08 or less.

[0028] In the case where the composite fiber is of an eccentric core-sheath type, a length C_t of a portion in which a region having the thickness t satisfying $1.00t_{\min} \leq t \leq 1.05t_{\min}$ and the circumferential line of the composite fiber are overlapped preferably satisfies $C_t \geq 0.33C$ with respect to a circumferential length C of the entire composite fiber. In this way, as compared with a conventional eccentric core-sheath composite fiber having the same ratio of an area (S_A) of the polyester-based thermoplastic resin A to an area (S_B) of the polyester-based thermoplastic resin B in its cross-section, the centers of gravity of regions where the respective resins exist are apart from each other, so that the obtained crimping fiber can form a finer spiral, and can exhibit more satisfactory crimpiness. It is more preferable to satisfy $C_t \geq 0.40C$. In addition, in principle, $C_t < C$, and $C_t \leq 0.70C$ is preferable.

[0029] Furthermore, in the false-twist textured yarn of the present invention, the apparent thick-to-thin ratio ($D_{\text{thick}}/D_{\text{thin}}$) is 1.05 to 3.00. In the present invention, the apparent thick-to-thin ratio ($D_{\text{thick}}/D_{\text{thin}}$) refers to a ratio of a fiber diameter (D_{thick}) of a portion where a width of a false-twist textured yarn bundle in a direction perpendicular to the fiber axis direction is relatively larger than an average value to a fiber diameter (D_{thin}) of a portion where the width is relatively smaller than the average value at a load of 0.11 cN/dtex. If the apparent thick-to-thin ratio ($D_{\text{thick}}/D_{\text{thin}}$) of the false-twist textured yarn of the present invention is less than 1.05, grain appearance is not obtained when the false-twist textured yarn is formed into a woven or knitted fabric. The apparent thick-to-thin ratio ($D_{\text{thick}}/D_{\text{thin}}$) is preferably 1.25 or more, more preferably 1.40 or more. In addition, when the apparent thick-to-thin ratio ($D_{\text{thick}}/D_{\text{thin}}$) exceeds 3.00, the appearance deviates from natural appearance and does not become a preferable appearance. The apparent thick-to-thin ratio ($D_{\text{thick}}/D_{\text{thin}}$) is preferably 2.00 or less.

[0030] Specific measurement methods of the thickness t , the fiber diameter D , the thick-to-thin ratio, the circumferential length C , and the like are as described in Examples.

[0031] Furthermore, the false-twist textured yarn of the present invention has a slit in a single-fiber axis direction and a crack in a direction substantially orthogonal to the single-fiber axis direction on a surface of the single fiber surface. By having unevenness in the single-fiber axis direction and a direction substantially orthogonal thereto, light from all angles may be scattered, and natural appearance with glare suppressed may be obtained. In the present invention, the crack is unevenness in a direction substantially orthogonal to the single-fiber axis direction of the false-twist textured yarn, and the depth of the crack is preferably 0.5 to 5.0 μm . In the present invention, the slit is unevenness formed in the single-fiber axis direction of the false-twist textured yarn, and the depth of the slit is preferably 0.1 to 1.5 μm . When the depth of the crack is 0.5 μm or more or the depth of the slit is 0.1 μm or more, the effect of suppressing glare is further improved. In addition, when the depth of the slit is 5.0 μm or less or the depth of the slit is 1.5 μm or less, the wear resistance is improved.

[0032] For the same reason, the width of the crack is preferably 1.0 to 30.0 μm , and the width of the slit is preferably 0.1 to 10.0 μm . In addition, the length of the slit is preferably 100 μm or more.

[0033] Here, the depth of the crack or the slit is measured at a point that is deepest thereof. As schematically exemplified in Fig. 3, the direction substantially orthogonal to the fiber axis direction of the false-twist textured yarn is a direction along

the circumference of a single fiber of a false-twist textured yarn 4, and is a direction within $\pm 80^\circ$ with respect to the fiber axis direction. Fig. 3 is a perspective view illustrating one embodiment of a surface of the false-twist textured yarn of the present invention. The false-twist textured yarn 4 has slits 6 in the single-fiber axis direction and cracks 5 in a direction substantially orthogonal to the single-fiber axis direction on the single fiber surface of the false-twist textured yarn 4. The length of the crack is not particularly limited. Although usually depending on a ratio $S_A : S_B$ of the area (S_A) of the polyester-based thermoplastic resin A to the area (S_B) of the polyester-based thermoplastic resin B in the false-twist textured yarn before formation of cracks, which will be described later, generally in the case where the ratio is about 50 : 50 (for example, about 40 to 60 : 60 to 40), cracks are likely to be formed in a region of about 1/2 of the length of the outer circumference of the single fiber of the false-twist textured yarn. About 1/2 of the length of the outer circumference of the single fiber of the false-twist textured yarn is preferable because it is well-balanced with slit formation and glare can be further suppressed when the false-twist textured yarn is formed into a woven or knitted fabric. Here, "about 1/2 of the length of the outer circumference" may be an aspect in which a crack is formed in about 1/2 of the length of the outer circumference of the single fiber by one crack, or two or more cracks are formed to be dispersed in a region of about 1/2 of the length of the outer circumference of the single fiber. In addition, it is not necessary to strictly be 1/2 of the length of the outer circumference, and it is sufficient that the length is about 1/2 of the circumference.

[0034] In addition, the frequency at which cracks are formed is preferably in a dispersion form in which 10 or less cracks are dispersed over substantially the entire region in the outer circumference direction of the region where no slit is formed, and it is more preferable that cracks are formed at a frequency at which such a dispersion form exists within a range of 1 cm in the fiber axis direction.

[0035] In addition, as schematically exemplified in Fig. 3, the fiber axis direction of the false-twist textured yarn refers to the longitudinal direction of the false-twist textured yarn 4. The length of the false-twist textured yarn in the circumferential direction in which such slits are formed is not particularly limited, but about 1/2 of the length of the outer circumference of the single fiber of the false-twist textured yarn is preferable because it is well-balanced with crack formation and glare can be further suppressed when the false-twist textured yarn is formed into a woven or knitted fabric. It is particularly preferable that both cracks and slits are formed in the single fiber constituting the false-twist textured yarn. In that case, as illustrated in Fig. 3, an aspect is preferable that has a region in which a crack is formed on about a half of the outer circumference and a region in which a slit is formed on about a half circumference of the outer circumference.

[0036] In the present invention, the depth and length of each of the cracks and the slits are measured using an electron microscope, and an average value obtained by measuring ten cracks or slits in one false-twist textured yarn is used. A specific measurement method is as described in Examples.

[0037] Examples of the method for forming cracks on the surface of the false-twist textured yarn include a method in which the false-twist textured yarn after being subjected to pin draw within a range not exceeding the natural draw ratio of the composite fiber is subjected to alkali weight reduction. When the draw ratio is set as described above, a difference in orientation of molecules constituting the composite fiber is generated in the length direction of the fiber, and a portion not oriented is preferentially eluted by alkali, so that the weight reduction rate is different in the fiber length direction, and unevenness in a direction substantially orthogonal to the fiber axis direction, that is, cracks are formed.

[0038] Examples of the method for forming slits on the surface of the false-twist textured yarn include a method in which the shape of a discharge hole is changed when composite fiber is obtained from a normal circular shape into a shape of a discharge hole having a multilobal cross-section of eight or more protrusions to provide unevenness in the fiber axis direction.

[0039] The slits may also be formed by obtaining a false-twist textured yarn from a composite fiber having an eccentric core-sheath structure and then performing alkali weight reduction. Here, a method for forming the slits based on a composite fiber having an eccentric core-sheath structure will be described in detail. When the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B having the above-described molecular weight differences are spun using a distribution plate described later, unevenness is formed at the joint interface of the eccentric core-sheath structure due to a viscosity difference between the thermoplastic resins. Furthermore, in the alkali weight reduction of the woven or knitted fabric using the false-twist textured yarn, the amount of the polyester-based thermoplastic resin B is preferentially reduced, so that the polyester-based thermoplastic resin A is exposed to expose the unevenness, which is at the joint interface, and the unevenness (slits) in the fiber axis direction is formed.

[0040] The slit can be formed more stably based on the composite fiber having the eccentric core-sheath structure described above and can be formed into a deep slit, and thus the composite fiber having the eccentric core-sheath structure is preferable.

[0041] In the present invention, by simultaneously satisfying the requirements (1) to (4) described above, it is possible to provide at once the feelings such as dryness and resilience, which are disadvantages with the conventional false-twist textured yarn, and both properties of the high sensitiveness of worsted-wool feeling such as natural appearance and functionality such as stretchability.

[0042] In addition, the false-twist textured yarn is not limited to a particular cross-sectional shape, and cross-sectional shapes such as a circular shape, an elliptical shape, and a triangular shape can be adopted, but a circular shape is more

preferable because the composite fiber for obtaining the false-twist textured yarn can be stably spun when the cross-sectional shape is a circular shape.

[0043] In the present invention, when the ratio $S_A : S_B$ of the area (S_A) of the polyester-based thermoplastic resin A to the area (S_B) of the polyester-based thermoplastic resin B in the cross section of the false-twist textured yarn before formation of cracks is preferably 70 : 30 to 30 : 70, more preferably 60 : 40 to 40 : 60, physical properties are improved. In addition, in order to make the crimpiness of the false-twist textured yarn finer, $S_A \geq S_B$ is further preferable.

[0044] The single yarn fineness of the false-twist textured yarn in the present invention is preferably 3.0 dtex or more. The upper limit is preferably 5.0 dtex or less. Within this range, dryness in forming into a woven or knitted fabric is enhanced, and a touch closer to worsted-wool may be obtained. In the present invention, the single yarn fineness is a value calculated by total fineness (dtex)/number of filaments.

[0045] The false-twist textured yarn of the present invention preferably has a stretch recovery rate (crimp rigidity (CR)) measured from the decomposed yarn of the woven or knitted fabric of 25.0% or more. When CR is 25.0% or more, crimps are exhibited in the woven or knitted fabric, and better stretchability is obtained. CR is more preferably 30.0% or more. In addition, CR is preferably 50.0% or less. When CR is 50.0% or more, excessive bulging of the woven or knitted fabric is suppressed, and moderate resilience is easily obtained. CR can be measured by the method described in Examples including the case of using the composite false-twist textured yarn described later. Examples of the method for setting CR within the above range include increasing the draw ratio at the time of false-twist texturing to increase the orientation difference between the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B.

[Composite False-Twist Textured Yarn]

[0046] A composite false-twist textured yarn of the present invention includes the false-twist textured yarn of the present invention and at least one kind of another thread. With this configuration, grainy feeling in forming into a woven or knitted fabric can be further improved.

[0047] The other thread is not particularly limited as long as it is different from the false-twist textured yarn of the present invention, but in particular, the thread is preferably constituted of a polyester-based resin because of satisfactory mechanical properties and excellent dimensional stability against humidity and temperature changes. As a specific example of the polyester-based resin, it is preferable to use a polyethylene terephthalate-based resin with a main repeat unit of ethylene terephthalate, a polytrimethylene terephthalate-based resin with a main repeat unit of trimethylene terephthalate, or a polybutylene terephthalate-based resin with a main repeat unit of butylene terephthalate. Note that the polyethylene terephthalate-based resin or the polybutylene terephthalate-based resin described above may have a small amount (usually less than 30 mol% (amount with respect to total 100 mol% of acid components, diol components) of copolymerization components as necessary. In addition, from the viewpoint of soft feelings and recycling of the fibers to fibers, all the threads constituting the composite false-twist textured yarn are more preferably polyethylene terephthalate resins that do not contain a shared synthetic component.

[0048] In addition, the boiling water shrinkage rate of the other thread is preferably 10.0% or less. When the boiling water shrinkage rate is 10.0% or less, the false-twist textured yarn and the other thread are hardly bound in the woven or knitted fabric, and the stretchability is further improved.

[0049] Furthermore, the other thread is preferably an explicit crimping yarn. Here, the "explicit crimping yarn" is yarn having a stretch recovery rate of 5.0% or more, and refers to a thread in which two kinds of polymers having different contractility are combined in a side-by-side or eccentric core-sheath type, or a yarn to which crimpiness is mechanically imparted by false-twist texturing. In this case, the CR of the other thread is preferably 10.0 to 20.0% higher than the CR of the false-twist textured yarn. By setting CR within such a range, the false-twist textured yarn and the crimp having a different coil diameter are mixed in the composite false-twist textured yarn, so that dryness closer to worsted-wool can be obtained without suppressing the stretchability. It is preferable that the other thread as raw yarn before being combined is a latent crimping yarn. The latent crimping yarn becomes an explicit crimping yarn constituting the composite false-twist textured yarn of the present invention through a step such as dyeing after compositing.

[Twist Yarn]

[0050] The twist yarn of the present invention includes any one of the false-twist textured yarn and the composite false-twist textured yarn, and has a twist coefficient of 1200 to 6000. By using the false-twist textured yarn or the composite false-twist textured yarn as a twist yarn and setting the twist coefficient within the above range, the step passability of the weaving step is improved while the stretchability is maintained. The twist coefficient is preferably 1500 to 4500. Here, the twist coefficient can be calculated by the following formula.

Twist coefficient (K) = Number of twists (T/m) $\times \sqrt[3]{\text{fineness (dtex)} \times 0.9}$.

[0051] The twist yarn direction is preferably the same as a twisting direction of false twisting. When the twist yarn direction and the false twisting direction are the same, the resilience is further improved.

[Woven or Knitted Fabric]

[0052] The woven or knitted fabric of the present invention includes any one of the false-twist textured yarn, the composite false-twist textured yarn, or their twist yarn in at least a part thereof. The ratio at which these are used is preferably 30 mass% or more, and more preferably 40 mass% or more, with respect to the mass of the woven or knitted fabric. In another preferable aspect, all the fibers constituting the woven or knitted fabric include any one of the false-twist textured yarn, the composite false-twist textured yarn, or the twist yarn of the present invention.

[0053] The woven or knitted fabric of the present invention has a fabric structure as a woven fabric or a knitted fabric. A woven fabric texture is selected from plain weave, twill weave, satin weave, and derivative weave thereof according to feelings and design properties. Furthermore, a multiple weave texture such as double weave may be employed. A knitted fabric texture may be selected according to desired feelings and design properties, and examples of weft knitting include Jersey stitch, rubber stitch, pearl stitch, tuck stitch, float stitch, lace stitch, and derivative texture thereof, and examples of warp knitting include single denbigh stitch, single van dyke stitch, single cord stitch, Berlin stitch, double denbigh stitch, atlas stitch, cord stitch, half tricot stitch, satin stitch, sharkskin stitch, and derivative texture thereof. Among them, it is more preferable to use a relatively simple woven and knitted structure such as plain weave or derivative texture thereof, twill weave or derivative texture thereof, and satin weave in order to have a delicate worsted-wool feeling and a deep natural appearance.

[Clothing]

[0054] The clothing of the present invention include the woven or knitted fabric of the present invention in at least a part of the clothing thereof. In this way, clothing may be provided having the feelings such as dryness and resilience, high sensitiveness of worsted-wool feeling such as natural appearance, and functionality such as stretchability, which are given to the false-twist textured yarn, the composite false-twist textured yarn or the twist yarn, or the woven or knitted fabric of the present invention. The clothing of the present invention includes an item in the field of outerwear worn as a women's or men's garment, sportswear, and outdoor wear particularly a jacket, a suit, lower garment, and clothing including a part thereof, for example, a front main panel, a back main panel, a collar, a sleeve, a chest pocket, and a side pocket, innerwear, socks, hats, and the like.

[Method for Producing False-Twist Textured Yarn and Woven or Knitted Fabric]

[0055] Next, an example of a preferred method for producing the false-twist textured yarn and the woven or knitted fabric of the present invention will be described.

[0056] The false-twist textured yarn of the present invention may be produced by false-twist texturing a composite fiber obtained by winding discharged thermoplastic resins as an undrawn yarn or a half drawn yarn and subjecting the resultant to alkali weight reduction. In particular, using the composite fiber obtained in the step of drawing after being wound as a half drawn yarn, for false-twist texturing is preferable because the composite fiber is particularly excellent in stretchability when formed into the woven or knitted fabric and subjected to dyeing processing due to an orientation difference between the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B, and is also excellent in resistance to embrittlement due to alkali weight reduction because of an increase in orientation of the polyester resin A.

[Spinning Step]

[0057] In the method for producing the false-twist textured yarn of the present invention, first, the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B are individually melted, and ejected from a spinneret, and wound up as the undrawn yarn or the half drawn yarn at a spinning speed of preferably 1400 m/min to 3800 m/min. In the present invention, the yarn is preferably wound as a half drawn yarn at a spinning speed of 2500 m/min to 3800 m/min.

[0058] In the present invention, forming the false-twist textured yarn of the present invention from the half drawn yarn is preferable because the false-twist textured yarn is excellent in wear resistance after alkali weight reduction. Since the half drawn yarn is more crystallized than the undrawn yarn, a local fiber cutting due to alkali weight reduction can be inhibited.

[0059] A spinning temperature is preferably +20°C to +50°C higher than each of melting points (T_{mA} , T_{mB}) of the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B. When the temperature is +20°C or more higher than (T_{mA} , T_{mB}), it is possible to prevent the melted polyester-based thermoplastic resin A and polyester-based thermoplastic resin B from solidifying in pipelines of a spinning machine and clogging the pipelines. On the other

hand, when the temperature is +50°C or less higher than (T_{mA} , T_{mB}), it is possible to inhibit thermal deterioration of the melted polyester-based thermoplastic resin A and polyester-based thermoplastic resin B.

[0060] The spinneret used in the method for producing the false-twist textured yarn of the present invention may have any of common internal structures so long as the spinneret renders stable spinning with respect to quality and operation.

[0061] Here, when the cross-section of the false-twist textured yarn of the present invention is of a side-by-side type, a slit in a direction substantially parallel to the fiber axis direction is obtained on the surface of the polyester-based thermoplastic resin A by making the spinneret shape uneven.

[0062] By forming such a cross-section of the eccentric core-sheath type composite fiber, it is also possible to suppress ejected-filament bending occurring due to a difference in flow rate between the two types of thermoplastic resins ejected from the spinneret, which has been a problem in production of the composite fiber before false-twist texturing.

[0063] In order for the composite fiber to have a cross section of an eccentric core-sheath type, it is preferable to precisely control the minimum value t_{min} of the thickness t of the polyester-based thermoplastic resin B covering the polyester-based thermoplastic resin A and a length C_t of a portion in which a region having the thickness t in the cross-section of the composite fiber satisfying $1.00t_{min} \leq t \leq 1.05t_{min}$ and the circumferential line of the composite fiber are overlapped, and a spinning method using distribution plates as exemplified in Japanese Patent Laid-open Publication No. 2011-174215, Japanese Patent Laid-open Publication No. 2011-208313, and Japanese Patent Laid-open Publication No. 2012-136804 is suitably used. By using such a distribution plate, t_{min} can be set within the above-described range. The obtained eccentric core-sheath type composite fiber may be directly used as an eccentric core-sheath type false-twist textured yarn, or may be used as a false-twist textured yarn having a cross-sectional structure as illustrated in Fig. 1 by alkali weight reduction.

[0064] In the case of a false-twist textured yarn having a cross-sectional structure as illustrated in Fig. 1, when the difference in weight-average molecular weight between the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B falls within the range specified in the present invention, unevenness parallel to the fiber axis direction is formed at the composite interface of the composite fiber according to the difference in viscosity. Therefore, by subjecting the eccentric core-sheath type composite fiber to false-twist texturing and then to alkali treatment, a part of the polyester-based thermoplastic resin B covering the polyester-based thermoplastic resin A is removed, and by exposing a part of the polyester-based thermoplastic resin A, a slit parallel to the fiber axis direction as illustrated in Fig. 3 is stably obtained.

[0065] When the t_{min} of the composite fiber is excessively small, the effect of suppressing the ejected-filament bending cannot be sufficiently obtained, and as a result, fluff may be generated in the false-twist textured yarn, step passability may be deteriorated, or strength may be deteriorated. Also, an excessive increase in t_{min} can be suppressed, and the crimpiness of the false-twist textured yarn can be exhibited in a suitable range to improve the stretchability of the woven or knitted fabric. In the method using such distribution plates, a cross-sectional form of single yarn can be controlled by disposition of distribution holes in a final distribution plate installed most downstream among the plurality of distribution plates.

[False-Twist Texturing Step]

[0066] Next, the yarn produced through the above-described spinning step is subjected to pin draw using a false-twist texturing device as illustrated in Fig. 4 at a draw ratio within a range not exceeding a natural draw ratio of the yarn, and then false-twist texturing while being subjected to heater draw to form a false-twist textured yarn. By this step, a desired false-twist textured yarn may be obtained. Fig. 4 is a schematic view of the false-twist texturing device used in production of the false-twist textured yarn of the present invention. That is, a composite fiber 7 is subjected to heat draw by a hot pin 9 between a first feed roller 8 and a second feed roller 10, and is further subjected to false-twist texturing by a heater 11 and a twister 12 between the second feed roller 10 and a third feed roller 13. When another thread 16 is mixed, it is supplied from a fourth feed roller 17 to the heater 11 together with the composite fiber 7 to perform false-twist texturing, to form a false-twist textured yarn or a composite false-twist textured yarn 14, which is to be wound by a winding section 15.

[0067] For example, a half drawn yarn obtained by composite spinning at a spinning speed of 2500 m/min to 3800 m/min is subjected to pin draw at a yarn speed of 100 to 800 m/min, a pin draw ratio described later, and a hot pin temperature of 70 to 120°C, and then subjected to false-twist texturing at the heater draw ratio described later and a heater temperature of 140 to 200°C (example conditions: a half drawn yarn obtained by composite spinning at a spinning speed of 2600 m/min is subjected to pin draw at a yarn speed of 400 m/min, a pin draw ratio of 1.4 times, and a hot pin temperature of 80°C, and then subjected to false-twist texturing at a heater draw ratio of 1.20 times and a heater temperature of 170°C), whereby a false-twist textured yarn having an apparent thick-to-thin ratio of 1.05 or more and 3.00 or less may be obtained. In the pin draw, a desired thick-to-thin ratio may be obtained by performing draw in a region of the lower limit of the natural draw ratio $\times 1.2$ times to the upper limit of the natural draw ratio $\times 0.8$ times, and performing false-twist texturing such that the total draw ratio represented by the pin draw ratio $\times$ the heater draw ratio is the upper limit of the natural draw ratio $\times 1.1$ times, whereby a crack and a slit may be formed on the surface of the false-twist textured yarn by the alkali treatment. When the

total draw ratio is set to the upper limit of the natural draw ratio $\times 1.3$ times or more, the orientation difference between the polyester-based thermoplastic resins constituting the composite fiber is increased, so that stretchability is easily obtained, which is preferable. When false-twist texturing is performed at a total draw ratio that is less than the upper limit of the natural draw ratio $\times 1.1$ times, processing stability is poor, and cracks are preferentially exhibited by alkali treatment, so that it is difficult to form slits.

[0068] In addition, before or after winding the false-twist textured yarn, another thread may be combined by mixing or the like to form a composite false-twist textured yarn. The combining method is not particularly limited, and typical methods such as interlaced fiber mixing and Taslan fiber mixing can be used with no problem.

[Step of Forming Woven or Knitted Fabric]

[0069] The false-twist textured yarn or the composite false-twist textured yarn obtained by the false-twist texturing is used to obtain a woven fabric or a knitted fabric. In the case of the woven fabric, weaving is performed using an air-jet loom, a water-jet loom, a rapier loom, a projectile loom, a shuttle loom, or the like. In the case of the knitted fabric, knitting is performed using a weft knitting machine such as a flat knitting machine, a full-fashion knitting machine, a circular knitting machine, a computer jacquard knitting machine, a socks knitting machine, and a cylindrical knitting machine, or a warp knitting machine such as a tricot knitting machine, a raschel knitting machine, an air-jet loom, and a milanese knitting machine.

[Alkali Weight Reduction Step]

[0070] Furthermore, the woven or knitted fabric obtained at the above-described step of forming the woven or knitted fabric is subjected to an alkali weight reduction treatment so that an alkali weight reduction rate is 5% or more, more preferably 10 to 25%. As described above, the false-twist textured yarn subjected to pin draw within a range not exceeding the natural draw ratio of the composite fiber having an eccentric structure has an orientation difference in the fiber length direction, and the weight reduction rate due to alkali is different in the fiber length direction. Therefore, unevenness in a direction substantially orthogonal to the fiber axis direction, that is, cracks are formed by performing alkali weight reduction processing. In addition, in the case of making the false-twist textured yarn having the structure of Fig. 1, as described above, a slit is formed by removing a part of the polyester-based thermoplastic resin B of the eccentric core-sheath type composite fiber and exposing a part of the polyester-based thermoplastic resin A. At this time, the slit depth can be easily controlled by controlling the exposed state of the polyester-based thermoplastic resin A.

[0071] The alkali weight reduction step is preferably a batch type weight reduction process (for example, liquid flow reduction) because resilience is easily obtained.

[Dyeing Step]

[0072] Furthermore, if necessary, before and/or after the above-described alkali weight reduction step, or simultaneously, conventional scouring, relaxation treatment, intermediate thermal setting, dyeing processing, and finishing thermal setting may be performed (in the present invention, these processes may be collectively referred to as "dyeing step"). In order to obtain the stretchability and the resilience of the present invention, feed and tension management of each step are appropriately performed. For example, in the axis direction of the composite fiber of the present invention, it is desirable that overfeed is within 10% in a feed amount and a facility of, for example, a roll-to-roll system capable of controlling, and that a liquid amount and a flow rate area controlled so that an excessive tension is not applied to a travel direction in a batch-type jet dyeing machine or the like. Dyeing is preferably performed in a dyeing solution at 110 to 130°C using a disperse dye or a cationic dye, though depending on the dyeability of the thermoplastic resins constituting the false-twist textured yarn or another thread to be combined.

[0073] In the false-twist textured yarn in the woven or knitted fabric produced and woven using the false-twist textured yarn subjected to false-twist texturing using the composite fiber described above, structural exhibition usually occurs and crimpiness exhibits due to the thermal history in the dyeing step or the alkali weight reduction step. Then, slits are formed in the fiber axis direction by the alkali weight reduction step, and cracks are formed in a direction substantially orthogonal to the fiber axis direction. In the composite false-twist textured yarn, when a latent crimping yarn is used as another thread, the latent crimping yarn also exhibits the structure due to the thermal history in the dyeing step or the alkali weight reduction step, and becomes an explicit crimping yarn.

EXAMPLES

[0074] Next, the present invention is described in detail on the basis of the Examples. However, the present invention is not limited only to these Examples. Unless otherwise described, physical properties are measured on the basis of the

methods described above.

[Measurement Method]

(1) Measurement of Weight-Average Molecular Weight of Thermoplastic Resin

[0075] The weight-average molecular weights of the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B used in the composite fiber were measured using "TOSO GMHHR-H (S) HT" manufactured by Tosoh Corporation as a gel permeation chromatography (GPC) tester.

[0076]

Detector: Differential refractive index detector RI (Waters-2414, Sensitivity 128x)
 Column: ShodexHFIP806M (two columns connected) manufactured by Showa Denko K.K.
 Solvent: Tetrahydrofuran (25cm³)
 Flow rate: 1.0 mL/min
 Column temperature: 30°C
 Injection volume: 0.10 mL
 Standard substance: Polystyrene

(2) Measurement of Fiber Diameter D, Thickness t of Polyester-Based Thermoplastic Resin B Covering Polyester-Based Thermoplastic Resin A, and Circumferential Length C of Fiber

[0077] A multifilament including composite fibers, embedded in an embedding material such as an epoxy resin continuously at 10 locations at intervals of 1 cm in the fiber axis direction was used as a sample, and each sample was photographed with a transmission electron microscope (TEM) to obtain an image thereof at such a magnification that 10 or more fibers can be observed. At this time, metal dyeing was performed to render the contrast of a joint portion between the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B clear. By using "WinROOF 2015" manufactured by Mitani Corporation as image analysis software, the fiber diameter D was measured from all the single yarns in the observation image, and the circumferential length C and the thickness t of the polyester-based thermoplastic resin B were individually measured therefrom. Note that the fiber diameter D was a circle equivalent diameter. The fiber diameter D, the circumferential length C, the thickness t, and the area ratio Sa of the polyester-based thermoplastic resin A of the present invention were obtained by preparing and averaging 10 sets of the obtained fiber diameters D, circumferential lengths C, thicknesses t, and area ratios Sa and determining the fiber diameter D to three significant figures and the circumferential length C and the thickness t to two significant figures. The thickness t was measured at 360 points every 1° in the fiber circumferential direction, the smallest thickness was $t_{\min}$, and the length of a portion in which a region having the thickness t satisfying $1.00t_{\min} \leq t \leq 1.05t_{\min}$ and the circumferential line of the composite fiber are overlapped was C_t . The area ratio Sa of the polyester-based thermoplastic resin A was subtracted from the total area S of the cross section to obtain the area ratio Sb of the polyester-based thermoplastic resin B.

(3) Measurement of Apparent Thick-to-Thin Ratio ($D_{\text{thick}}/D_{\text{thin}}$)

[0078] The false-twist textured yarn is taken out from the woven or knitted fabric after the dyeing step (finishing thermal setting), and both ends of the false-twist textured yarn are fixed in a state where a load of 0.11 cN/dtex was applied. In an image obtained by photographing a side surface of the fixed sample with a digital microscope "VHX-2000" manufactured by Keyence Corporation at a magnification of 200 times, the diameter of a fiber bundle was continuously measured at 500 locations at intervals of 1.0 mm in the fiber axis direction. The fiber diameter (D_{thick}) of the thick portion and the fiber diameter (D_{thin}) of the thin portion were determined by defining a portion thinner than an average value of all the measurement data as the thin portion (thin portion < average value) and defining a portion thicker than the average value of all the measurement data as the thick portion (thick portion > average value). The apparent thick-to-thin ratio was obtained by rounding off the third decimal place to two decimal places.

(4) Measurement of Presence or Absence of Crack and Slit and Depth Thereof

[0079] An arbitrary portion was observed using a scanning electron microscope "S-3400N" manufactured by Hitachi, Ltd. as an electron microscope. The composite fiber was pulled out from the woven or knitted fabric after the finishing thermal setting without applying an external force, and the presence or absence of a crack or a slit was confirmed. In the case of the presence of a crack or a slit, a side surface in a fiber axis direction was observed at a magnification of 2,000 times. The largest depths and lengths of the crack or the slit were measured, and an average value obtained by measuring

10 cracks and 10 slits in one false-twist textured yarn was defined as the crack depth and the slit depth, respectively. The crack refers to a groove in a direction substantially orthogonal to the fiber axis direction, and the slit is a groove in a direction substantially parallel to the fiber axis direction.

[0080] In the table, the case where an aspect is observed in which a region has a crack formed on about a half circumference of the outer circumference of a single fiber and a region has a slit formed on about a half of the outer circumference of the single fiber was denoted as "crack/slit", the case where an aspect was observed in which a region has a crack formed on the entire circumference of the single fiber, and no slit was observed was denoted as "entire circumference crack", and the case where an aspect is observed in which a region has a crack formed on the half circumference of the single fiber, and no slit was observed was denoted as "half circumference crack". In Examples and Comparative Examples described later, in all the cases where there was a crack, the width of the crack was within the range of 1.0 to 30.0 μm . In the region, cracks were formed at a frequency that such a distribution form of 10 or less cracks being over substantially the entire area in the outer circumference direction of the region was present within a range of 1 cm in the fiber axis direction. In addition, the slit length was 100 μm or more in all the cases where there was a slit. In addition, the case where neither a crack nor a slit was observed was denoted as "none".

(5) Single Yarn Fineness

[0081] For each fiber before weaving, the fineness/the number of filaments was determined from the fineness and the number of filaments measured by the following method.

Fineness: JIS L 1013:2021 Testing methods for man-made filament yarns 8.3.1 (Correct mass fineness) a) method
Number of Filaments: JIS L 1013:2021 Testing methods for man-made filament yarns (8.4 Number of filaments)

[0082] For fibers after weaving, the false-twist textured yarn was taken out from the woven or knitted fabric after the dyeing processing, and the fineness and the number of filaments were measured in accordance with JIS L 1013 (2010) 8.3.1, method B and JIS L 1013 (2010) 8.4, respectively, to obtain a single yarn fineness by the fineness/the number of filaments.

[0083] In the case of the composite false-twist textured yarn, the composite false-twist textured yarn was wound without being composited for measurement, and evaluation was performed (single yarn fineness of false-twist textured yarn before crack formation). Furthermore, heat treatment equivalent to the dyeing processing, and in the case where alkali weight reduction processing has been performed, processing equivalent thereto are performed, and evaluation was performed (single yarn fineness of the false-twist textured yarn).

(6) Stretch recovery rate (CR)

[0084] The stretch recovery rate (CR) was measured according to JIS L 1013:2021, Testing methods for man-made filament yarns 8.12, except that a small skein (skein length: 20 cm, the number of turns: 1) produced from a false-twist textured yarn decomposed from the sample of the woven or knitted fabric in the present invention was used as a sample. The measurement was performed 5 times, and the result was obtained by rounding off the second decimal place of the average value to one decimal place. Note that in the case of the composite false-twist textured yarn, the composite false-twist textured yarn was wound without being composited for measurement, and heat treatment equivalent to the dyeing processing, and in the case where alkali weight reduction processing has been performed, processing equivalent thereto are performed, and evaluation was performed.

(7) Boiling water shrinkage rate

[0085] Using a false-twist textured yarn before crack formation as a sample, the boiling water shrinkage rate was measured according to JIS L 1013:2021 Testing methods for man-made filament yarns 8.18.1 (rate of dimensional change in hot water) a) method (rate of dimensional change in skein).

[0086] Note that in the case of the composite false-twist textured yarn, the composite false-twist textured yarn was wound without being composited for measurement, and evaluation was performed.

(8) Twist coefficient

[0087] The number of twists of a false-twist textured yarn or a composite false-twist textured yarn decomposed from the sample of the woven or knitted fabric in the present invention was measured according to JIS L 1013:2021 Testing methods for man-made filament yarns 8.13.1 (number of twists). The twist coefficient was calculated from the obtained number of twists according to the following formula.

Twist coefficient (K) = Number of twists (T/m) $\times \sqrt{(\text{fineness (dtex)} \times 0.9)}$.

(9) Stretchability of Woven or Knitted Fabric

[0088] An elongation rate in a direction along the false-twist textured yarn or the composite false-twist textured yarn of the present invention was measured in accordance with JIS L 1096 (2010) 8.16.1, method B. In a case where the false-twist textured yarn or the composite false-twist textured yarn of the present invention was used for both the warp and the weft, the elongation rate of each of the warp and the weft was measured, and an average value thereof was used as the result.

(10) Glare suppression degree

[0089] The woven or knitted fabric was dyed black, and the dyed woven or knitted fabric was observed using a digital microscope "VHX-2000" manufactured by KEYENCE CORPORATION. The observation conditions were a magnification of 50 times, illuminance settings of auto 60, a supercharge of 60 ms, and a gain of 0 dB. After the surface of the woven or knitted fabric was photographed under the above conditions, a region (S2) having a lightness of 200 to 255 was extracted from the entire observation region (S1), and the degree of glare suppression was calculated by the following formula.

$$\text{Degree of glare suppression} = 1/(S2/S1)$$

[0090] Three measurements were taken and their average was adopted as the result.

(11) Evaluation of grainy feeling, dryness, and resilience of woven or knitted fabric

[0091] Samples of the woven or knitted fabric in the present invention were subjected to sensory evaluation in five stages of very good (5 points), good (4 points), normal (3 points), not very good (2 points), and bad (1 point) by using 10 healthy adults (5 men and 5 women) as evaluators to evaluate the grainy feeling of the woven or knitted fabric visually and dryness and resilience thereof by touch, and an average value of the inspectors was rounded off to perform evaluation. For comparison, a woven fabric made of a false-twist textured yarn of polyethylene terephthalate having the same total fineness and the same number of filaments as those in Examples and Comparative Examples was defined as normal (three points).

[Example 1]

[0092] Polyethylene terephthalate having a weight-average molecular weight of 25,000 was used as the polyester-based thermoplastic resin A, polyethylene terephthalate having a weight-average molecular weight of 15,000 was used as the polyester-based thermoplastic resin B, and the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B were caused to flow into a composite fiber spinneret having 36 ejection holes so as to have a mass composition ratio of 50 : 50 at a spinning temperature of 290°C, with disposition of distribution holes in a final distribution plate installed most downstream among a plurality of distribution plates being in a shape illustrated in Fig. 5. Fig. 5 is a schematic view of a final distribution plate of the false-twist textured yarn of the present invention according to Example 1, in which a group of distribution holes 19 of the polyester-based thermoplastic resin B is formed in an eccentric core-sheath type around a group of distribution holes 18 of the polyester-based thermoplastic resin A among distribution holes in the final distribution plate.

[0093] In this way, a composite cross section of an eccentric core-sheath type (Fig. 2) in which the polyester-based thermoplastic resin A was contained in the polyester-based thermoplastic resin B was formed. Threads ejected from the spinneret were cooled by an air-cooling device, oiled, and wound up with a winder at a speed of 2600 m/min, and a composite fiber was stably obtained as a half drawn yarn having a total fineness of 240 dtex and 36 single yarn filaments. For this composite fiber, the above-described ($t_{\min}/D$) was 0.02, and the relationship between C_t and C was $C_t/C = 0.40$. In addition, $S_A : S_B = 50 : 50$.

[0094] Subsequently, using a friction false-twisting machine (ATF 12, manufactured by TMT Machinery Co., Ltd.), the half drawn yarn was fed from a feed roller, and the obtained composite fiber was subjected to false-twist texturing at a processing speed of 400 m/min, a pin draw ratio of 1.40 times, a pin temperature of 80°C, a heater draw ratio of 1.20 times, a heater temperature of 170°C, a false twist coefficient of 28,000, and a twisting direction of S, to obtain a false-twist textured yarn having a fineness of 143 dtex.

[0095] Next, the false-twist textured yarn was used as the warp and the weft, and a woven fabric having a plain texture having a warp density of 105 yarns/2.54 cm and a weft density of 90 yarns/2.54 cm was produced.

[0096] The woven fabric was further subjected to scouring, relaxation treatment, and intermediate thermal setting.

Thereafter, the alkali weight reduction processing (weight reduction rate 20%) was performed to form a crack and a slit on the single yarn surface of the false-twist textured yarn, and as the dyeing step, dyeing was performed at a concentration of 1.0 owf% and a temperature of 130°C for 30 minutes using a disperse dye "Dystar Navy BlueS-GL", and finishing thermal setting was performed at 160°C. At this time, the apparent thick-to-thin ratio ($D_{\text{thick}}/D_{\text{thin}}$) was 1.23, and the stretch recovery rate (CR) was 20.0%. The results are shown in Table 1.

[Example 2]

[0097] A false-twist textured yarn and a woven fabric were obtained in the same manner as in Example 1 except that the total fineness of the half drawn yarn was 270 dtex, the pin draw ratio was 1.45 times, and the heater draw ratio was 1.30 times in Example 1. The obtained false-twist textured yarn had an elongation recovery rate (CR) of 28.0% and the obtained woven fabric had an elongation rate of 25%, which means they had more excellent stretchability. The results are shown in Table 1.

[Example 3]

[0098] A false-twist textured yarn and a woven fabric were obtained in the same manner as in Example 1 except that the pin draw ratio was 1.35 times and the heater draw ratio was 1.20 times in Example 1. The results are shown in Table 1.

[Example 4]

[0099] A false-twist textured yarn and a woven fabric were obtained in the same manner as in Example 1 except that the pin draw ratio was 1.20 times and the heater draw ratio was 1.35 times in Example 1. The results are shown in Table 1.

[Example 5]

[0100] A false-twist textured yarn and a woven fabric were obtained in the same manner as in Example 2 except that the number of spinneret holes was changed to obtain a half drawn yarn having a total fineness of 240 dtex and 48 single yarn filaments. The results are shown in Table 1.

[Example 6]

[0101] A woven fabric was obtained in the same manner as in Example 2 except that in the false-twisting step, a half drawn yarn made of polyethylene terephthalate fibers were joined as another thread before a heater to form a composite false-twist textured yarn in which the mixing ratio of the false-twist textured yarn was 63% at a heater draw ratio of the other thread of 1.50 times, and the warp density was 88 yarns/inch (2.54 cm) and the weft density was 75 yarns/inch (2.54 cm). The obtained woven fabric had a more excellent grainy feeling due to the difference in dyeability between the false-twist textured yarn and the other thread. The results are shown in Table 1.

[Example 7]

[0102] A half drawn yarn was obtained in the same manner as in Example 1 except that the number of spinneret holes and the inflow amount of the polyester-based thermoplastic resin were changed to obtain a half drawn yarn having a total fineness of 113 dtex and 24 single yarn filaments. A composite false-twist textured yarn and a woven fabric were obtained in the same manner as in Example 6 using this half drawn yarn as another thread. In the obtained woven fabric, the obtained woven fabric had a more excellent grainy feeling due to the difference in dyeability between the false-twist textured yarn and the other thread, and further had a high CR of the other thread, and thus had excellent stretchability. The results are shown in Table 1.

[Example 8]

[0103] A woven fabric was obtained in the same manner as in Example 2 except that yarn twisting was performed on the false-twist textured yarn obtained in Example 2 with a twist coefficient of 3000 in the twisting direction S. The convergence of the false-twist textured yarn was improved by the yarn twisting, the passability through the weaving step was good, and further, the stretchability and the resilience of the woven fabric were equivalent to those in the case of not performing yarn twisting. The results are shown in Table 1.

[Example 9]

[0104] A woven fabric was obtained in the same manner as in Example 2 except that yarn twisting was performed on the false-twist textured yarn obtained in Example 2 with a twist coefficient of 3000 in a twisting direction Z. The convergence of the false-twist textured yarn was improved by the yarn twisting, and the passability through the weaving step was good. Furthermore, the stretchability of the woven fabric was the same as that in the case where no yarn twisting was performed. The results are shown in Table 1.

[Example 10]

[0105] A woven fabric was obtained in the same manner as in Example 2 except that yarn twisting was performed on the false-twist textured yarn obtained in Example 2 with a twist coefficient of 10000 in the twisting direction S. The convergence of the false-twist textured yarn was improved by the yarn twisting, and the passability through the weaving step was good. The results are shown in Table 1.

[Example 11]

[0106] A woven fabric was obtained in the same manner as in Example 1 except that polyester having a weight-average molecular weight of 25,000 obtained by copolymerizing isophthalic acid (IPA) with respect to an acid component in an amount of 10 mol% was used as the polyester-based thermoplastic resin A. The results are shown in Table 1.

[Example 12]

[0107] A woven fabric was obtained in the same manner as in Example 1 except that a polyester having a weight-average molecular weight of 19,000 was used as the polyester-based thermoplastic resin A. The results are shown in Table 1.

[Comparative Example 1]

[0108] A false-twist textured yarn and a woven fabric were obtained in the same manner as in Example 2 except that alkali weight reduction processing was not performed. Since the obtained woven fabric was not subjected to alkali weight reduction, cracks and slits were not formed, the glare suppression was low, and the worsted-wool appearance was poor. The results are shown in Table 2.

[Comparative Example 2]

[0109] Polyethylene terephthalate having a weight-average molecular weight of 20,000 was caused to flow into a fiber spinneret (round hole) having 36 discharge holes at a spinning temperature of 290°C. Threads ejected from the spinneret were cooled by an air-cooling device, oiled, and wound up with a winder at a speed of 2,600 m/min, to be stably wound up as a half drawn yarn having a total fineness of 240 dtex and 36 single yarn filaments. A false-twist texturing and a woven fabric were obtained in the same manner as in Example 2 except that this half drawn yarn was used. Since the obtained woven fabric was poor in stretchability and formed of one kind of thermoplastic resin, slits were not obtained even when alkali weight reduction was performed, and the worsted-wool appearance was poor because the degree of glare suppression was low. The results are shown in Table 2.

[Comparative Example 3]

[0110] A false-twist textured yarn and a woven fabric were obtained in the same manner as in Example 2 except that polyethylene terephthalate having a weight-average molecular weight of 20,000 was used as the polyester-based thermoplastic resin A and polyethylene terephthalate having a weight-average molecular weight of 19,000 was used as the polyester-based thermoplastic resin B. The obtained woven fabric was poor in stretchability and had a small difference in molecular weight, so that sufficient unevenness was not obtained at the joint interface of the composite fiber, cracks cannot be formed, and since the degree of glare suppression was low, the worsted-wool appearance was poor. The results are shown in Table 2.

[Comparative Example 4]

[0111] A woven fabric were obtained in the same manner as in Example 2 except that the spinneret used in Example 2,

which was the spinneret of the distribution plate type, was replaced with a spinneret of the type described in Japanese Patent Laid-open Publication No. H09-157941, to obtain a side-by-side type composite fiber constituted of the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B. In the case of the side-by-side type composite fiber, the polyester-based thermoplastic resin A was exposed at the time of the composite fiber, and no slit was formed even when alkali weight reduction was performed, so that the degree of glare suppression was low and the worsted-wool appearance was poor. The results are shown in Table 2.

[Comparative Example 5]

[0112] A woven fabric was obtained in the same manner as in Example 2 except that only draw was performed without passing through the twister of the false-twist texturing machine in Example 2. The obtained woven fabric had a smooth surface and was poor in dryness. The results are shown in Table 2.

[Comparative Example 6]

[0113] A false-twist texture having an apparent thick-to-thin ratio ($D_{\text{thick}}/D_{\text{thin}}$) of 1.02 and a woven fabric were obtained in the same manner as in Example 2 except that pin draw was not performed and the heater draw ratio was 1.68 times in the false-twist texturing of Example 2. In the obtained woven fabric, the thick-to-thin ratio of the false-twist textured yarn was small and the naturalness was low, and the structure in the longitudinal direction of the fiber was uniform, the orientation difference in the longitudinal direction of the molecules constituting the fiber was small, and cracks due to alkali weight reduction were not obtained, so that glare suppression was low, and the worsted-wool appearance was poor. The results are shown in Table 2.

[Comparative Example 7]

[0114] A false-twist texture having an apparent thick-to-thin ratio ($D_{\text{thick}}/D_{\text{thin}}$) of 3.20 was obtained at a pin draw ratio of 1.30 times and a heater draw ratio of 1.02 in the false-twist texturing in Example 2. A woven fabric was obtained in the same manner as in Example 2 except that the warp density was 88 yarns/inch (2.54 cm) and the weft density was 75 yarns/inch (2.54 cm). The obtained woven fabric had a large thick-to-thin ratio of the false-twist textured yarn and had a grain with mechanical contrasting density, and was poor in worsted-wool appearance. The results are shown in Table 2.

[Comparative Example 8]

[0115] A woven fabric were obtained in the same manner as in Example 2 except that the disposition of the distribution holes of the final distribution plate of the spinneret used was changed from that in Fig. 5 to Fig. 6 so that the value of the minimum value t_{min} of the thickness t of the polyester-based thermoplastic resin B covering the polyester-based thermoplastic resin A increased by 10 times, to obtain a core-sheath type composite fiber constituted of the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B and having (t_{min}/D) of 0.20. Fig. 6 is a schematic view of the final distribution plate according to the present Comparative Example 1, in which a group of distribution holes 19 of the polyester-based thermoplastic resin B is formed in an eccentric core-sheath type around a group of distribution holes 18 of the polyester-based thermoplastic resin A among distribution holes in the final distribution plate, but the minimum value t_{min} of the thickness t is as described above. In the obtained woven fabric, in which the polyester-based thermoplastic resin B covering the polyester-based thermoplastic resin A was thick, so that a joint interface was not exposed even when alkali weight reduction processing was performed, slits were not formed, and thus the degree of glare suppression was low, and the woven fabric was poor in worsted-wool appearance. In addition, the woven fabric was poor also in stretchability. The results are shown in Table 2.

[Table 1-1]

		Example	Example	Example	Example	Example	Example
		1	2	3	4	5	6
5	Composite fiber	Weight-average molecular weight (MA) of polyester-based thermo-plastic resin A	25000	25000	25000	25000	25000
10		Weight-average molecular weight (M3) of polyester-based thermo-plastic resin B	15000	15000	15000	15000	15000
15		M_A-M_b	10000	10000	10000	10000	10000
20		Copolymerization component of thermoplastic resin A					
25		Fiber cross-section	Eccentric core-sheath type	Eccentric core-sheath type	Eccentric core-sheath type	Eccentric core-sheath type	Eccentric core-sheath type
		t_{min}/D	0.02	0.02	0.02	0.02	0.02
		C_t/C	0.40	0.40	0.40	0.40	0.40
30		Spinning speed (m/min)	2600	2600	2600	2600	2600
35	False-twist texturing conditions	Hot pin draw ratio	1.40	1.45	1.35	1.20	1.45
		Heater draw ratio	1.20	1.30	1.20	1.30	1.30
40	False-twist textured yarn before crack formation	Fineness (dtex)	143	143	148	154	143
		Number of filaments	36	36	36	36	48
		Single yarn fineness (dtex)	4.0	4.0	4.1	4.3	2.7
		False-twist texturing (presence or absence/twisting direction)	Present/S	Present/S	Present/S	Present/S	Present/S
45		Boiling water shrinkage rate	5.4	5.4	5.4	5.4	5.2

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(continued)

		Example	Example	Example	Example	Example	Example
		1	2	3	4	5	6
5	False-twist textured yarn	Stretch recovery rate (CR (%))	20.0	28.0	23.0	26.0	28.0
10		Apparent thick-to-thin ratio ($D_{\text{thick}}/D_{\text{thin}}$)	1.23	1.13	1.54	2.50	1.23
15		Crack/slit configuration	Crack/Slit	Crack/Slit	Crack/Slit	Crack/Slit	Crack/Slit
		Crack depth (μm)	2.1	2.1	2.1	2.4	2.1
		Slit depth (μm)	1.2	1.2	1.2	1.4	1.2
		Single yarn fineness (dtex)	3.0	3.2	3.3	3.4	2.1
20		Twist yarn (direction/twist coefficient)					
25	Other thread	Materials					PET
		Stretch recovery rate (CR (%))					0.0
		Boiling water shrinkage rate					8.0
		Fineness (dtex)					113
30	Woven or knitted fabric	Stretchability (elongation rate (%))	20.0	25.0	25.0	23.0	25.0
35		Glare suppression degree	312	312	312	312	200
		Grainy fooling	4.0	4.0	5.0	3.0	4.0
		Dryness	5.0	5.0	5.0	5.0	3.0
40		Resilience	5.C	5.0	5.0	5.0	5.0

[Table 1-2]

		Example	Example	Example	Example	Example	Example
		7	8	9	10	11	12
Composite fiber	Weight-average molecular weight (MA) of polyester-oased thermo-plastic resin A	25000	25000	25000	25000	25000	19000
	Weight-average molecular weight (UE) of polyester-based thermo-plastic resin B	15000	15000	15000	15000	15000	15000
	M_A-M_B	10000	10000	10000	10000	10000	4000
	Copolymerization component of thermoplastic resin A					IPA 1C mol%	
	Fiber cross-section	Eccentric core-sheath type	Eccentric core-sheath type	Eccentric core-sheath type	Eccentric core-sheath type	Eccentric core-sheath type	Eccentric core-sheath type
	t_{min}/D	0.02	0.02	0.02	0.02	0.02	0.02
	C_t/C	0.40	0.40	0.40	0.40	0.40	0.40
	Spinning speed (m/min)	2600	2600	2600	2600	2600	2600
False-twist texturing conditions	Hot pin draw ratio	1.45	1.45	1.45	1.45	1.40	1.40
	Heater draw ratio	1.30	1.30	1.30	1.30	1.20	1.20
False-twist textured yarn before crack formation	Fineness (dtex)	143	143	143	143	143	143
	Number of filaments	36	36	36	36	36	36
	Single yarn fineness (dtex)	4.0	4.0	4.0	4.0	4.0	4.0
	False-twist texturing (presence or absence/twisting direction)	Present/S	Present/S	Present/S	Present/S	Present/S	Present/S
	Boiling water shrinkage rate	5.4	5.4	5.4	5.4	15.0	15.0

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(continued)

		Example	Example	Example	Example	Example	Example
		7	8	9	10	11	12
False-twist textured yarn	Stretch recovery rate (CR (%))	28.0	28.0	28.0	28.0	24.0	17.0
	Apparent thick-to-thin ratio ($D_{\text{thick}}/D_{\text{thin}}$)	1.23	1.13	1.13	1.13	1.23	1.23
	Crack/slit configuration	Crack/Slit	Crack/Slit	Crack/Slit	Crack/Slit	Crack/Slit	Crack/Slit
	Crack depth (μm)	2.1	2.1	2.1	2.1	5.6	1.5
	Slit depth (μm)	1.2	1.2	1.2	1.2	1.2	0.5
	Single yarn fineness (dtex)	3.2	3.2	3.2	3.2	3.2	3.2
	Twist yarn (direction/twist coefficient)		S/3000	Z/3000	S/10000		
Other thread	Materials	PET/PET					
	rate (CR (%))	43.0					
	Boiling water shrinkage rate	0.0					
	Fineness (dtex)	113					
Woven or knitted Fabric	Stretchability (elongation rate (%))	25.0	25.0	25.0	15.0	22.0	15.0
	Glare suppressor degree	280	312	312	312	312	200
	Grainy feeling	5.0	4.0	4.0	4.0	3.0	3.0
	Dryness	5.0	5.0	5.0	5.0	4.0	4.0
	Resilience	5.0	5.0	4.0	3.0	3.0	3.0

[Table 2-1]

			Comparative Example	Comparative Example	Comparative Example	Comparative Example
			1	2	3	4
5	Composite fiber	Weight-average molecular weight (MA) of polyester-based thermoplastic resin A	25000	20000	20000	25000
10		Weight-average molecular weight (MB) of polyester-based thermoplastic resin B	15000	-	19000	15000
		M_A-M_B	10000	-	1000	10000
15		Copolymerization component of thermoplastic resin A				
20		Fiber cross-section	Eccentric core-sheath type	Single component yarn	Eccentric core-sheath type	Side-by-side type
		$t_{\min}/D$	0.02	-	0.02	-
		C_t/C	0.40	-	0.40	-
		Spinning speed (m/min)	2600	2600	2600	2600
25	False-twist texturing conditions	Hot pin draw ratio	1.45	1.45	1.45	1.45
		Heater draw ratio	1.30	1.30	1.30	1.30
30	False-twist textured yarn before crack formation	Fineness (dtex)	143	143	143	143
		Number of filaments	36	36	36	36
		Single yarn fineness (dtex)	4.0	4.0	4.0	4.0
		False-twist texturing (presence or absence/twisting direction)	Present/S	Present/S	Present/S	Present/S
35		Boiling water shrinkage rate	5.4	5.3	5.3	5.3
40	False-twist textured yarn	Stretch recovery rate (CR (%))	20.0	14.0	16.0	18.0
		Apparent thick-to-thin ratio ($D_{\text{thick}}/D_{\text{thin}}$)	1.23	1.23	1.23	1.23
		Crack/slit configuration	Absent	Entire area crack	Entire area crack	Half circumference crack
		Crack depth (μm)				2.3
		Slit depth (m)				
45		Single yarn fineness (dtex)	3.2	3.2	3.2	3.2
		Twist yarn (direction/twist coefficient)				
50	Other thread	Materials				
		Extension recovery rate (CR (%))				
		Boiling water shrinkage rate				
55		Fineness (dtex)				

(continued)

		Comparative Example	Comparative Example	Comparative Example	Comparative Example
		1	2	3	4
5 10	Woven or knitted fabric	Stretchability (elongation rate (%))	20.0	10.0	11.0
		Glare suppression degree	100	120	120
		Grainy feeling	4.0	4.0	4.0
		Dryness	5.0	3.0	3.0
		Resilience	5.0	3.0	3.0

[Table 2-2]

		Comparative Example	Comparative Example	Comparative Example	Comparative Example
		5	6	7	8
20 25 30 35	Composite fiber	Weight-average molecular weight (MA) of polyester-based thermoplastic resin A	25000	25000	25000
		Weight-average molecular weight (MB) of polyester-based thermoplastic resin B	15000	15000	15000
		M _A -M _B	10000	10000	10000
		Copolymerization component of thermoplastic resin A			
		Fiber cross-section	Eccentric core-sheath type	Eccentric core-sheath type	Eccentric core-sheath type
		t _{min} /D	0.02	0.02	0.02
		C _t /C	0.40	0.40	0.40
		Spinning speed (m/min)	2600	2600	2600
40	False-twist texturing conditions	Hot pin draw ratio	1.45	-	1.30
		Heater draw ratio	1.30	1.68	1.02
45 50	False-twist textured yarn before crack formation	Fineness (dtex)	143	160	203
		Number of filaments	36	36	36
		Single yarn fineness (dtex)	4.0	4.4	5.6
		False-twist texturing (presence or absence/twisting direction)	Absent/-	Present/S	Present/S
		Boiling water shrinkage rate	5.6	5.7	8.9

(continued)

5			Comparative Example	Comparative Example	Comparative Example	Comparative Example
			5	6	7	8
10 15	False-twist textured yarn	Stretch recovery rate (CR (%))	10.0	20.0	17.0	16.0
		Apparent thick-to-thin ratio ($D_{\text{thick}}/D_{\text{thin}}$)	1.23	1.02	3.20	1.23
		Crack/slit configuration	Crack/Slit	Half circumference slit	Crack/Slit	Half circumference crack
		Crack depth (μm)	2.3		5.7	2.3
		Slit depth (μm)		1.2	1.2	
		Single yarn fineness (dtex)	3.2	3.6	4.5	3.2
		Twist yarn (direction/twist coefficient)				
20 25	Other thread	Materials				
		Extension recovery rate (CR (%))				
		Boiling water shrinkage rate				
		Fineness (dtex)				
30	Woven or knitted fabric	Stretchability (elongation rate (%))	8.0	20.0	15.0	14.0
		Glare suppression degree	180	100	312	30
		Grainy feeling	2.0	1.0	1.0	4.0
		Dryness	2.0	5.0	5.0	5.0
		Resilience	2.0	5.0	4.0	4.0

35 DESCRIPTION OF REFERENCE SIGNS

[0116]

- 1: Polyester-based thermoplastic resin A
 2: Polyester-based thermoplastic resin B
 3: Thickness t of polyester-based thermoplastic resin B covering polyester-based thermoplastic resin A
 4: False-twist textured yarn
 5: Crack
 6: Slit
 7: Composite fiber
 8: First feed roller
 9: Hot pin
 10: Second feed roller
 11: Heater
 12: Twister
 13: Third feed roller
 14: False-twist textured yarn or composite false-twist textured yarn
 15: Winding unit
 16: Other thread
 17: Fourth feed roller
 18: Distribution hole of polyester-based thermoplastic resin A
 19: Distribution hole of polyester-based thermoplastic resin B

Claims

1. A false-twist textured yarn comprising a polyester-based thermoplastic resin A and a polyester-based thermoplastic resin B, the false-twist textured yarn satisfying following requirements:

(1) a difference ($M_A - M_B$) between a weight-average molecular weight M_A of the polyester-based thermoplastic resin A and a weight-average molecular weight M_B of the polyester-based thermoplastic resin B is 2,000 to 15,000;

(2) the polyester-based thermoplastic resin A and the polyester-based thermoplastic resin B are eccentrically joined;

(3) an apparent thick-to-thin ratio ($D_{\text{thick}}/D_{\text{thin}}$) of the false-twist textured yarn is 1.05 to 3.00; and

(4) the false-twist textured yarn has a slit in a fiber axis direction and a crack in a direction substantially orthogonal to the fiber axis direction on a surface of the false-twist textured yarn.

2. The false-twist textured yarn according to claim 1, wherein the false-twist textured yarn has a single yarn fineness of 3.0 dtex or more.

3. The false-twisted yarn according to claim 1 or 2, wherein the false-twist textured yarn has a stretch recovery rate (CR) of 25.0% or more.

4. A composite false-twist textured yarn comprising the false-twist textured yarn according to any one of claims 1 to 3 and at least one kind of another thread.

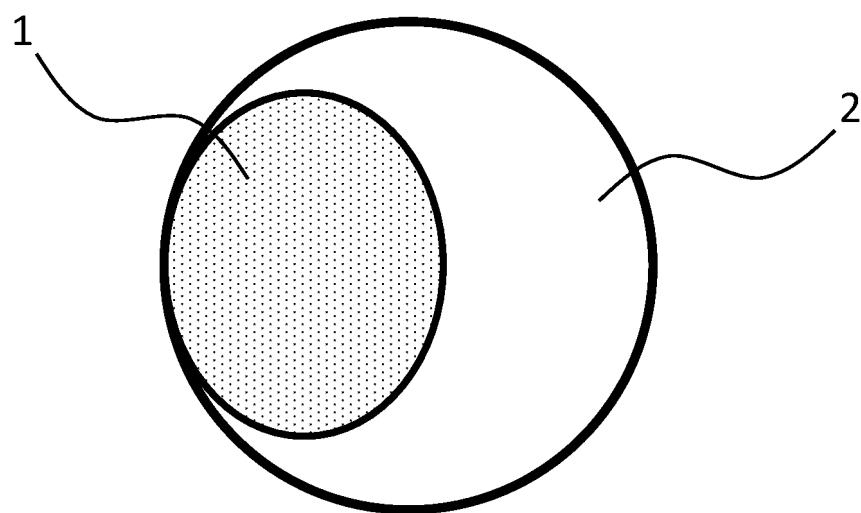
5. The composite false-twist textured yarn according to claim 4, wherein the other thread is an explicit crimping yarn.

6. A twist yarn comprising any one of the false-twist textured yarn according to any one of claims 1 to 3, and the composite false-twist textured yarn according to claim 4 or 5, wherein the twist yarn has a twist coefficient of 1200 to 6000.

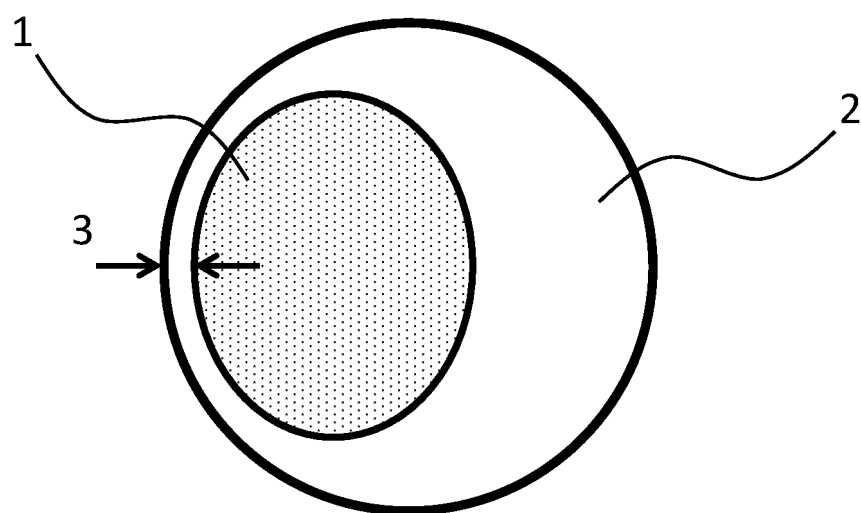
7. A woven or knitted fabric comprising any one of the false-twist textured yarn according to any one of claims 1 to 3, the composite false-twist textured yarn according to claim 4 or 5, and the twist yarn according to claim 6 in at least a part of the woven or knitted fabric.

8. Clothing comprising the woven or knitted fabric according to claim 7 in at least a part of the clothing.

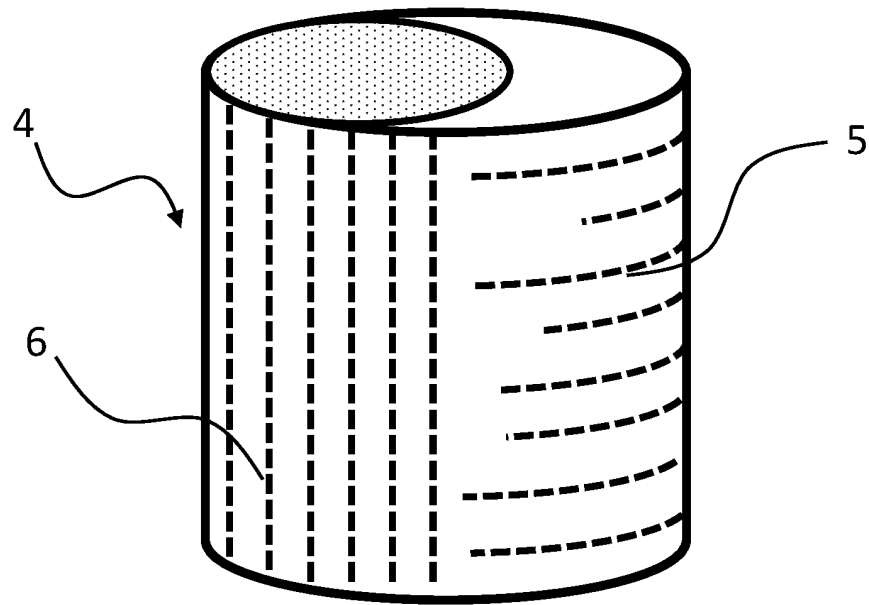
[Fig. 1]



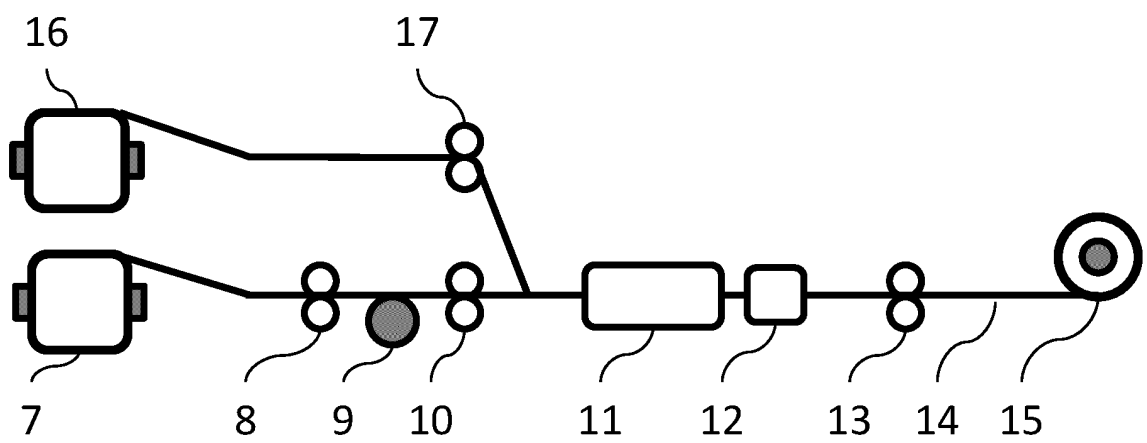
[Fig. 2]



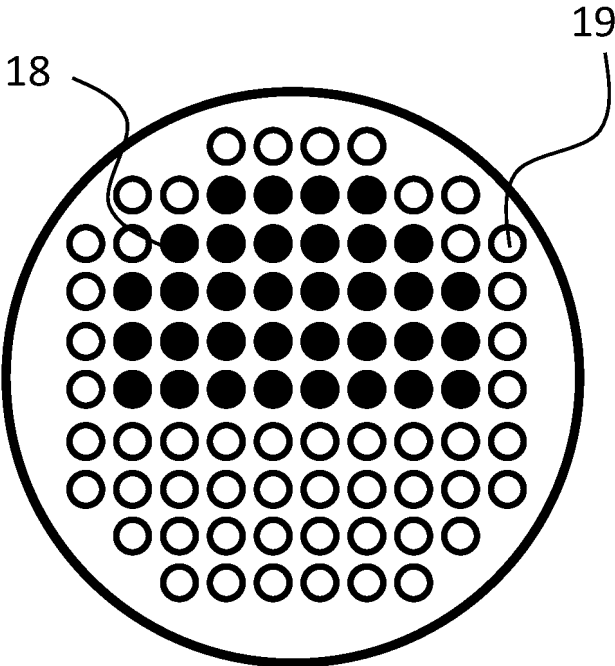
[Fig. 3]



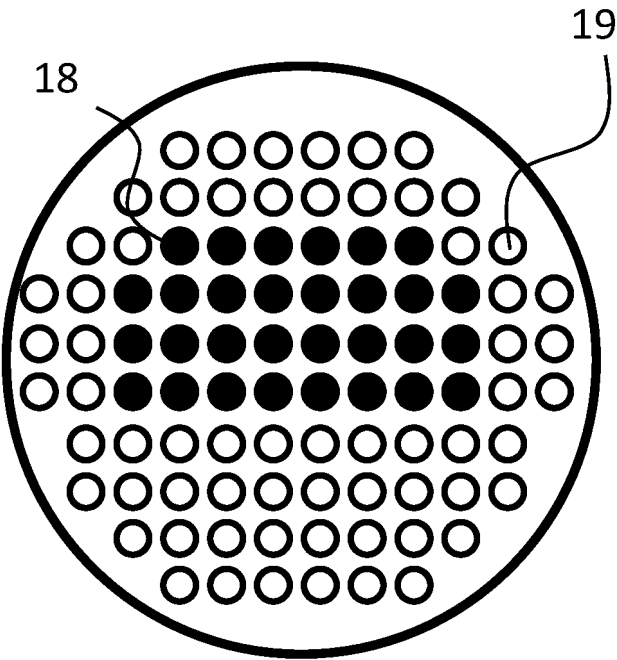
[Fig. 4]



[Fig. 5]



[Fig. 6]



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2023/023110

A. CLASSIFICATION OF SUBJECT MATTER

D01F 8/14(2006.01)i; **D02G 1/02**(2006.01)i

FI: D01F8/14 B; D02G1/02 A

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)

D01F8/00-8/18; D02G1/00-3/48; D02J1/00-13/00

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

Published examined utility model applications of Japan 1922-1996
 Published unexamined utility model applications of Japan 1971-2023
 Registered utility model specifications of Japan 1996-2023
 Published registered utility model applications of Japan 1994-2023

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2004-124271 A (MITSUBISHI RAYON CO., LTD.) 22 April 2004 (2004-04-22) claims 1, 5, paragraphs [0006], [0016], [0018]-[0022], [0044], [0052], [0073], examples	1-8
Y	JP 2005-273116 A (HYOSUNG CORP.) 06 October 2005 (2005-10-06) claims 1-4, paragraph [0009]	1-8
Y	JP 2006-507421 A (KOLON INDUSTRIES, INC.) 02 March 2006 (2006-03-02) claims 1, 2, 4, paragraph [0022], examples	1-8
Y	JP 2003-293226 A (NIPPON ESTER CO., LTD.) 15 October 2003 (2003-10-15) claims 1, 2, paragraphs [0013], [0018], examples	1-8
Y	JP 62-69820 A (NIPPON ESTER CO., LTD.) 31 March 1987 (1987-03-31) claim 1, page 5, lower left column, lines 13-17, page 6, lower left column, line 8 from the bottom to line 3, fig. 1, 3-5	1-8
Y	JP 50-123922 A (TEIJIN LTD.) 29 September 1975 (1975-09-29) claim 1, page 1, lower left column, lines 12-15, page 2, lower right column, lines 8-14	1-8
A	JP 2001-200445 A (MITSUBISHI RAYON CO., LTD.) 27 July 2001 (2001-07-27)	1-8

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

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"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
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