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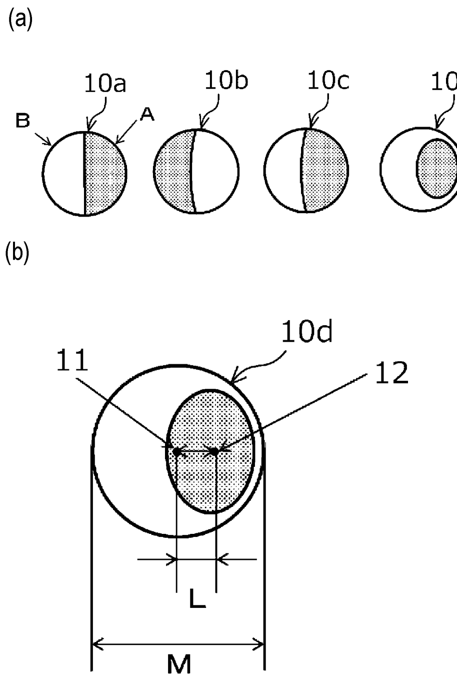
(54) **CRIMPED POLYAMIDE YARN, FALSE TWISTED YARN AND FABRIC**

(57) The present invention provides a latently crimped polyamide conjugate fiber which is suppressed in shrinkage rate variation and has few crepes or wrinkles due to dyeing speck or crimp unevenness, thereby having good quality. A crimped polyamide yarn according to the present invention is formed of a side-by-side type or eccentric core-sheath type polyamide conjugate fiber, and has a wet heat shrinkage stress variation rate of 150% or less.

FIG. 1



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Description

TECHNICAL FIELD

[0001] The present invention relates to a crimped yarn, a false twisted yarn and a fabric including side-by-side or eccentric sheath-core conjugate polyamide fibers.

BACKGROUND ART

[0002] In the related art, a polyamide fiber is softer and has a better tactile than a polyester fiber, and is widely used in clothing applications. A single fiber made of one kind of polymer, such as nylon 6 or nylon 66, which is a representative of polyamide fibers for clothing, has little stretchability in itself, and by false twisting or the like, the single fiber is imparted with the stretchability, and is used for a stretchable woven or knitted fabric. However, it has been difficult to obtain a woven or knitted fabric having sufficiently satisfactory stretchability from such a single fiber subjected to processing such as false twisting.

[0003] Therefore, there is a method of obtaining a stretchable woven or knitted fabric by using elastic fibers, or a method of obtaining a stretchable woven or knitted fabric by combining two kinds of polymers having different properties to form a conjugate fiber having a latent crimping property in which crimps are exhibited by a heat treatment such as a dyeing process.

[0004] Further, as a conjugate polyamide fiber having a latent crimping property, a conjugate fiber in which two kinds of polyamides having a difference in viscosity are arranged in a side-by-side or eccentric sheath-core has also been proposed (see Patent Literatures 1, 2, and 3).

[0005] For example, Patent Literature 1 discloses a false twisted yarn of a side-by-side conjugate yarn including a resin composition constituted by polymetaxylene adipamide and polyamide 6 as one component. Further, Patent Literature 2 discloses a latently crimped polyamide yarn in which two kinds of polyamides having a difference in viscosity, which are made of nylon 6/66 copolymer as a high viscosity polymer and nylon 6 as a low viscosity polymer, are laminated in side-by-side. Furthermore, Patent Literature 3 discloses a side-by-side or eccentric sheath-core conjugate polyamide fiber for false twisting that includes nylon 610 or nylon 612, which is low water absorptive polyamide, as one component.

CITATION LIST

PATENT LITERATURE

[0006]

Patent Literature 1: JP2014-80717A
Patent Literature 2: JP2009-57679A
Patent Literature 3: JP2018-3190A

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0007] However, in the conjugate fibers obtained by bonding two kinds of polymers having different characteristics described in Patent Literatures 1 and 2, slight variation in viscosity of each polymer changes a stress applied to each polymer during a spinning and drawing process, and thus variation occurs in orientation and crystallinity of each fiber in a longitudinal direction, a crimped yarn or a false twisted yarn obtained from the conjugate fibers has large variation in a shrinkage rate, and there is a problem that a dyeing speck, a crimped spot, and the like occur. Further, even if a raw yarn or a processed yarn is excellent in crimpability, in a wet-heat process of scouring and dyeing of the woven or knitted fabric, wrinkles peculiar to the polyamide fibers are likely to occur, and the generated wrinkles are difficult to remove, and thus it is necessary to apply tension to the woven or knitted fabric during the wet-heat process. As described above, in the conjugate polyamide fibers described in Patent Literatures 1 and 2, since the tension is applied to the woven or knitted fabric in the wet-heat process, there is a problem that crimps of the raw yarn or the processed yarn cannot be sufficiently exhibited, resulting in the woven or knitted fabric having poor stretchability.

[0008] Patent Literature 3 discloses that, in order to solve the problem of occurrence of the wrinkles in the polyamide conjugate fiber, by using the side-by-side or eccentric sheath-core conjugate polyamide fiber that includes nylon 610 or nylon 612, which is the low water absorptive polyamide, as one component, the wrinkles are less likely to occur in the wet-heat process such as dyeing during woven or knitted fabric production, and sufficient stretchability can be provided.

However, as in Patent Literatures 1 and 2, slight variation in viscosity causes variation in orientation and crystallinity of the fiber, and there are problems such as variation in shrinkage rate, dyeing specks, and crimped spot in the crimped yarn and the false twisted yarn.

[0009] Therefore, an object of the present invention is to solve the above problems, and to provide a crimped polyamide yarn which reduces variation in shrinkage rate and has good quality with less grains and wrinkles due to a dyeing speck and a crimped spot.

SOLUTION TO PROBLEM

[0010] In order to achieve the above object, a crimped polyamide yarn and a false twisted yarn according to the present invention have the following configurations.

(1) A crimped polyamide yarn including:

a side-by-side conjugate polyamide fiber or eccentric sheath-core conjugate polyamide fiber, in which
the crimped polyamide yarn has a wet-heat-shrinkage stress variation rate of 150% or less.

(2) The crimped polyamide yarn according to (1), in which
two kinds of polyamides having different shrinkage characteristics are laminated in a side-by-side or an eccentric sheath-core.
(3) The crimped polyamide yarn according to (1) or (2), having a wet-heat-shrinkage stress of 0.001 cN/dtex to 0.50 cN/dtex.
(4) The crimped polyamide yarn according to any one of (1) to (3), having a stretch elongation rate of 15% to 100%.
(5) A false twisted yarn including:
the crimped polyamide yarn according to any one of (1) to (4).
(6) The false twisted yarn according to (5), having a wet-heat-shrinkage stress variation rate of 150% or less.
(7) The false twisted yarn according to (5), having a stretch elongation rate of 70% to 300%.
(8) A fabric including:
the false twisted yarn according to (7).

ADVANTAGEOUS EFFECTS OF INVENTION

[0011] According to the present invention, it is possible to provide a stretchable polyamide woven or knitted fabric which reduces variation in shrinkage rate, which is a problem of a crimped polyamide yarn and a false twisted yarn, and has good quality with less grains and wrinkles due to a dyeing speck and a crimped spot.

BRIEF DESCRIPTION OF DRAWINGS

[0012]

[FIG. 1] FIG. 1 includes diagrams illustrating a form of a conjugate fiber, (a) of FIG. 1 shows cross-sectional views illustrating embodiments of side-by-side conjugate fibers and an eccentric sheath-core conjugate fiber, and (b) of FIG. 1 is a view illustrating an eccentric arrangement in the eccentric sheath-core conjugate fiber.
[FIG. 2] FIG. 2 is a schematic process diagram showing an embodiment of a production apparatus preferably used as a method for producing a crimped polyamide yarn according to the present invention.

DESCRIPTION OF EMBODIMENTS

[0013] Hereinafter, the present invention will be described in more detail.
[0014] In this specification, "mass" is synonymous with "weight".
[0015] A crimped polyamide yarn according to the present invention includes a side-by-side or eccentric sheath-core conjugate polyamide fiber and has a wet-heat-shrinkage stress variation rate of 150% or less.

<Two Kinds of Polyamides (PA) Having Different Shrinkage Characteristics>

[0016] A side-by-side or eccentric sheath-core structure of the conjugate polyamide fiber forming the crimped polyamide yarn according to the present invention is preferably formed by two kinds of polyamides having different shrinkage characteristics. That is, the conjugate polyamide fiber is formed by selecting a crystalline polyamide (A) and a crystalline polyamide (B) as two polyamides having different shrinkage characteristics. In the case where both components are constituted by polyamides, an affinity of a conjugate interface is high, interfacial peeling can be prevented, a cross-sectional variation and a cross-sectional shape defect are reduced, and oiling and interlacing can be uniformly applied, and thus it is possible to obtain a crimped polyamide yarn with little variation in oil content and interlacement.

[0017] Examples of the polyamide include nylon 6, nylon 66, nylon 4, nylon 11, nylon 12, nylon 410, nylon 510, nylon 610, nylon 612, and a copolymer containing these as main components.

[0018] The shrinkage characteristics of the crystalline polyamide (A) and the crystalline polyamide (B) are not particularly limited as long as effects of the present invention are not impaired, and it is preferable that a difference in boiling-water-shrinkage rate is 5.0% or more in the case where each polymer is spun as a single yarn. A practical upper limit of the difference in boiling-water-shrinkage rate is 40%.

[0019] The boiling-water-shrinkage rate is calculated from the following formula by taking a single yarn of 33 dtex and 12 filaments of the polymer in skein and applying a load of 90 mg/dtex for 30 seconds to determine a length B, immersing the single yarn in boiling water at 100°C for 20 minutes, air-drying the single yarn, and applying a load of 90 mg/dtex for 30 seconds to obtain a length A.

$$\text{Boiling-water-shrinkage rate (\%)} = [(B - A)/B] \times 100$$

<Crystalline Polyamide (A)>

[0020] The crystalline polyamide (A) is a polyamide different from the crystalline polyamide (B) among the polyamides shown above. Examples of the crystalline polyamide (A) preferably include nylon 6, nylon 66, nylon 4, nylon 610, nylon 11, nylon 12, or the like, and a copolymer containing these as main components.

[0021] The crystalline polyamide (A) can contain a component other than a lactam, an aminocarboxylic acid, a diamine, and a dicarboxylic acid in a repeated structure as long as the effects of the present invention are not impaired.

[0022] Further, from the viewpoint of a yarn producing property, strength, and an anti-peeling property, the crystalline polyamide (A) is preferably a polymer in which 90 mol% or more of the repeated structure is a single lactam, the aminocarboxylic acid, or a combination of the diamine and the dicarboxylic acid, and more preferably a polymer in which 95 mol% or more of the repeated structure is the single lactam, the aminocarboxylic acid, or the combination of the diamine and the dicarboxylic acid.

<Crystalline Polyamide (B)>

[0023] The crystalline polyamide (B) may be any polymer as long as the polymer has a shrinkage characteristic different from that of the crystalline polyamide (A). Examples of the crystalline polyamide (B) include the polyamides shown above. The crystalline polyamide (B) is preferably nylon 6, nylon 66, nylon 4, nylon 610, nylon 11, nylon 12, or the like, and a copolymer containing these as main components, and among these, a polymer in which 90 mol% or more of a repeated structure is a single lactam, an aminocarboxylic acid, or a combination of a diamine and a dicarboxylic acid is preferred, and a polymer in which 95 mol% or more of the repeated structure is the single lactam, the aminocarboxylic acid or the combination of the diamine and the dicarboxylic acid is more preferable.

<Combination of Polyamides>

[0024] A combination of the crystalline polyamide (A) and the crystalline polyamide (B) in the conjugate polyamide fiber is preferably nylon 610 or nylon 612 and nylon 6. By adopting such a configuration, it is possible to form a fabric which exhibits an excellent crimping property and has an excellent texture, durability, and soft stretchability.

<Additives>

[0025] If necessary, a pigment, a heat stabilizer, an antioxidant, a weathering agent, a flame retardant, a plasticizer, a mold releasing agent, a lubricant, a foaming agent, an antistatic agent, a moldability improver, a reinforcing agent, and the like can be added to and blended with the crystalline polyamide (A) and the crystalline polyamide (B).

<Conjugate Type>

[0026] The conjugate polyamide fiber forming the crimped polyamide yarn according to the present invention has a conjugate cross section formed by joining two kinds of crystalline polyamides having different shrinkage characteristics. The two kinds of crystalline polyamides are preferably present in an attached state without being substantially separated.

Examples of a form of the conjugate cross section include a side-by-side type (reference numerals 10a to 10c) and an eccentric sheath-core type (reference numeral 10d) as shown in (a) of FIG. 1. In the eccentric sheath-core conjugate polyamide fiber 10d, the crystalline polyamide (A) (symbol A) as a core component is covered with the crystalline polyamide (B) (symbol B) as a sheath component. In the eccentric sheath-core conjugate polyamide fiber 10d shown in (a) of FIG. 1, although a configuration in which the crystalline polyamide (A) constitutes a core portion is shown, the core portion may be constituted by the crystalline polyamide (B) as long as the eccentric sheath-core conjugate polyamide fiber 10d is constituted by two components having different shrinkage characteristics. Specifically, a configuration in which a polyamide on a low shrinkage side is positioned in the core portion and a high shrinkage polyamide having a higher shrinkage characteristic than the low shrinkage polyamide is a sheath portion may be adopted, or a reverse configuration may be adopted.

[0027] An interface between the crystalline polyamide (A) and the crystalline polyamide (B) in the cross section of the conjugate polyamide fiber may be flat or smooth. Further, the interface of attachment may be straight or curved. In the case where a conjugate form of the conjugate polyamide fiber is the side-by-side type or the eccentric sheath-core type, the crimps are exhibited due to a difference in shrinkage between the two components.

[0028] A conjugate ratio of the crystalline polyamide (A) and the crystalline polyamide (B) is preferably such that an area ratio of the crystalline polyamide (A) to the crystalline polyamide (B) in the fiber cross section perpendicular to a longitudinal direction of the fiber is 2:1 to 1:2.

[0029] In the eccentric sheath-core conjugate polyamide fiber, as shown in (b) of FIG. 1, it is more preferable that a ratio L/M of a distance L between a center 11 of the eccentric sheath-core conjugate polyamide fiber 10d and a center 12 of the crystalline polyamide (A) that is the core portion to a length M between intersections of a straight line extending the distance L and an outer circumference of the yarn is 1/8 to 1/2. A center of the core portion refers to a position of a center of gravity of the core portion in the fiber cross section.

<Wet-Heat-Shrinkage Stress Variation Rate/Crimped Yarn/False Twisted Yarn>

[0030] The crimped polyamide yarn according to the present invention has the wet-heat-shrinkage stress variation rate of 150% or less.

[0031] In the case where the wet-heat-shrinkage stress variation rate is 150% or less, variation in shrinkage rate of a yarn under wet-heat condition such as a scouring process or a dyeing process is prevented, and dyeing specks and crimped spot during these processes can be reduced. As a result, a woven or knitted fabric having good quality and excellent stretchability can be obtained.

[0032] On the other hand, in the case where the wet-heat-shrinkage stress variation rate is more than 150%, the dyeing specks and the crimped spots are likely to occur in the scouring process and the dyeing process, the quality becomes inferior, and stretchability of a woven fabric is also reduced.

[0033] The wet-heat-shrinkage stress variation rate is preferably 120% or less. Further, a practical lower limit of the wet-heat-shrinkage stress variation rate is 50%.

[0034] It is preferable that the false twisted yarn constituted by the crimped polyamide yarn according to the present invention has a wet-heat-shrinkage stress variation rate of 150% or less. The wet-heat-shrinkage stress variation rate of the false twisted yarn is more preferably 120% or less, and a practical lower limit of the wet-heat-shrinkage stress variation rate is 0.5%. In the case where the wet-heat-shrinkage stress variation rate of the false twisted yarn is in the above range, variation in shrinkage rate of the false twisted yarn under the wet-heat conditions is prevented, and thus it is possible to reduce the dyeing specks and the crimped spots in a processing step.

[0035] The wet-heat-shrinkage stress variation rate referred to herein is variation (CV%) when a shrinkage stress generated when a heat treatment is performed while moving the fiber under the wet-heat conditions is continuously measured in a fiber axial direction using a continuous heat shrinkage measuring device "FTA-500" manufactured by Toray Engineering Co., Ltd. In "FTA-500", the yarn moves between a yarn feeding roller and a yarn withdrawal roller, and is subjected to a wet-heat treatment in a heated water tank between these rollers, and the shrinkage stress is continuously measured with a tension measuring device provided behind the yarn.

[0036] A frequency of measurement of the shrinkage stress per yarn is 6 times per 1 cm, an average value of the 6 measurements is taken as one data, 1000 or more data are collected, and from the obtained 1000 data, an average value f_{ave} and a standard deviation of are calculated, and thus the wet-heat-shrinkage stress variation rate is calculated according to the following formula.

$$\text{Wet-heat-shrinkage stress variation rate (\%)} = (\text{standard deviation } \sigma f)/(\text{average value } f_{ave}) \times 100$$

[0037] Measurement conditions are as follows: the yarn to be measured is 25 m, a speed ratio between a delivery roller and a take-off roller is set to 99/100, a preset temperature of the heated water tank is set to 100°C, and a yarn speed is set to 5 m/min.

<Wet-Heat-Shrinkage Stress>

[0038] The average value f_{ave} of the shrinkage stress obtained by the measurement of the continuous heat shrinkage measuring device "FTA-500" is measured according to JIS L1013 (2010) and divided by total fineness to obtain the wet-heat-shrinkage stress.
[0039] The crimped polyamide yarn according to the present invention preferably has the wet-heat-shrinkage stress of 0.001 cN/dtex to 0.50 cN/dtex. In such a range, it is possible to exhibit a sufficient coil crimp even in a fabric in which the yarn is constrained, so that a woven or knitted fabric having excellent stretchability can be obtained.
[0040] The wet-heat-shrinkage stress is more preferably 0.002 cN/dtex to 0.40 cN/dtex.

<Total Fineness and Single Yarn Fineness>

[0041] A total fineness of the crimped polyamide yarn is preferably 20 dtex to 200 dtex in consideration of clothing applications. Further, the single yarn fineness is not limited as long as the effects of the present invention are not impaired, and is preferably 1.0 dtex to 6.0 dtex when used for sports wear, down jackets, outer, and inner applications.

<Elongation>

[0042] An elongation of the crimped polyamide yarn is preferably 50% to 80%. In such a range, an actual number of twists to be performed in a false twisting process becomes appropriate, a uniform crimp is imparted to the obtained processed yarn, and a processed yarn is obtained in which a temporal change of the crimp and a decrease in the crimp due to repeated tension are small.

<Stretch Elongation Rate >

[0043] A stretch elongation rate of the crimped polyamide yarn according to the present invention is preferably 15% or more. Within this range, the sufficient coil crimp is exhibited, and the woven fabric having good soft stretchability can be obtained.
[0044] A practical upper limit of the stretch elongation rate is 100%. The stretch elongation rate of the crimped polyamide yarn is more preferably 16% or more, and further preferably 17% or more.
[0045] The stretch elongation rate of the false twisted yarn according to the present invention is preferably 70% or more. Within this range, the sufficient coil crimp is exhibited, and the woven fabric having good soft stretchability can be obtained.
[0046] A practical upper limit of the stretch elongation rate is 300%. The stretch elongation rate of the false twisted yarn is more preferably 75% or more, and further preferably 80% or more.
[0047] The stretch elongation rate is calculated by the following formula by preparing a loop having a circumference of 1 m using the yarn, immersing the loop in boiling water at a temperature of 90°C for 20 minutes, air-drying the loop, applying a load of 1.8 mg/dtex for 30 seconds to determine a length A, and applying a load of 90 mg/dtex for 30 seconds to determine a length B.

$$\text{Stretch elongation rate (\%)} = [(B - A)/B] \times 100$$

<Producing Method>

[0048] A method for producing the crimped polyamide yarn according to the present invention will be described.
[0049] In the method for producing the crimped polyamide yarn according to the present invention, it is preferable that the polyamide on the low shrinkage side is prevented from an increase in viscosity during melt retention. It is known that a polymerization reaction of the polyamides proceeds due to the retention during melt spinning, resulting in the increase in viscosity. Therefore, by adjusting a chip moisture content of the polyamide on the low shrinkage side and controlling a polymerization equilibrium reaction, it is possible to prevent the increase in viscosity due to the retention during the melt spinning.
[0050] The polyamide on the low shrinkage side preferably satisfies $\eta s - \eta 0 \leq 50$ poises, in which $\eta 0$ represents a melt viscosity immediately after melting in the melt spinning, and ηs is a melt viscosity immediately before a yarn is

discharged from a spinneret. In the case where ηs - η0 is 50 poises or less, the increase in viscosity of the low shrinkage polyamide is prevented, a stress during the spinning and drawing is appropriately applied to the high shrinkage polyamide, and a difference in orientation occurs, resulting in desirable latent crimps. ηs - η0 is more preferably -150 poises ≤ ηs - η0 ≤ 50 poises. In the case where ηs-η0 is set to -150 poises or more, variation in melt viscosity of the polymer in a spinning pipe is prevented, a fiber structure of the conjugate fiber can be stabilized, variation in shrinkage rate of the crimped yarn or the false twisted yarn under the wet-heat conditions such as a scouring process or a dyeing process is prevented, and dyeing specks or crimped spots during these processes are reduced.

[0051] In the case where nylon 610 having a sulfuric acid relative viscosity of 2.7 is used as the low shrinkage polyamide, a chip moisture content is preferably 600 ppm to 1800 ppm. In the case where a moisture content of the polyamide is 1800 ppm or less, a hydrolysis of the polyamide is prevented when the polyamide retains in a weld fusion zone, the pipe, and the spinneret, and an extreme decrease in viscosity does not occur, and thus variation in melt viscosity is stabilized. Further, yarn bending during discharge from the spinneret is prevented, and stable operation becomes possible.

[0052] The sulfuric acid relative viscosity is determined by dissolving 0.25 g of polyamide in 25 ml of sulfuric acid having a concentration of 98% by mass so as to form 1 g/100 ml, measuring a flow-down time (T1) at a temperature of 25°C using an Ostwald viscometer, and calculating a ratio T1/T2 of T1 to a flow-down time (T2) of only sulfuric acid having a concentration of 98% by mass.

[0053] A difference in sulfuric acid relative viscosity between the crystalline polyamide (A) and the crystalline polyamide (B) is not limited as long as the effects of the present invention are not impaired, and is preferably in the range of 0.5 to 1.0. In the case where the difference in sulfuric acid relative viscosity is 0.5 or more, a difference in stress applied to each polyamide at the time of producing the yarn easily occurs, the difference in orientation occurs, and a high latent crimping property is obtained. Further, in the case where the difference in sulfuric acid relative viscosity is 1.0 or less, the yarn bending due to the difference in viscosity at the time of producing the yarn is prevented, and it is possible to stably produce the yarn.

[0054] A difference in melt viscosity between the crystalline polyamide (A) and the crystalline polyamide (B) is preferably 1000 poises or less. In the case where the difference in melt viscosity is 1000 poises or less, the yarn bending at the time of discharging the yarn from the spinneret is prevented, and it is possible to stably produce the yarn, which is preferable. The difference in melt viscosity is more preferably 600 poises to 1000 poises. In the case where the difference in melt viscosity is 600 poises or more, the difference in stress applied to each polyamide during the spinning is likely to occur, the difference in orientation occurs, and a conjugate polyamide fiber excellent in the latent crimping property is likely to be obtained.

[0055] The conjugate polyamide fiber forming the crimped polyamide yarn according to the present invention has a conjugate cross section in which two kinds of crystalline polyamides are joined together. In the side-by-side conjugate polyamide fiber, in the case where the difference between the melt viscosities of the two kinds of polyamides is large, due to difference in polymer flow resistance at the time of discharging the yarn from the spinneret and a difference in flow speed, the yarn bending tends to occur and the stability of yarn production tends to deteriorate. Therefore, in the production of the conjugate polyamide fiber using the crystalline polyamide (A) and the crystalline polyamide (B) having the difference in melt viscosity, the eccentric sheath-core type is preferably adopted from the viewpoint of yarn producing stability.

[0056] Next, a producing method by high-speed direct spinning will be described.

[0057] The crystalline polyamide (A) and the crystalline polyamide (B) are separately melted, weighed and transported using a gear pump, a conjugate flow is formed so as to form a side-by-side shape or an eccentric sheath-core shape by an ordinary method as it is, and the conjugate flow is discharged from the spinneret so as to form a cross section illustrated in (a) of FIG. 1 using the spinneret for the side-by-side or eccentric sheath-core conjugate fiber. The yarn of the discharged conjugate polyamide fiber is cooled to 30°C by blowing cooling air by a yarn cooling device such as a chimney. Subsequently, the cooled yarn is supplied with oil by an oil feeder, converged, interlaced through an interlacing device, is taken off (spinning speed) at 2000 m/min to 4500 m/min by a take-off roller, passes through the take-off roller and a drawing roller, and is drawn at a draw ratio of 1.0 to 1.5 according to a ratio of the peripheral speeds of the take-off roller and the drawing roller. Further, the yarn is wound around a package at a winding speed of 3000 m/min or more.

[0058] The spinning speed is preferably 2000 m/min to 3500 m/min. By setting the spinning speed to 2000 m/min or more, a spinning draft up to the take-off roller is large, and the difference in stress applied to each polyamide is likely to occur, the difference in orientation occurs, and the conjugate polyamide fiber (crimped polyamide yarn) excellent in the latent crimping property can be obtained. By setting the spinning speed to 3500 m/min or less, the yarn bending at the time of discharging the yarn from the spinneret is prevented, and a yarn producing property is stabilized.

[0059] The false twisted yarn according to the present invention can be obtained by a known false twisting method in the related art. Preferably, the false twisting is performed by a drawing friction false twisting device. An example is as follows. For example, the crimped polyamide yarn according to the present invention supplied to the drawing friction false twisting device is fed to a supply roller via a desired yarn guide or a fluid treatment device. Thereafter, the crimped polyamide yarn is guided to the drawing roller through a heated false twisting heater, a cooling plate, and a twisting body that performs drawing friction false twisting, and wound as the false twisted yarn. In the drawing friction false twisting, friction false twisting may be performed after drawing the crimped polyamide yarn with a heat pin or a hot plate before the crimped polyamide yarn is supplied to the supply roller of the drawing friction false twisting device, or the friction false twisting may be performed while the crimped polyamide yarn is drawn between the supply roller and the drawing roller.

[0060] A twisting method is not limited to a spindle method, a triaxial twister method, a belt nip method, or the like. It is preferable to use the spindle method in the case where crimping is to be strengthened, and to use the triaxial twister or the belt nip, which is a friction false twisting method, in the case where it is desired to increase a processing speed and reduce a production cost.

[0061] The crimped polyamide yarn and the false twisted yarn according to the present invention can be woven and knitted by known methods. The obtained woven fabric and knitted fabric have excellent stretchability.

[0062] In the case of the woven fabric, a texture thereof may be a plain weave texture, a twill weave texture, a satin weave texture, a variation texture thereof, or a mixed weave texture depending on a used application.

[0063] In the case of the knitted fabric, a texture may be a jersey weave texture of a circular knitting fabric, an interlock weave texture, a half stitch of a warp knitted fabric, a satin weave texture, a jacquard weave texture, a variation texture thereof, or a mixed texture depending on a used application.

[0064] A use of the woven or knitted fabric made from the crimped polyamide yarn and the false twisted yarn according to the present invention are not limited, but is preferably used for clothing applications, and more preferably for sports, casual wear, and clothing of women and men such as down jackets, windbreakers, golf wear, and rain wear. In particular, the present invention can be suitably used for the sports wear and the down jackets.

EXAMPLES

[0065] Next, the conjugate polyamide fiber according to the present invention will be specifically described with reference to Examples.

A. Melting Point:

[0066] A polyamide chip sample was subjected to a thermal analysis using Q1000 manufactured by TA Instruments, and data processing was performed using Universal Analysis 2000. The thermal analysis was carried out under a nitrogen flow (50 mL/min) at a temperature range of -50°C to 300°C, a temperature rising speed of 10°C/min, and a chip sample mass of about 5 g (heat quantity data was normalized by mass after measurement). A melting point was measured from a melt peak.

B. Relative Viscosity:

[0067] 0.25 g of the polyamide chip sample was dissolved in 25 ml of sulfuric acid having a concentration of 98% by mass so as to form 1 g/100 ml, and the flow-down time (T1) at a temperature of 25°C was measured using the Ostwald viscometer. Subsequently, the flow-down time (T2) of only sulfuric acid having a concentration of 98% by mass was measured. The ratio of T1 to T2, that is, T1/T2, was defined as the sulfuric acid relative viscosity.

C. Melt Viscosity (Capilograph):

[0068] Polyamide chip samples were adjusted to a predetermined moisture content as shown in Tables 1 to 3, and melt viscosities were measured by gradually changing a strain rate using Capilograph 1B manufactured by Toyo Seiki Seisaku-sho, Ltd. A measurement temperature was the same as a spinning temperature, and was measured at three points at which a time (holding time) from a time the sample was put into a heating furnace until a start of the measurement was 5 minutes, 10 minutes, and 20 minutes. In Examples and Comparative Examples, a melt viscosity of 1216 s^{-1} was described when the holding time was set to 5 minutes. Further, a value (maximum value - minimum value) obtained by subtracting a minimum value from a maximum value of the melt viscosity of 1216 s^{-1} in each holding time was defined as a melt viscosity variation width.

D. Chip Moisture Content:

[0069] For the polyamide chip sample, coulometric titration method of a Karl Fischer reaction was used using a moisture measuring device, that is, a trace moisture meter CA-200 (manufactured by Mitsubishi Chemical Corporation), an electrolytic solution containing mainly iodide ions, sulfur dioxide, and alcohol is placed in a titration cell, iodine required for titration is generated internally by electrolysis, and an amount of electricity required for electrolytic oxidation was integrated to calculate the moisture content.

E. Boiling-Water-Shrinkage Rate of Single Yarn:

[0070] Each polymer described in Examples was used as a raw material, and was melt-discharged at a temperature of 280°C using a spinneret having 12 spinneret discharge holes. After the obtained yarn was cooled, supplied with the oil and interlaced, the obtained yarn was taken off with the take-off roller at 2570 m/min, drawn 1.7 times, and then heat-set at a temperature of 155°C to obtain a single polyamide yarn of 33 dtex and 12 filaments at a winding speed of 4000 m/min. The obtained fiber sample was taken in skein and subjected to a load of 90 mg/dtex for 30 seconds to determine the length B. Then, the fiber sample was immersed in boiling water at 100°C for 20 minutes, air-dried, and subjected to a load of 90 mg/dtex for 30 seconds to determine the length A. A boiling-water-shrinkage rate was calculated based on the following formula.

$$\text{Boiling-water-shrinkage rate (\%)} = [(B - A)/B] \times 100$$

F. Total Fineness:

[0071] The test was based on JIS L1013 (2010). The fiber sample was wound 200 times with tension of 1/30 (g) using a measuring machine including a frame circumference of 1.125 m. The fiber sample was dried at a temperature of 105°C for 60 minutes, transferred to a desiccator, and was cooled for 30 minutes in an environment having a temperature of 20°C and a relative humidity of 55% RH, and a mass per 10000 m was calculated from a value obtained by measuring a mass of the skein, and a total fineness of the fiber yarn was calculated with an official moisture regain of 4.5%. The measurement was performed five times, and an average value thereof was defined as the total fineness.

G. Wet-Heat-Shrinkage Stress and Wet-Heat-Shrinkage Stress Variation Rate:

[0072] A heat shrinkage stress measuring device (manufactured by Toray Engineering Co., Ltd., model "FTA-500") is used, the fiber yarn to be measured was 25 m, a speed ratio between the delivery roller and the take-off roller was set to 99/100, tension of 1/50 g of yarn fineness (dtex) was applied, and the wet-heat-shrinkage stress and the wet-heat-shrinkage variation rate were calculated according to the following formulas from the shrinkage stress obtained by performing measurement under conditions of a set temperature of the heated water tank of 100°C, a yarn speed of 5 m/min, and the wet heat.

$$\text{Wet-heat-shrinkage stress (cN/dtex)} = (\text{average value } f_{ave})/(\text{total fineness})$$

$$\text{Wet-heat-shrinkage stress variation rate (\%)} = (\text{standard deviation } \sigma f)/(\text{average value } f_{ave}) \times 100$$

H. Stretch Elongation Rate:

[0073] A loop having a circumference of 1 m was prepared from the fiber sample, immersed in boiling water at a temperature of 90°C for 20 minutes, and then air-dried, a load of 1.8 mg/dtex was applied for 30 seconds to obtain the length A, and then a load of 90 mg/dtex was applied for 30 seconds to obtain the length B. The stretch elongation rate was calculated by the following formula.

$$\text{Stretch elongation rate (\%)} = [(B - A)/B] \times 100$$

I. Strength and Elongation:

[0074] The fiber sample was measured using "TENSILON" (registered trademark), UCT-100 manufactured by ORIENTEC CO., LTD. under a constant-rate elongation conditions shown in JIS L1013 (chemical fiber filament yarn test method, 2010). The elongation was determined from an elongation at a point showing maximum strength in a tensile strength-elongation curve. Further, the strength was obtained by dividing the maximum strength by fineness. The measurement was performed 10 times, and an average value thereof was defined as the strength and the elongation.

J. Fabric Evaluation:

(a) Production of Weft Yarn

[0075] N6 (relative viscosity: 2.70, melting point: 222°C) was used, and was melt-discharged at a temperature of 275°C using the spinneret having 12 spinneret discharge holes. After the N6 was melt-discharged, the obtained yarn was cooled, supplied with the oil and interlaced, the obtained yarn was taken off with the take-off roller at 2570 m/min, drawn 1.7 times, and then heat-set at a temperature of 155°C to thereby obtain a nylon 6 yarn of 70 dtex and 12 filaments at a winding speed of 4000m/min.

(b) Production of Fabric

[0076] Plain weave fabrics (warp yarn/processed yarn) were woven using the side-by-side or eccentric sheath-core conjugate polyamide false twisted yarn obtained in Examples 1 to 10 and Comparative Examples 1 to 4 as the warp (warp density: 90 yarns/2.54 cm), and the nylon 6 yarn obtained in the above (a) as the weft (weft density: 90 yarns/2.54 cm).

[0077] The obtained woven fabrics were scoured at a temperature of 80°C for 20 minutes, adjusted to pH 4 using Kayanol Yellow N5G 1% owf and acetic acid, dyed at a temperature of 100°C for 30 minutes, fixed at a temperature of 80°C for 20 minutes, and finally heat-treated at a temperature of 170°C for 30 seconds to improve the texture.

(c) Elongation Rate (Stretchability) of Woven Fabric in Warp Direction

[0078] An elongation rate of the woven fabric in a warp direction was measured according to a fixed loading method (B method, 2010) of woven fabric described in JIS L1096. The stretchability was evaluated in the following three grades. An evaluation of "A" indicates sufficient stretchability.

A: 15% or more
B: 5% or more and less than 15%
C: less than 5%

(d) Cloth Quality

[0079] A quality of a lengthwise stripe of each of the woven fabrics was checked by visual judgment of an experienced inspector, and evaluated according to the following four grades. Evaluations of "A" and "B" indicate a practical level.

A: Good
B: Slightly good (stripes are visible, although the woven fabric is not a defect)
C: Slightly poor (although there are defects such as dyeing specks and stripes, the woven fabric can be used as a product by cutting and avoiding the defects, or in limited colors)
D: Poor (the woven fabric has defects such as dyeing specks and stripes, and cannot be used as a product)

[Example 1]

[0080] As the crystalline polyamide (A), nylon 6 (N6) having a relative viscosity of 2.6, a melting point of 222°C, a boiling-water-shrinkage rate of a single yarn of 13.0%, and a moisture content of 50 ppm was used, and as the crystalline polyamide (B), nylon 610 (N610) having a relative viscosity of 2.7, a melting point of 225°C, a boiling-water-shrinkage rate of a single yarn of 7.0%, and a moisture content of 1400 ppm was used. The crystalline polyamide (A) and the crystalline polyamide (B) are melted respectively, and were melt-discharged (at a spinning temperature 270°C) at a conjugate ratio (mass ratio) of the crystalline polyamide (A) and the crystalline polyamide (B) of 5:5 by using a spinneret (12 holes and round holes) for the side-by-side conjugate fiber. The yarn discharged from the spinneret was cooled and solidified by the yarn cooling device, and as shown in Table 1, after being supplied with a water-containing oil agent containing a wax component by a two-stage oil feeder, the yarn was interlaced by a fluid interlacing nozzle device, taken off by the take-off roller (room temperature 25°C) at 3700 m/min, drawn 1.15 times between the drawing rollers (room temperature 25°C), and then wound on the package at a winding speed of 4000 m/min.

[0081] A latently crimped conjugate polyamide fiber yarn having 63 dtex and 12 filaments, a stretch elongation rate of 17.4%, and a wet-heat-shrinkage stress variation rate of 100% was obtained.

[0082] The obtained latently crimped conjugate polyamide fiber yarn was used and subjected to pin false twisting under conditions of the number of twists (D/Y) of 1.95 with a draw ratio of 1.25 at a heater temperature of 190°C to thereby obtain a false twisted yarn having a stretch elongation rate of 140%. A plain weave fabric was woven using the obtained false twisted yarn as the warp. The obtained woven fabric was excellent in stretchability and cloth quality. The results are shown in Table 1.

[Example 2]

[0083] In the same manner as in Example 1 except that the crystalline polyamide (B) had a moisture content of 1100 ppm, was melt-discharged from the spinneret (12 holes, round holes) for the side-by-side conjugate fiber, and was drawn 1.10 times between the drawing rollers (at room temperature 25°C), a latently crimped conjugate polyamide fiber yarn having 63 dtex and 12 filaments, a stretch elongation rate of 18.1%, and a wet-heat-shrinkage stress variation rate of 110% was obtained.

[0084] The obtained latently crimped conjugate polyamide fiber yarn was subjected to the pin false twisting in the same method as in Example 1 to thereby obtain a false twisted yarn having a stretch elongation rate of 145%. A plain weave fabric was woven using the obtained false twisted yarn as the warp. The obtained woven fabric was excellent in stretchability and cloth quality. The results are shown in Table 1.

[Example 3 and 4]

[0085] A latently crimped conjugate polyamide fiber yarn was obtained in the same manner as in Example 1 except that the moisture content of the crystalline polyamide (B) was changed as shown in Table 1.

[0086] The obtained latently crimped conjugate polyamide fiber yarn was subjected to the pin false twisting in the same manner as in Example 1, and the obtained false twisted yarn was used as the warp to weave a plain weave fabric. The obtained woven fabric was excellent in stretchability. Regarding the cloth quality, Example 3 was good, and Example 4 was slightly good. The results are shown in Table 1.

[Example 5]

[0087] In the same manner as in Example 1 except that, as shown in Table 2, a spinneret (12 holes and round holes) for the eccentric sheath-core conjugate fiber was used for melt-discharging a yarn at a spinning temperature of 290°C, the yarn was supplied with a water-containing oil agent for the false twisting in a second stage of the two-stage oil supply, taken off by the take-off roller (at room temperature 25°C) at 3000 m/min, drawn 1.20 times between the drawing rollers (at room temperature 25°C), and then wound on the package at a winding speed of 3582 m/min, a latently crimped conjugate polyamide fiber yarn having 66 dtex and 12 filaments, a stretch elongation rate of 19.5%, and a wet-heat-shrinkage stress variation rate of 100% was obtained.

[0088] The obtained latently crimped conjugate polyamide fiber yarn was subjected to friction false twisting to thereby obtain a false twisted yarn having a stretch elongation rate of 165%. A plain weave fabric was woven using the obtained false twisted yarn as the warp. The obtained woven fabric was excellent in stretchability and cloth quality. The results are shown in Table 2.

[Examples 6 to 8]

[0089] Latently crimped conjugate polyamide fiber yarns were obtained in the same manner as in Example 5 except that the moisture contents of the crystalline polyamide (B) were changed as shown in Table 2.

[0090] The obtained latently crimped conjugate polyamide fiber yarns were subjected to the friction false twisting in the same manner as in Example 5, and obtained false twisted yarns were used as the warp to weave plain weave fabrics. The obtained woven fabric was excellent in stretchability. Regarding the cloth quality, Examples 6 and 7 were good, and Example 8 was slightly good. The results are shown in Table 2.

[Example 9]

[0091] A latently crimped conjugate polyamide fiber yarn was obtained in the same manner as in Example 5 except that a take-off roller speed was set to 2218 m/min, the draw ratio between the take-off roller and the drawing roller was set to 1.45, and the yarn was wound on the package at a winding speed of 3200 m/min.

[0092] The obtained latently crimped conjugate polyamide fiber yarns were subjected to the friction false twisting in the same manner as in Example 5, and obtained false twisted yarns were used as the warp to weave plain weave fabrics.

The obtained woven fabric was excellent in stretchability and cloth quality. The results are shown in Table 2.

[Example 10]

[0093] A latently crimped conjugate polyamide fiber yarn was obtained in the same manner as in Example 5 except that a polymer of the crystalline polyamide (A) and a polymer of the crystalline polyamide (B) were replaced with each other.
[0094] The obtained latently crimped conjugate polyamide fiber yarns were subjected to the friction false twisting in the same manner as in Example 5, and obtained false twisted yarns were used as the warp to weave plain weave fabrics. The obtained woven fabric was excellent in stretchability and cloth quality. The results are shown in Table 2.

[Table 1]

		Example 1	Example 2	Example 3	Example 4
Total fineness-the number of filaments		63-12	63-12	63-12	63-12
Conjugate form		Side-by-side type	Side-by-side type	Side-by-side type	Side-by-side type
Polymer type	Polyamide A component	N6(T200)	N6(T200)	N6(T200)	N6(T200)
	Polyamide B component	N610	N610	N610	N610
Relative viscosity of polymer	Polyamide A component	2.6	2.6	2.6	2.6
	Polyamide B component	2.7	2.7	2.7	2.7
Difference in relative viscosity between polymers		0.1	0.1	0.1	0.1
Boiling-water-shrinkage rate of single yarn (%)	Polyamide A component	13	13	13	13
	Polyamide B component	7	7	7	7
Difference in boiling-water-shrinkage rate between single-yarns (%)		6	6	6	6
Moisture content of polymer (ppm)	Polyamide A component	50	50	50	50
	Polyamide B component	1400	1100	800	1700
Spinning temperature (°C)		270	270	270	270
Melt viscosity of polymer (poise)	Polyamide A component	800	800	800	800
	Polyamide B component	770	800	850	700

(continued)

			Example 1	Example 2	Example 3	Example 4
Difference in melt viscosity (poise)			30	0	-50	100
Melt viscosity variation width of low shrinkage component (poise)			-35	-10	20	-90
Oil supply	First stage oil supply (Before interlacing)	Oil agent type	Water-containing oil agent for false twisting	Water-containing oil agent for false twisting	Water-containing oil agent for false twisting	Water-containing oil agent for false twisting
	Second stage oil supply (After interlacing)	Oil agent type	Water-containing oil agent (containing wax) for false twisting	Water-containing oil agent (containing wax) for false twisting	Water-containing oil agent (containing wax) for false twisting	Water-containing oil agent (containing wax) for false twisting
Yarn producing conditions	Take-off speed (spinning speed)	m/min	3700	3820	3700	3700
	Draw ratio	-	1.15	1.10	1.15	1.15
Raw yarn characteristics	Fineness	dtex	63	63	63	63
	Strength	cN/dtex	4.1	4.0	4.0	4.2
	Elongation	%	66.9	69.7	67.8	64.7
	Wet-heat-shrinkage stress	cN/dtex	0.011	0.010	0.006	0.014
	Wet-heat-shrinkage stress variation rate	%	100	110	88	130
	Stretch elongation rate	%	17.4	18.1	15.6	18.0
Processing evaluation	False twisting method		Pin type	Pin type	Pin type	Pin type
	Wet-heat-shrinkage stress variation rate	%	60	80	65	70
	Stretch elongation rate	%	140	145	135	145
Fabric evaluation	Stretchability	-	A	A	A	A
	Cloth quality	-	A	A	A	B

[Table 2]

		Example 5	Example 6	Example 7	Example 8	Example 9	Example 10
Total fineness-the number of filaments		66-12	66-12	66-12	66-12	66-12	66-12
Conjugate form		Eccentric sheath-core	Eccentric sheath-core	Eccentric sheath-core	Eccentric sheath-core	Eccentric sheath-core	Eccentric sheath-core
Polymer type	Polyamide A component	N6(T700)	N6(T700)	N6(T700)	N6(T700)	N6(T700)	N610
	Polyamide B component	N610	N610	N610	N610	N610	N6(T700)
Relative viscosity of polymer	Polyamide A component	3.3	3.3	3.3	3.3	3.3	2.7
	Polyamide B component	2.7	2.7	2.7	2.7	2.7	3.3
Difference in relative viscosity between polymers		0.6	0.6	0.6	0.6	0.6	0.6
Boiling-water-shrinkage rate of single yarn (%)	Polyamide A component	13	13	13	13	13	7
	Polyamide B component	7	7	7	7	7	13
Difference in boiling-water-shrinkage rate between single-yarns (%)		6	6	6	6	6	6
Moisture content of polymer (ppm)	Polyamide A component	50	50	50	50	50	1400
	Polyamide B component	1400	1100	800	1700	1700	50

(continued)

			Example 5	Example 6	Example 7	Example 8	Example 9	Example 10
Spinning temperature (°C)			290	290	290	290	290	290
Melt viscosity of polymer (poise)		Polyamide A component	1400	1400	1400	1400	1400	570
		Polyamide B component	570	620	680	500	570	1400
Difference in melt viscosity (poise)			830	780	720	900	830	830
Melt viscosity variation width of low shrinkage component (poise)			-100	-55	-10	-140	-100	-100
Oil supply	First stage oil supply (before interlacing)	Oil agent type	Water-containing oil agent for false twisting	Water-containing oil agent for false twisting	Water-containing oil agent for false twisting	Water-containing oil agent for false twisting	Water-containing oil agent for false twisting	Water-containing oil agent for false twisting
	Second stage oil supply (after interlacing)	Oil agent type	Water-containing oil agent for false twisting	Water-containing oil agent for false twisting	Water-containing oil agent for false twisting	Water-containing oil agent for false twisting	Water-containing oil agent for false twisting	Water-containing oil agent for false twisting
Yarn producing conditions	Take-off speed (spinning speed)	m/min	3000	3000	3000	3000	2218	3000
	Draw ratio	-	1.20	1.20	1.20	1.20	1.45	1.20

(continued)

			Example 5	Example 6	Example 7	Example 8	Example 9	Example 10
Raw yarn characteristic s	Fineness	dtex	66	66	66	66	66	66
	Strength	cN/dtex	3.9	4.0	40	3.8	4.1	4.0
	Elongation	%	76.5	75.3	74.4	78.5	74.2	75.8
	Wet-heat-shrinkage stress	cN/dtex	0.042	0.038	0.030	0.061	0.045	0.048
	Wet-heat-shrinkage stress variation rate	%	100	95	85	120	85	105
	Stretch elongation rate	%	19.5	19.0	18.5	20.8	18.9	18.7
Processing evaluation	False twisting method		Friction type	Friction type	Friction type	Friction type	Friction type	Friction type
	Wet-heat-shrinkage stress variation rate	%	50	55	58	40	35	55
	Stretch elongation rate	%	165	160	150	170	160	160
Fabric evaluation	Stretchability	-	A	A	A	A	A	A
	Cloth quality	-	A	A	A	B	A	A

[Comparative Example 1]

[0095] In the same manner as in Example 1, except that nylon 610 (N610) having a relative viscosity of 2.7, a melting point of 225°C, and a moisture content of 200 ppm was used as the crystalline polyamide (B), a latently crimped conjugate polyamide fiber yarn having 63 dtex and 12 filaments, a stretch elongation rate of 15.3%, and a wet-heat-shrinkage stress variation rate of 210% was obtained.

[0096] The obtained latently crimped conjugate polyamide fiber yarn was subjected to the pin false twisting in the same method as in Example 1 to thereby obtain a false twisted yarn having a stretch elongation rate of 130%. A plain weave fabric was woven using the obtained false twisted yarn as the warp. The obtained woven fabric was excellent in stretchability, but was poor in cloth quality. The results are shown in Table 3.

[Comparative Example 2]

[0097] In the same manner as in Example 1 except that the moisture content of the crystalline polyamide (B) was changed to 2000 ppm, a latently crimped conjugate polyamide fiber yarn having 63 dtex and 12 filaments, a stretch elongation rate of 17.1%, and a wet-heat-shrinkage stress variation rate of 180% was obtained.

[0098] The obtained latently crimped conjugate polyamide fiber yarn was subjected to the pin false twisting in the same method as in Example 1 to thereby obtain a false twisted yarn having a stretch elongation rate of 140%. A plain weave fabric was woven using the obtained false twisted yarn as the warp. The obtained woven fabric was excellent in stretchability, but was slightly poor in cloth quality. The results are shown in Table 3.

[Comparative Example 3]

[0099] In the same manner as in Example 5, except that nylon 610 (N610) having a relative viscosity of 2.7, a melting point of 225°C, and a moisture content of 200 ppm was used as the crystalline polyamide (B), a latently crimped conjugate polyamide fiber yarn having 66 dtex and 12 filaments, a stretch elongation rate of 16.3%, and a wet-heat-shrinkage stress variation rate of 200% was obtained.

[0100] The obtained latently crimped conjugate polyamide fiber yarn was subjected to the friction false twisting to thereby obtain a false twisted yarn having a stretch elongation rate of 145%. A plain weave fabric was woven using the obtained false twisted yarn as the warp. The obtained woven fabric was excellent in stretchability, but was poor in cloth quality. The results are shown in Table 3.

[Comparative Example 4]

[0101] In the same manner as in Example 5 except that the moisture content of the crystalline polyamide (B) was changed to 2000 ppm, a latently crimped conjugate polyamide fiber yarn having 66 dtex and 12 filaments, a stretch elongation rate of 21. 1%, and a wet-heat-shrinkage stress variation rate of 170% was obtained.

[0102] The obtained latently crimped conjugate polyamide fiber yarn was subjected to the friction false twisting to thereby obtain a false twisted yarn having a stretch elongation rate of 175%. A plain weave fabric was woven using the obtained false twisted yarn as the warp. The obtained woven fabric was excellent in stretchability, but was slightly poor in cloth quality. The results are shown in Table 3.

[Table 3]

		Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4
Total fineness-the number of filaments		63-12	63-12	66-12	66-12
Conjugate form		Side-by-side type	Side-by-side type	Eccentric sheath-core	Eccentric sheath-core
Polymer type	Polyamide A component	N6(T200)	N6(T200)	N6(T700)	N6(T700)
	Polyamide B component	N610	N610	N610	N610

(continued)

			Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4
Relative viscosity of polymer		Polyamide A component	2.6	2.6	3.3	3.3
		Polyamide B component	2.7	2.7	2.7	2.7
Difference in relative viscosity between polymers			0.1	0.1	0.6	0.6
Boiling-water-shrinkage rate of single yarn (%)		Polyamide A component	13	13	13	13
		Polyamide B component	7	7	7	7
Difference in boiling-water-shrinkage rate between single-yarns (%)			6	6	6	6
Moisture content of polymer (ppm)		Polyamide A component	50	50	50	50
		Polyamide B component	200	2000	200	2000
Spinning temperature (°C)			270	270	290	290
Melt viscosity of polymer (poise)		Polyamide A component	800	800	1400	2000
		Polyamide B component	1000	740	760	440
Difference in melt viscosity (poise)			-200	60	640	1560
Melt viscosity variation width of low shrinkage component (poise)			155	-155	170	-190
Oil supply	First stage oil supply (before interlacing)	Oil agent type	Water-containing oil agent for false twisting	Water-containing oil agent for false twisting	Water-containing oil agent for false twisting	Water-containing oil agent for false twisting
	Second stage oil supply (after interlacing)	Oil agent type	Water-containing oil agent (containing wax) for false twisting	Water-containing oil agent (containing wax) for false twisting	Water-containing oil agent for false twisting	Water-containing oil agent for false twisting

(continued)

			Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4
Yarn producing conditions	Take-off speed (spinning speed)	m/min	4000	4000	3000	3000
	Draw ratio	-	1.15	1.15	1.20	1.20
Raw yarn characteristics	Fineness	dtex	63	63	66	66
	Strength	cN/dtex	4.0	4.1	3.8	4.1
	Elongation	%	68.2	66.3	80.4	72.5
	Wet-heat-shrinkage stress	cN/dtex	0.003	0.013	0.039	0.071
	Wet-heat-shrinkage stress variation rate	%	210	180	200	170
	Stretch elongation rate	%	15.3	17.1	16.3	21.1
Processing evaluation	False twisting method		Pin type	Pin type	Friction type	Friction type
	Wet-heat-shrinkage stress variation rate	%	200	165	170	155
	Stretch elongation rate	%	130	140	145	175
Fabric evaluation	Stretchability	-	A	A	A	A
	Cloth quality	-	D	C	D	C

[0103] From Tables 1 to 3, it is found that in Examples 1 to 10, the woven fabrics each having excellent stretchability and excellent cloth quality were obtained.

[0104] Although the present invention has been described in detail with reference to specific embodiments, it is apparent to those skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the present invention. The present application is based on Japanese Patent Application (Japanese Patent Application No. 2021-036047) filed on March 8, 2021, and the content thereof is incorporated herein as reference.

REFERENCE SIGNS LIST

[0105]

A crystalline polyamide (A)
B crystalline polyamide (B)
Y yarn
1 spin block
2 spinneret
3 cooling device
4-1 oil feeder (first stage)
4-2 oil feeder (second stage)

5 interlacing nozzle device
6 take-off roller
7 drawing roller
8 winding device
10a to 10c side-by-side conjugate polyamide fiber
10d eccentric sheath-core conjugate polyamide fiber
11 center of eccentric sheath-core conjugate fiber
12 center of core portion

Claims

1. A crimped polyamide yarn comprising:

    a side-by-side conjugate polyamide fiber or eccentric sheath-core conjugate polyamide fiber, wherein the crimped polyamide yarn has a wet-heat-shrinkage stress variation rate of 150% or less.

2. The crimped polyamide yarn according to claim 1, wherein two kinds of polyamides having different shrinkage characteristics are laminated in a side-by-side or an eccentric sheath-core.

3. The crimped polyamide yarn according to claim 1 or 2, having a wet-heat-shrinkage stress of 0.001 cN/dtex to 0.50 cN/dtex.

4. The crimped polyamide yarn according to any one of claims 1 to 3, having a stretch elongation rate of 15% to 100%.

5. A false twisted yarn comprising: the crimped polyamide yarn according to any one of claims 1 to 4.

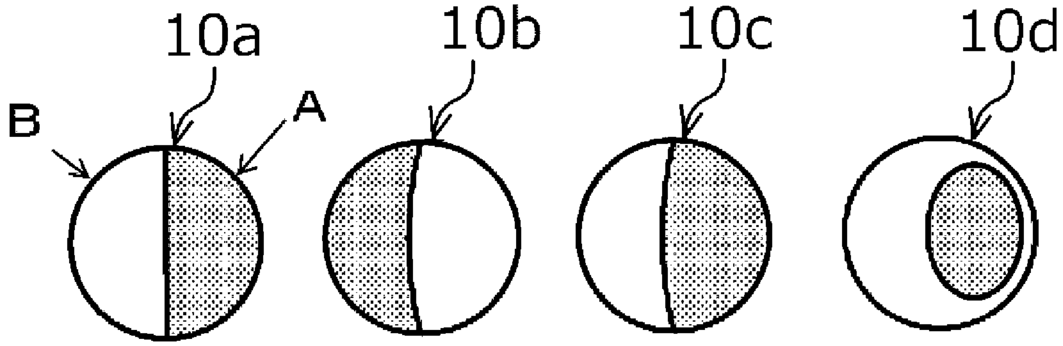
6. The false twisted yarn according to claim 5, having a wet-heat-shrinkage stress variation rate of 150% or less.

7. The false twisted yarn according to claim 5, having a stretch elongation rate of 70% to 300%.

8. A fabric comprising: the false twisted yarn according to claim 7.

FIG. 1

(a)



(b)

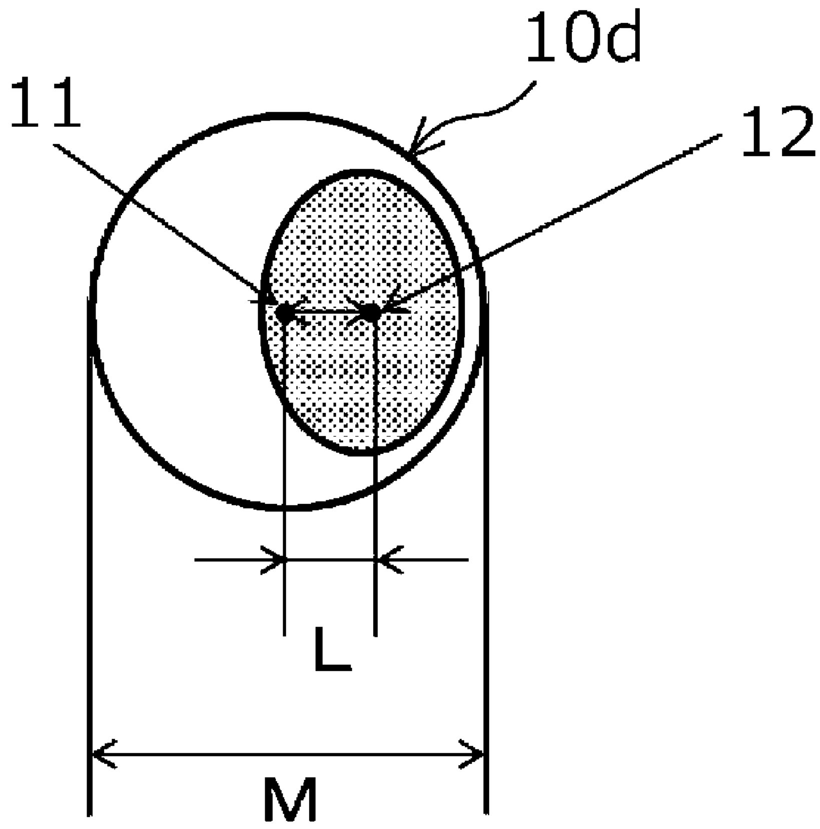
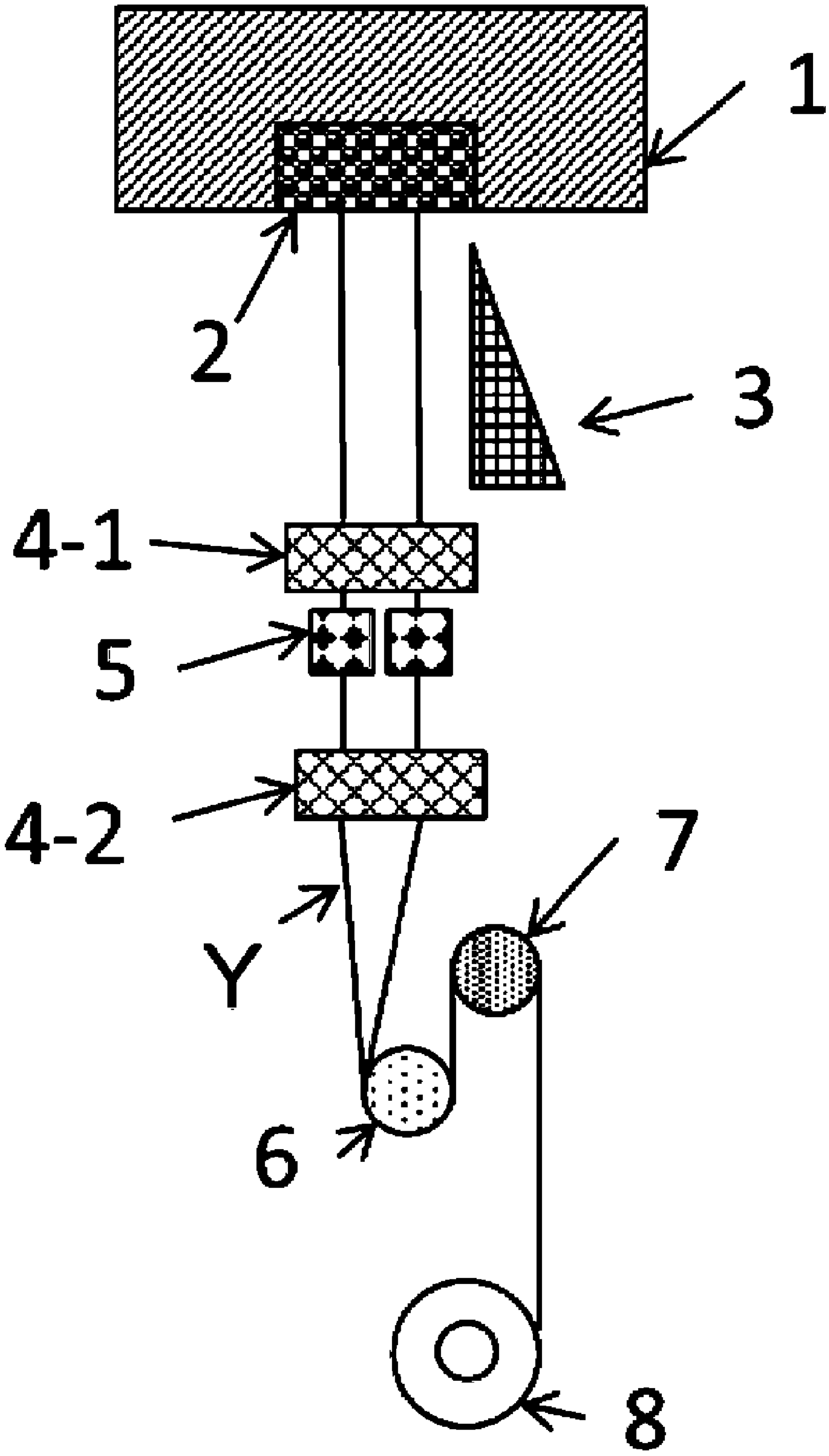


FIG. 2



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2022/009564

A. CLASSIFICATION OF SUBJECT MATTER

D01F 8/12(2006.01)i; ***D02G 3/02***(2006.01)i; ***D03D 15/292***(2021.01)i
FI: D01F8/12 Z; D02G3/02; D03D15/292

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; D03D1/00-27/18; D04B1/00-1/28; 21/00-21/20

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

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2022
Registered utility model specifications of Japan 1996-2022
Published registered utility model applications of Japan 1994-2022

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 109957856 A (SHANGHAI CATHAY BIOTECHNOLOGY RES CT CO LTD) 02 July 2019 (2019-07-02) example 4, paragraph [0053]	1-8
X	JP 47-2058 B1 (KANEGAFUCHI SPINNING K.K.) 20 January 1972 (1972-01-20) claims, column 7, example 2	1-8
X	JP 46-25531 B1 (KANEGAFUCHI SPINNING K.K.) 23 July 1971 (1971-07-23) claims, example 1	1-8
X	JP 54-2420 A (MONSANTO CO) 10 January 1979 (1979-01-10) claims, examples 1-2	1-8

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

* Special categories of cited documents:
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
02 May 2022	**17 May 2022**

Name and mailing address of the ISA/JP	Authorized officer
Japan Patent Office (ISA/JP) **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2022/009564

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 109957856 A	02 July 2019	(Family: none)	
JP 47-2058 B1	20 January 1972	(Family: none)	
JP 46-25531 B1	23 July 1971	(Family: none)	
JP 54-2420 A	10 January 1979	US 4129677 A claims, examples 1-2	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2014080717 A **[0006]**
- JP 2009057679 A **[0006]**
- JP 2018003190 A **[0006]**
- JP 2021036047 A **[0104]**