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(72) Inventors:
• **YOSHIDA, Manabu**
Osaka-shi
Osaka 530-8222 (JP)
• **KIMURA, Toshiaki**
Okazaki-shi
Aichi 444-8522 (JP)
• **GAMO, Yoshinobu**
Tokyo 103-8666 (JP)

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(71) Applicant: **Toray Industries, Inc.**
Tokyo, 103-8666 (JP)

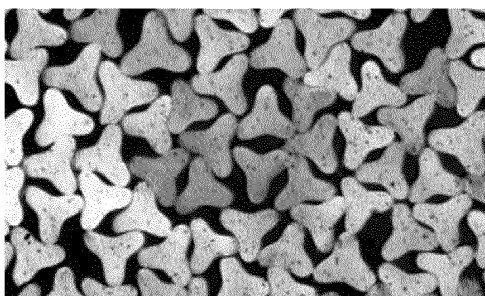
(74) Representative: **Webster, Jeremy Mark et al**
Mewburn Ellis LLP
City Tower
40 Basinghall Street
London EC2V 5DE (GB)

(54) **POLYAMIDE CRIMPED YARN FOR CLOTHING AND WOVEN OR KNITTED FABRIC FOR CLOTHING COMPRISING SAME**

(57) The invention provides: polyamide crimped yarn for clothing that makes it possible to provide woven or knitted fabric that is lightweight and has a prominent woven or knitted texture together with having the feeling of volume and resilience greatly sought after for clothing, particularly for women's clothing materials focusing on fall and winter women's clothing; woven or knitted fabric for clothing; and women's apparel.

[Solution] This polyamide crimped yarn for clothing is characterized by fulfilling requirements (1)-(3) and being composed of multifilaments. (1) The monofilament fineness is from 1.5 to 25 decitex, (2) the total fineness is from 400 to 1500 decitex, and (3) the monofilament cross-sectional shape is a multilobar shape having three or more lobes, and the degree of modification is from 1.5 to 5.5.

【Fig. 1】



Description

Technical Field

5 **[0001]** This invention relates to a polyamide crimped yarn for clothing and a woven or knitted fabric for clothing comprising such polyamide crimped yarn. More specifically, this invention relates to a polyamide crimped yarn for clothing particularly adapted for use in women's clothing and a woven or knitted fabric for clothing comprising such polyamide crimped yarn which has sufficient bulkiness and resilience required for materials used for women's clothing particularly for fall and winter clothing as well as lightness and aesthetic quality with visually recognizable woven or knitted organization or texture. This invention also relates to a women's clothing produced by using such polyamide crimped yarn or knitted fabric for clothing.

Background Art

15 **[0002]** Recent trend of the yarns and woven and knitted fabrics for clothing is materials focusing on soft texture and high drapability, and fabrics with lightness produced by using thinner and finer polyester and polyamide fibers have been investigated and proposed as such materials. More specifically, the lineup of medium and thick woven fabrics mainly for fall and winter seasons is supported by the woven and knitted fabrics produced by using false twisted yarn, sea-island type fiber, and composite divided yarn of polyester and polyamide fibers. However, these fabrics are still insufficient and inferior in their bulkiness and resilience compared to spun wool materials which are mainly used for coats and outer clothing.

20 **[0003]** In the meanwhile, the polyester fiber yarns and polyamide fiber yarns for clothing on the market are typically those having a total fineness in the range of 22 dtex to 200 dtex, and when these yarns are combined and twisted to realize the bulkiness comparable to the spun wool material, twisting of at least 3 to 4 yarns is necessary, and use as universal material for the clothing was difficult due to the increased production cost. When the false twisted textured yarn and the like are used for realizing the bulkiness, the fabric will have hard and coarse texture despite its bulkiness, and use of such fabric was difficult because of the excessive weight after the fabrication into clothing.

25 **[0004]** In the meanwhile, a light weight thick woven fabric having a hollowness of 5 to 30%, a monofilament fineness of at least 5 denier, and a total fineness of at least 300 denier prepared by using a nylon hollow multifilament yarn having a hollow multilobal cross section has been proposed (see Patent Document 1).

30 **[0005]** This proposal uses a drawn yarn of nylon fiber having an irregular hollow cross section, and a light weight thick woven fabric is produced by utilizing the space between the monofilaments formed by the irregular cross section and the fineness of at least 300 denier. As a consequence, the fabric has thickness and lightness while crispness, dryness, resilience are too strong, and bulkiness with volume is not realized. Such fabric was unsatisfactory in the softness which is highly demanded in recent apparel material.

35 **[0006]** A fabric for Western dress having both softness and resilience has been proposed (see Patent Document 2). This fabric is produced by using a synthetic fiber yarn having a monofilament fineness of at least 5 denier for the weft. In this proposal, however, the sufficient volume and bulkiness like those of spun wool is not yet realized since the synthetic fiber yarn having a monofilament fineness of at least 5 denier is used only for the weft in view of realizing the resilience and the yarn used is a drawn yarn.

Prior Art Document

Patent Document

45 **[0007]**

Patent Document 1: Japanese Patent No. 3321321

Patent Document 2: Japanese Patent No. 4214612

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Summary of the Invention

Problems to Be Solved by the Invention

55 **[0008]** As described above, a woven or knitted fabric with sufficient bulkiness and resilience required in the application of clothing, and particularly in the application of women's clothing for fall and winter clothing is not yet realized.

[0009] In view of such situation, an object of the present invention is to provide a polyamide crimped yarn for clothing capable of providing a light weight woven or knitted fabric for clothing having sufficient bulkiness and adequate resilience

as well as good aesthetic quality with visually recognizable knitted or woven organization at a reduced cost. Another object of the present invention is to provide a woven or knitted fabric for clothing comprising such polyamide crimped yarn and a women's clothing produced by using such polyamide crimped yarn or knitted fabric for clothing.

5 Means for Solving the Problems

[0010] The present invention is an attempt to solve the problems as described above, and the polyamide crimped yarn for clothing of the present invention is the one comprising a multifilament satisfying the following conditions (1) to (3):

- 10 (1) monofilament fineness is at least 1.5 dtex and up to 25 dtex,
- (2) total fineness is least 400 dtex and up to 1500 dtex, and
- (3) the monofilament has a multilobal cross section with three or more lobes and a degree of irregularity of at least 1.5 and up to 5.5.

15 **[0011]** According to a preferable embodiment of the polyamide crimped yarn for clothing of the present invention, the monofilament has a multilobal cross-section with 3 or more lobes radially extending from the center of the monofilament cross section, the degree of irregularity is at least 1.7 and up to 5.5, and the coefficient of variation (CV, %) of the degree of irregularity is less than 7.0 and at least 1.0.

20 **[0012]** According to a preferable embodiment of the polyamide crimped yarn for clothing of the present invention, the monofilament is a hollow filament having a hollowness of at least 5% and up to 25%.

[0013] According to a preferable embodiment of the polyamide crimped yarn for clothing of the present invention, the elongation after boiling water treatment is at least 5% and up to 30%, and number of interlace nodes is at least 5 nodes/m and up to 50 nodes/m.

25 **[0014]** According to a preferable embodiment of the polyamide crimped yarn for clothing of the present invention, the polyamide crimped yarn for clothing of the present invention is twisted (net twist), and twist factor (K) represented by the following equation (1) is at least 300 and up to 35,000

$$\text{Twist factor } K = T \times D^{1/2} \quad \dots (1)$$

30 T = twist number per yarn length of 1 m, and
D = total fineness (dtex) of the yarn.

[0015] A woven or knitted fabric for clothing of the present invention contains the polyamide crimped yarn for clothing as described above.

35 **[0016]** According to a preferable embodiment of the woven or knitted fabric for clothing of the present invention, the woven or knitted fabric for clothing of the present invention contains at least 25% by weight of the polyamide crimped yarn for clothing.

[0017] According to a preferable embodiment of the woven or knitted fabric for clothing of the present invention, the lightness (cm³/g) is at least 3.0 and up to 6.0, and heat retention (%) is at least 20 and up to 50.

40 **[0018]** According to a preferable embodiment of the woven or knitted fabric for clothing of the present invention, the woven or knitted fabric for clothing of the present invention is the one produced by weaving or knitting and dyeing the yarn comprising the polyamide crimped yarn for clothing and at least one fiber selected from the following group consisting of natural fibers, synthetic fibers, semi-synthetic fibers, and regenerated fibers:

- 45 [groups]
natural fibers: wool, cotton, animal hair, or linen,
synthetic fibers: polyester or acryl resin which can be dyed with a cationic dye,
semi-synthetic fibers: acetate, and
50 regenerated fibers: rayon or cuprammonium rayon.

[0019] According to a preferable embodiment of the woven or knitted fabric for clothing of the present invention, crimp factor of the polyamide crimped yarn for clothing obtained by undoing the woven or knitted fabric for clothing of the present invention is at least 2.5% and up to 25%.

55 **[0020]** According to a preferable embodiment of the woven or knitted fabric for clothing of the present invention, the clothing produced by using a woven or knitted fabric for clothing of the present invention is a clothing selected from the group consisting of coat, cloak, jacket, skirt, one-piece dress, and dress.

Advantageous Effect of the Invention

[0021] The present invention is capable of providing a polyamide crimped yarn for clothing well adapted for producing a bulky woven or knitted fabric for clothing and a woven or knitted fabric for clothing comprising such polyamide crimped yarn. More preferably, the present invention is capable of providing a polyamide crimped yarn for clothing most suitable for use in women's clothing and a woven or knitted fabric for clothing comprising such polyamide crimped yarn which has sufficient bulkiness and adequate resilience required for materials used for women's clothing particularly for fall and winter clothing and which has light weight and good aesthetic quality with visually recognizable knitted or woven organization. This invention also relates to a women's clothing produced by using such polyamide crimped yarn or knitted fabric for clothing.

Brief Description of the Drawings

[0022]

[FIG. 1] FIG. 1 is a photograph as a substitute of a drawing showing a cross section of the monofilament of the polyamide crimped yarn for clothing obtained in Example 1 of the present invention.

[FIG. 2] FIG. 2 is a photograph as a substitute of a drawing showing a cross section of the monofilament of the polyamide crimped yarn for clothing obtained in Example 2 of the present invention.

Description of Preferred Embodiments

[0023] Next, the polyamide crimped yarn for clothing of the present invention and the woven or knitted fabric for clothing are described in further detail.

[0024] The polyamide crimped yarn for clothing of the present invention is a polyamide crimped yarn for clothing comprising a multifilament satisfying the following conditions (1) to (3):

(1) monofilament fineness is at least 1.5 dtex and up to 25 dtex,

(2) total fineness is least 400 dtex and up to 1500 dtex, and

(3) the monofilament has a multilobal cross section with three or more lobes and a degree of irregularity of at least 1.5 and up to 5.5.

[0025] The polyamide crimped yarn for clothing of the present invention has a monofilament fineness of at least 1.5 dtex and up to 25 dtex, preferably at least 1.5 dtex and up to 20 dtex, and more preferably, at least 1.5 dtex and up to 15 dtex.

[0026] The monofilament fineness of less than 1.5 dtex may result in an insufficient bulkiness due to the reduced space between the monofilaments while the product may have a soft texture. On the other hand, when the monofilament fineness is in excess of 25 dtex, production of a fabric with stable bulkiness with sufficient volume and adequate resilience and texture required for clothing will be difficult even if the fabric has sufficient thickness. Such fabric, when used for women's clothing application, may also become a cause of injury by the stimulation or insufficient aesthetic quality due to the friction with the women's skin or inner clothing.

[0027] The polyamide crimped yarn for clothing of the present invention has a total fineness of at least 400 dtex and up to 1500 dtex, preferably at least 400 dtex and up to 1200 dtex, and more preferably at least 800 dtex and up to 1100 dtex.

[0028] When the total fineness is less than 400 dtex, realization of the bulkiness in the weaving or knitting will be difficult, and the step of twisting 3 or more yarns will be required for the realization of the bulkiness, and this results in the economically undesirable increased production cost. In the meanwhile, the total fineness in excess of 1500 dtex may result not only in the hard texture but also in the loss of process passability in the steps of twisting, warping, weaving or knitting or the like in the production of the woven or knitted fabric for clothing as well as incapability of the use of the installation normally used in the production of the woven or knitted fabric for clothing.

[0029] The polyamide crimped yarn for clothing of the present invention has a monofilament cross section with a multilobal shape having three or more lobes and a degree of irregularity of at least 1.5 and up to 5.5. Typical multilobal shapes with three or more lobes include Y-shaped, cross, H-shaped, and X-shaped cross sections, and the preferred is a Y-shaped cross section in view of the balance between the texture and the bulkiness.

[0030] More specifically, the polyamide crimped yarn for clothing of the present invention has a multilobal cross section with three or more lobes radially extending from the center of the monofilament cross section, and preferably, the polyamide crimped yarn for clothing of the present invention has a degree of irregularity of at least 1.7 and up to 5.5, and a coefficient of variation (CV) % of the degree of irregularity of less than 7.0 and up to 1.0.

[0031] More preferably, the monofilament has a trilobal or tetralobal cross section, and the degree of irregularity is more preferably at least 2.0 and up to 4.0. Most preferably, the cross section of the monofilament is trilobal (Y-shape),

and the degree of irregularity is at least 2.0 and up to 3.0. When the monofilament has a cross section with less than three lobes, the space between the monofilaments is hardly realized and realization of bulkiness will be difficult. When the multifilament does not have a multilobal cross section with lobes radially extending from the center of the monofilament cross section, the woven or knitted fabric will suffer from insufficient aesthetic quality with uneven dyeing detracting from the high quality. When the degree of irregularity is less than 1.5, the space between the monofilaments is hardly realized, and the realization of bulkiness will be difficult, while the degree of irregularity in excess of 5.5 is also unfavorable since the resulting fabric will suffer from hard texture and excessive crispness as well as stimulation to the skin when worn and insufficient aesthetic quality by friction with other clothing.

[0032] The coefficient of variation (CV) of the degree of irregularity is preferably at least 1.0% and less than 7.0%, and more preferably at least 1.0% and up to 5.5%. The crimped yarn having a CV of less than 1% corresponds to the state wherein variation in the degree of irregularity between the monofilaments of the crimped yarn is substantially absent, and production of such crimped yarn is substantially difficult. In the meanwhile, when the CV is in excess of 7.0%, the increased variation in the degree of irregularity between the monofilaments invites the situation such that the monofilament with relatively small degree of irregularity are surrounded by the monofilaments with relatively large degree of irregularity which results in the loss of the space between the monofilaments. In such case, realization of stable bulkiness with sufficient volume and adequate resilience and texture required for clothing will be difficult.

[0033] In the investigation by the inventors of the present invention, the false twisted textured yarn having a high degree of irregularity has been confirmed to have an increased CV. This phenomenon, however, is conceived to be the result of different deformation by the stress of the cross section between the monofilaments in the course of simultaneous application of the heat and the twisting under strong conditions in the course of false twisting step.

[0034] In the case of the false twisted textured yarn having the degree of irregularity of less than 1.5, the resulting crimped yarn will have a CV of less than 5.5. However, in the case of such yarn, the space between monofilaments will be insufficient and bulkiness will not be realized.

[0035] The monofilaments constituting the polyamide crimped yarn for clothing of the present invention may preferably have a hollowness of at least 5% and up to 25%. Bulkiness with higher lightness can be realized by employing the hollow filament having hollow cross section. More preferably, the hollowness is 5% to 15%. When the hollowness is less than 5%, realization of the lightness will be difficult while the hollowness in excess of 25% may invite difficulty in producing the yarn in the production of the crimped yarn and higher incidence of the collapse of the hollow cross section in the course of crimping. While the monofilament may have single or two or more hollow parts in its cross section perpendicular to the axial direction of the monofilament, total of such hollowness is preferably in the range of 5 to 25%.

[0036] The polyamide crimped yarn for clothing of the present invention may preferably have the elongation after boiling water treatment of at least 5% and up to 30%, and more preferably at least 8% and up to 30%. When the elongation after boiling water treatment is less than 5%, the bulkiness and the volume may be reduced, while the elongation in excess of 30% may result in the higher incidence of the collapse of the monofilament cross section despite the ability of conducting the crimping by using a false twisting machine using a pin or belt, and also, in the insufficient aesthetic quality such as uneven glittering and dyeing.

[0037] The number of interlace nodes of the polyamide crimped yarn for clothing of the present invention is preferably at least 5 nodes/m and up to 50 nodes/m, more preferably at least 10 nodes/m and up to 40 nodes/m, and still more preferably at least 10 nodes/m and up to 20 nodes/m. When the number of interlace nodes is less than 5 nodes/m, fluff will be generated in the course of twisting, warping, and weaving or knitting in the production of the woven or knitted fabric for clothing resulting in reduced process passability. In the meanwhile, the number of interlace nodes in excess of 50 nodes/m results in the stronger bundling of the monofilaments, reduced space between the monofilaments, and higher difficulty in realizing the bulkiness despite good process passability in the production of the woven or knitted fabric for clothing.

[0038] The polyamide crimped yarn for clothing of the present invention is provided with net twists, and the twist factor (K) represented by the following equation (1) is preferably at least 300 and up to 35,000.

$$\text{Twist factor } K = T \times D^{1/2} \quad \dots \cdot (1)$$

T = twist number per m of the yarn

D = total fineness (dtex) of the yarn

[0039] More preferably, the twist factor (K) is at least 600 and up to 32,000, and still more preferably at least 800 and up to 28,000. The twist factor (K) of less than 300 may result in the reduced process passability in the production of the woven or knitted fabric for clothing, and in particular, in the likeliness of fluffing in the warping step when the yarn is used for the warps despite realization of the bulkiness. In the meanwhile, the twist factor (K) in excess of 35,000 is likely to result in the stronger bundling of the monofilaments, difficulty in realizing the bulkiness, and excessive crispness and

dryness. By imparting the net twist corresponding to the twist factor (K) of at least 600 and up to 32,000, the process passability in producing the woven or knitted fabric for clothing can be improved, and also, the bulkiness and the volume intended in the present invention can be realized to maximum extent by the adequate bundling and detwisting torque of the polyamide crimped yarn for clothing.

[0040] Exemplary methods used for providing the net twists include down twisting and double twisting commonly used in the clothing application. When there are problems such as snarls relating to the process passability, the twisted yarn may be subjected to steam set or other treatment to thereby stop the de-twisting.

[0041] In producing the polyamide crimped yarn for clothing of the present invention, the polymer used may be nylon 6, nylon 66, nylon 610, nylon 56, or the like, and the preferred is the use of the polymer comprising nylon 6 or nylon 66. The polymer used may also contain a copolymer component to the extent not adversely affecting the merit of the present invention.

[0042] Exemplary preferable copolymer components include ϵ -caplamide, tetramethylene adipamide, hexamethylene sebacamide, tetramethylene isophthalamide, and tetramethylene terephthalamide. Preferable matting agent is titanium oxide.

[0043] With regard to the basic steps of producing the polyamide crimped yarn for clothing of the present invention, the polyamide crimped yarn is produced by the production steps of the crimped yarn commonly used in the art comprising melt spinning, cooling, oiling, drawing, and crimping treatment. The melt spinning machine used in the present invention may be either an extruder-type spinning machine or a pressure melter-type spinning machine, and the preferred is the extruder-type spinning machine in view of the uniformity of the product and the yarn yield. When a matting agent is used, a blend of a master chip having the matting agent added at a high concentration and the polyamide chip may be incorporated in the spinning machine, or the chips of both types may be measured just above the spinning machine before the incorporated in the spinning machine. Alternatively, the matting agent in the form of a powder or a liquid may be directly incorporated in the spinning machine.

[0044] In order to satisfy the particular total fineness, monofilament fineness, cross sectional shape, and the like of the polyamide crimped yarn for clothing of the present invention, the melt spinning is conducted by adequately setting the spinning conditions such as viscosity of the polyamide, spinning temperature, shape of the nozzle orifice, ejection rate, and cooling.

[0045] The melt spun filaments are cooled and solidified by cool air, and after application of an oiling agent, the filaments are taken up by winding around a take up roller rotating at a predetermined take up speed. The take up speed is preferably 300 to 1500 m/minute. Normally, the taken up filaments are continuously subjected to drawing step and crimping treatment. Alternatively, the non-drawn filaments may be wound up before conducting the drawing and crimping in separate steps, or the drawn filaments may be wound up before conducting the crimping in the separate step.

[0046] For realizing the elongation after boiling water treatment of at least 5% and up to 30% in the present invention, crimping of the polyamide yarn is preferably conducted after the sufficient increase of the orientation of the molecular chain in the drawing step. The drawing is preferably conducted so that the draw ratio is in the range of 2.0 to 4.0, and the elongation is 30 to 100%. The drawn yarn is then subjected to the crimping treatment in the course of passing through the crimping apparatus. The crimping treatment is conducted by treating the yarn with a heated fluid such as saturated steam, superheated steam, or heated air. The crimping apparatus used may be, for example, the crimping nozzle apparatus disclosed in Japanese Unexamined Patent Publication (Kokai) No. 2004-84080. The yarn is typically crimped by using jet nozzle process with the crimping nozzle wherein a high temperature fluid at high pressure such as superheated steam or heated air as the surrounding atmosphere is contacted with the yarn passing through the needle, and the yarn is then released into the atmosphere for cooling to thereby impart the crimping with the yarn. Alternatively, the method used may further comprise the step of blowing cool air to the crimped yarn that had passed through the crimping nozzle for the purpose of fixing the crimping, or depositing the crimped yarn on the surface of a rotary filter which sucks the cooled air into its interior to thereby cool the crimped yarn.

[0047] The temperature of the crimping nozzle in the crimping is preferably 190 to 250°C, and more preferably 210 to 240°C. When the temperature of the crimping nozzle is less than 190°C, the sufficient crimping will not be possible due to the insufficient heat treatment whereas the temperature of the crimping nozzle in excess of 250°C may invite excessive heat treatment resulting in the fusion and deterioration of the polymer to detract from the physical properties such as strength, elongation, elongation rate, and the like of the crimped yarn.

[0048] The crimped yarn which has been subjected to the crimping is adequately drawn for partial non-manifestation of the crimps, and interlaced before winding for the bundling of the yarns. The yarn is then wound by using a winder.

[0049] The woven or knitted fabric for clothing of the present invention is a fabric containing the polyamide crimped yarn for clothing of the present invention as described above, and the fabric may preferably contain at least 25% by weight of the polyamide crimped yarn for clothing of the present invention.

[0050] When the amount of the polyamide crimped yarn for clothing in the entire woven or knitted fabric for clothing of the present invention is less than 25% by weight, realization of the bulkiness, the resilience, the lightness, and the high aesthetic quality with visually recognizable woven or knitted organization which are the effects of the present

invention may not be realized. The proportion of the polyamide crimped yarn for clothing in the woven or knitted fabric for clothing may be selected in the range up to 100% by weight.

[0051] The woven or knitted fabric for clothing of the present invention preferably has a lightness (cm^3/g) of at least 3.0 and up to 6.0 simultaneously with a heat retention (%) of at least 20 and up to 50. When the lightness is less than 3.0, realization of the bulkiness which is an object of the present invention will be difficult, and the lightness is insufficient since such lightness can be realized by conventional woven or knitted fabrics for clothing of polyester fiber or polyamide fiber yarn having a total fineness in the range of 22 dtex to 200 dtex. In the meanwhile, when the lightness is in excess of 6.0, the resulting woven or knitted fabric will be very thick and sewing will be difficult and production will be substantially impossible despite the capability of producing the fabric satisfying all of the bulkiness, the lightness, and the heat retention. Such fabric is also likely to suffer from insufficient resilience, insufficient fabric property (slipping seam), and fraying of the fabric.

[0052] With regard to the heat retention of up to 20%, the heat retention of this level is not the one required for the clothing of fall and winter season, and such heat retention can be realized by the conventional woven or knitted fabrics for clothing of polyester fiber or polyamide fiber yarn having a total fineness in the range of 22 dtex to 200 dtex. In the meanwhile, when the heat retention is in excess of 50%, realization of the intended lightness will be difficult, and the resulting fabric will be very thick and production will be substantially impossible.

[0053] The woven or knitted fabric for clothing of the present invention may also contain fibers other than the polyamide crimped yarn for clothing of the present invention. Exemplary such other fibers include raw or false-twisted textured yarn of polyester filament, raw or false-twisted textured yarn of nylon filament, spun filament of synthetic fiber, acetate filament of semisynthetic fiber, rayon filament or spun filament of regenerated fiber, and natural fiber such as wool and cotton. Other forms of incorporating other fibers include weaving and knitting with other single fiber, mixed spun, combined, or twisted yarn.

[0054] The organization of the woven fabric in the woven or knitted fabric for clothing of the present invention is the one produced by using the polyamide crimped yarn for clothing of the present invention for at least the warp and/or the weft, and in the preferable embodiment, the fabric contains at least 25% by weight of the polyamide crimped yarn for clothing of the present invention. An aesthetic quality with visually recognizable woven or knitted organization is realized when the woven fabric has organizations such as plain, twill, satin, ripple, Amundsen, plain double, or twill double weave.

[0055] In the case of the knitted fabric, exemplary knit organizations include warp knitted fabrics such as half and Denbigh knitted fabrics and circular knitted fabrics such as punch, mockrody, plain, and rib knitted fabrics. Particularly in the case of the circular knitting, the knitted fabric has high bulkiness, resilience, and lightness as well as high aesthetic quality with visually recognizable woven or knitted organization realized by the space of the knit organization and the effects of the polyamide crimped yarn for clothing of the present invention.

[0056] Furthermore, the polyamide crimped yarn for clothing used in the woven or knitted fabric of the present invention may also be used in non-twisted state as long as such state does not adversely affect the bulkiness and resilience characteristic to the present invention or the process passability in the production of the woven or knitted fabric. In order to realize the bulkiness and the volume to their maximum, the twist factor (K) of the polyamide crimped yarn for clothing in the preferable embodiment is in the range of at least 300 and up to 35,000.

[0057] In another preferable embodiment, the polyamide crimped yarn for clothing of the present invention and a natural fiber, a synthetic fiber, a semisynthetic fiber, or a regenerated fiber selected from the following group are woven or knitted together and dyed with two or more different types of dyes or with a single type of dye as a means for realizing the aesthetic character with visually recognizable woven or knitted organization.

[0058] Exemplary such fiber groups include natural fibers such as wool, cotton, linen, and animal hair (cashmere, mohair, angora, and camel), synthetic fibers such as polyester fiber and acryl fiber which can be dyed with a cationic dye, semisynthetic fibers such as acetate fiber, and regenerated fibers such as rayon and cuprammonium rayon.

[0059] In producing the woven or knitted fabric for clothing of the present invention, the woven or knitted greige preferably containing at least 25% by weight of the polyamide crimped yarn for clothing is treated by normal steps of woven or knitted fabric production such as scouring, relaxing, drying, and dry heat setting, and the fabric is then dyed, dried, and finished.

[0060] Depending on the type of the fiber knitted or woven together, the fabric may be treated by various commonly used methods such as mercerization, fulling, enzyme reduction, and alkaline reduction. In addition, it is also preferable to incorporate the step of contracting the polyamide fiber filaments by heat treatment using a treatment solution containing benzyl alcohol to realize the higher bulkiness and resilience. Furthermore, finishing resin treatments such as softening, water repellent, soil resistant, antimicrobial, and antistatic treatments may be conducted as desired to the extent not adversely affecting the object of the present invention.

[0061] The "dye types" as used herein include disperse dye, metal-containing dye, acidic dye, reactive dye, cationic dye, and direct dye. When the fabric knitted or woven from two or more yarns as described above is dyed with two or more types of dyes, the knitted or woven organization becomes visually recognizable due to the color difference by the due difference between the fibers. The fashionability required in women's clothing is also realized. When the knitted or

woven fabric is dyed with single types of dye, the knitted or woven organization also becomes visually recognizable due to the hue contrast between the dyed fiber and the non-dyed fiber. When the fabric dyed is a fabric woven or knitted with a fiber which is not dyed by the same dye or a fabric woven or knitted with a preliminarily dyed yarn, the knitted or woven organization also becomes visually recognizable due to the difference between the hue of the dyed fiber and non-dyed fiber, and the fashionability is also realized.

[0062] The dye used for the dye type as mentioned above may be a dye that is normally commercially available, and the method used for the dyeing may be a method known in the art that are normally used for the dyeing.

[0063] The woven or knitted fabric for clothing of the present invention is preferably the one wherein the polyamide crimped yarn for clothing obtained by undoing the woven or knitted fabric for clothing has a crimp factor of at least 2.5% and up to 25%. The crimp factor is more preferably at least 3% and up to 20%. When the crimp factor of the polyamide crimped yarn for clothing obtained by undoing the woven or knitted fabric is less than 2.5%, realization of the bulkiness with sufficient volume becomes difficult. The crimp factor in excess of 25% results in the strong softness and difficulty in the realization of adequate resilience, and the clothing prepared by using the fabric with such crimp factor is also likely to experience deformation phenomenon wherein the drawn fabric does not recover its normal state.

[0064] The thus obtained woven or knitted fabric for clothing of the present invention is well adapted for use in the outer clothing for women selected from coat, cloak, jacket, skirt, one piece dress, and dress.

Examples

[0065] Next, the polyamide crimped yarn for clothing of the present invention and the woven or knitted fabric for clothing are described in further detail by referring to the Examples. The values of various properties in the foregoing description and the following Examples and Comparative Examples are those measured by the procedure as described below.

(1) Total fineness: The conditioned fineness defined in JIS L1013 (2010 edition) 8.3.1 method b)B was measured, and this value was used for the total fineness.

(2) Monofilament fineness: Total fineness was divided by the number of filaments, and the resulting value was used for the monofilament fineness.

(3) Elongation after boiling water treatment: Polyamide crimped yarn for clothing was wound on a reel and allowed to stand in a room at a temperature of 20°C and a relative humidity of 65% for 3 hours for de-crimping. The yarn was then immersed in boiling water for 20 minutes to conduct the boiling water treatment. The yarn wound on the reel that has been subjected to the boiling water treatment is then allowed to dry in the same room for 12 hours. The yarn was then cut to a length of approximately 1 m, and the length L1 of the yarn was measured after applying an initial load of 17.7 A (μN) (1.8 A (mg)) (wherein A (dtex) is the total fineness of the yarn) for 30 seconds.

Next, the predetermined load of 883 A (μN) (90 A(mg)) was applied for 30 seconds, and the length L2 of the yarn was measured. The crimp elongation G(%) of the present invention was measured from the lengths L1 and L2 by the following equation (2). The crimp elongation G(%) was average of 5 samples.

$$G = \{(L2-L1)/L1\} \times 100(\%) \quad \dots (2)$$

(4) Number of interlace nodes: The number of interlace nodes per meter in the polyamide crimped yarn for clothing was counted by visual inspection. More specifically, the polyamide crimped yarn for clothing was measured 5 times in the longitudinal direction, and the number of interlace nodes was the average of 5 measurements. In the case of the polyamide crimped yarn for clothing obtained by undoing the woven or knitted fabric for clothing, the number of interlace nodes per 50 cm was visually counted, and the counting was conducted after removing the net twists by de-twister when the yarn has net twists. The polyamide crimped yarn for clothing after the de-crimping was measured 5 times in the longitudinal direction, and the average of the number of interlace nodes per meter was used for the number of interlace nodes.

(5) Degree of irregularity: The end of the polyamide crimped yarn for clothing wrapped by rayon staples was passed through a hole (inner diameter, 1.0 mm) in the stainless steel plate having a thickness of 0.5 mm, and the yarn was cut with a safety razor at opposite surfaces of the plate in the direction parallel with the plate surface to prepare the sample for observation at the cross section. This sample was observed with digital microscope "VHX-500" manufactured by Keyence Corporation at a magnification of 500 to determine the degree of irregularity from diameter D of the circumscribed circle of the monofilament cross section and diameter d of the inscribed circle of the monofilament cross section by the following equation (3). Average of 10 samples was used for the degree of irregularity. The "circumscribed circle" as used herein means minimum circle including the monofilament cross section in its interior, and the "inscribed circle" as used herein means maximum circle included in the monofilament cross section (the

hollow part is included in the monofilament cross section in the case of a hollow filament) in its interior.

$$\text{Degree of irregularity} = D/d \quad \dots (3)$$

(6) Hollowness: The end of the polyamide crimped yarn for clothing wrapped by rayon staples was passed through a hole (inner diameter, 1.0 mm) in the stainless steel plate having a thickness of 0.5 mm, and the yarn was cut with a safety razor at opposite surfaces of the plate in the direction parallel with the plate surface to prepare the sample for observation at the cross section. This sample was observed with digital microscope "VHX-500" manufactured by Keyence Corporation at a magnification of 500, and by using the area measurement function, the hollowness was determined from cross sectional area S of the filament containing the hollow part and the area s of the hollow part by the following equation(4). The average of 10 samples was used for the hollowness.

$$\text{Hollowness} = (s/S) \times 100(\%) \quad \dots (4)$$

(7) Twist factor: By using the polyamide crimped yarn for clothing or the polyamide crimped yarn for clothing obtained by undoing the woven or knitted fabric for clothing, the twist factor was determined from the twist number T per m calculated by de-twister and the total fineness D described in the above (1) by the following equation (1). The average of 10 samples was used for the twist factor.

$$\text{Twist factor } K = T \times D^{1/2} \quad \dots (1)$$

T = number of twists per 1 m of the yarn, and
D = total fineness (dtex) of the yarn.

(8) Crimp factor: Crimp factor is the value measured according to method B of the methods for measuring weave shrinkage of the yarn defined in JIS L1096 (2010 edition) by using the initial load of 0.002 cN/dtex and the predetermined load of 0.11 cN/dtex by the following equation (5). The average of 3 samples (20 cm) was used for the crimp factor.

$$\text{Crimp factor } (\%) = \frac{(\text{the length upon application of the predetermined load} - \text{the length upon application of the initial load})}{(\text{the length upon application of the initial load})} \times 100$$

$$\dots (5)$$

(9) Coefficient of variation (CV) of the degree of irregularity: The procedure used in the measurement of the degree of irregularity in the above (5) was repeated except that the samples measured were all monofilaments, and the coefficient of variation (CV) of the degree of irregularity was determined from the standard deviation σ and the average μ of the degree of irregularity of the all monofilaments by the following equation (6):

$$CV = (\sigma/\mu) \times 100(\%) \quad \dots (6)$$

(10) Bulkiness: The bulkiness was determined by sensory test of the texture by a panel of 5 people, and A was evaluated "pass".

A: sufficient bulkiness

B: insufficient bulkiness, insufficient

C: no bulkiness, fail

(11) Resilience: The resilience was determined by sensory test of the texture by the panel of 5 people, and A was evaluated "pass".

A: adequate resilience, good

B: insufficient resilience, insufficient

C: no resilience or excessive resilience, fail

(12) Aesthetic quality: The visually recognizable quality of knitted or woven organization was visually evaluated on a fabric inspection machine, and A was evaluated "pass".

A: good visual recognizability of the knitted or woven organization

B: insufficient visual recognizability of the knitted or woven organization

C: no visual recognizability of the knitted or woven organization, fail

(13) Unit weight: The value determined by unit mass (mass per unit area) measurement method A in standard conditions defined in JIS L1096 (2010 edition) was used for the unit weight.

(14) Thickness: The value determined by thickness measurement method A defined in JIS L1096 (2010 edition) was used for the thickness.

(15) Lightness: The value determined by the method for measuring bulkiness defined in JIS L1096 (2010 edition) was used for the lightness.

(16) Heat retention: The value determined by heat retention method A defined in JIS L1096 (2010 edition) was used for the heat retention (%).

(17) Productivity and process passability: The productivity and process passability of the woven or knitted fabric was evaluated by the incidence of yarn cutting and fluffing, and A was evaluated "pass".

A: no problem in the dividing, twisting, warping, and weaving or knitting, and good productivity

B: slight fluffing and some yarn cutting in the dividing, twisting, warping, and weaving or knitting, and slightly insufficient productivity

C: fluffing and cutting in the dividing, twisting, warping, and weaving or knitting, and poor productivity

(Example 1)

[0066] Nylon 6 polymer having a sulfuric acid relative viscosity of 2.8 containing 0.13% by weight of titanium oxide was subjected to melt spinning by using an extruder-type spinner. The spinning was conducted at a spinning temperature of 250°C using a nozzle having trilobal (Y-shaped) orifice so that the resulting yarn had a total fineness of 970 dtex, a filament number of 360, a monofilament fineness of 2.7 dtex, and a degree of irregularity of 2.15. The spinning speed was 1200 m/minute, and thermal drawing was conducted at a draw ratio of 2.4 and a draw temperature of 195°C. The drawn yarn was continuously crimped by using a known jet stuffer nozzle. After cooling the yarn on a cooling roll without winding, the yarn was drawn by applying 0.12 cN/dtex for non-manifestation of the crimps, and the yarn was passed through an interlace nozzle to provide 12 interlace nodes per meter. The yarn was then wound at 2600 m/minute.

[0067] The resulting yarn was a polyamide crimped yarn for clothing having a total fineness of 970 dtex, a filament number of 360, a monofilament fineness of 2.7 dtex, a degree of irregularity of 2.15, a CV of 5.35%, a draw ratio after the boiling water treatment of the Y-shaped cross section of 9.3%, and a number of interlace nodes of 12 nodes/m. Cross section of the thus obtained polyamide crimped yarn for clothing is shown in FIG. 1.

[0068] Next, the polyamide crimped yarn for clothing was divided into an adequate winding weight by using a rewinder, and 100 T/m of net twist was applied by using a double twister in S twist direction to obtain a polyamide crimped yarn for clothing having a twist factor K of 3114.

[0069] By using the resulting polyamide crimped yarn for clothing, a woven fabric (greige) using 100% by weight of the polyamide crimped yarn for clothing having oxford organization with the warp density of 31 yarns/2.54 cm and the weft density of 35 yarns/2.54 cm was woven using the polyamide crimped yarn for clothing applied with the twisting of 100 T/m for the warp and the non-twisted polyamide crimped yarn for clothing for the weft. The process passability in the steps of producing the woven fabric was favorable. Next, the resulting greige was treated by normal steps of woven fabric production such as scouring, relaxing, and dry heat setting and dyed by using an acidic dye using a jet dyeing machine and finished by drying and dry heat setting to produce a woven fabric for clothing using the polyamide crimped yarn for clothing.

[0070] The resulting woven fabric for clothing had a crimp factor of the polyamide crimped yarn for clothing obtained by undoing the fabric of 11.2%, a lightness of 3.16, a heat retention of 21.6%, a high bulkiness, and an adequate resilience. The woven fabric had high aesthetic quality with visually recognizable woven organization, and the fabric was suitable for women's clothing application, and in particular, for outer clothing.

(Example 2)

[0071] The melt spinning was conducted by repeating the procedure of Example 1 using the Nylon 6 polymer which is the same as the one used in Example 1. The spinning was conducted at a spinning temperature of 250°C using a nozzle having trilobal (Y-shaped) orifice for hollow cross section so that the resulting yarn has a total fineness of 940 dtex, a filament number of 68, a monofilament fineness of 13.8 dtex, and a degree of irregularity of 2.65. The spinning

speed was 1200 m/minute, and thermal drawing was conducted at a draw ratio of 2.4 and a draw temperature of 195°C. The drawn yarn was continuously crimped by using a known jet stuffer nozzle. After cooling the yarn on a cooling roll without winding, the yarn was drawn by applying 0.12 cN/dtex for non-manifestation of the crimps, and the yarn was passed through an interlace nozzle to provide 14 interlace nodes per meter. The yarn was then wound at 2600 m/minute.

[0072] The resulting yarn was a polyamide crimped yarn for clothing having a total fineness of 940 dtex, a filament number of 68, a monofilament fineness of 13.8 dtex, a degree of irregularity of 2.65, a CV of 4.16%, a Y-shape cross section with hollowness of 12%, a draw ratio after the boiling water treatment of 17.0%, and a number of interlace nodes of 14 nodes/m. Cross section of the thus obtained polyamide crimped yarn for clothing is shown in FIG. 2.

[0073] Next, the polyamide crimped yarn was divided as in the case of Example 1, and 200 T/m of net twist was applied in S twist direction to obtain a polyamide crimped yarn for clothing having a twist factor K of 6132.

[0074] By using the resulting polyamide crimped yarn for clothing for the warp and weft, a woven fabric (greige) using 100% by weight of the polyamide crimped yarn for clothing having oxford organization with the warp density of 24 yarns/2.54 cm and the weft density of 35 yarns/2.54 cm was woven. The process passability in the steps of producing the woven fabric was favorable.

[0075] Next, the resulting greige was treated by normal steps of woven fabric production similar to those used in Example 1 to produce a woven fabric for clothing using the polyamide crimped yarn for clothing. The resulting woven fabric for clothing had a crimp factor of the polyamide crimped yarn for clothing obtained by undoing the fabric of 6.8%, a lightness of 4.71, a heat retention of 23.7%, a high bulkiness, and an adequate resilience. The woven fabric had high aesthetic quality with recognizable woven organization, and the fabric was suitable for women's clothing application, and in particular, for outer clothing.

(Example 3)

[0076] A knitted fabric (greige) using 50 % by weight of inlaid polyamide crimped yarn for clothing was knitted by using the untwisted polyamide crimped yarn for clothing obtained in Example 1, a dyed mixed yarn (wool gauge, 1/16) of 90% by weight of wool and 10% by weight of nylon, and a dyed spun yarn (wool gauge, 2/48) of 100% by weight of wool by using a 12 G single knit circular knitting machine. The process passability in the steps of producing the knitted fabric was favorable.

[0077] Next, the resulting greige was finished by using a softener in the relaxing and the dry heat setting which are normal steps of knitting to prepare a knitted fabric for clothing using the polyamide crimped yarn for clothing.

[0078] The resulting knitted fabric for clothing had a crimp factor of the polyamide crimped yarn for clothing obtained by undoing the fabric of 16.7%, a lightness of 5.08, a heat retention of 34.8%, a high bulkiness, and an adequate resilience. The knitted fabric had a very high lightness, hue difference and contrast effect between the non-dyed polyamide crimped yarn for clothing, the dyed wool, and the nylon, and high aesthetic quality with recognizable knitted organization, and accordingly, the fabric was suitable for women's clothing application, and in particular, for outer clothing.

(Example 4)

[0079] The polyamide crimped yarn for clothing obtained in Example 2 was twisted (net twist) in S twist direction at 300 T/m so that the twist factor K was 9198. Next, a woven fabric (greige) using 60% by weight of polyamide crimped yarn for clothing was woven by using the resulting polyamide crimped yarn for clothing for the warp, and a mixed yarn (wool gauge, 2/52) of 60% acryl and 40% rayon and a false twisted nylon textured yarn having 10 filament of 33 dtex for the weft. The fabric was a connected twill double weave having a warp density of 61 yarns/2.54 cm and a weft density of 80 yarns/2.54 cm. The process passability in the steps of producing the woven fabric was favorable.

[0080] Next, the resulting greige was treated by normal steps of woven fabric production such as scouring, relaxing, and dry heat setting and dyed by using an acidic dye, cationic dye, and direct dye using a jet dyeing machine and finished by drying and dry heat setting to produce a woven fabric for clothing using the polyamide crimped yarn for clothing.

[0081] The resulting woven fabric had a crimp factor of the polyamide crimped yarn for clothing obtained by undoing the fabric of 7.1%, a lightness of 4.03, a heat retention of 28.2%, a high bulkiness, and an adequate resilience. The woven fabric had hue difference and hue contrast effect of the polyamide crimped yarn for clothing, the nylon, and the acryl and rayon, and high aesthetic quality with recognizable woven organization, and accordingly, the fabric was suitable for women's clothing application, and in particular, for outer clothing.

(Example 5)

[0082] The polyamide crimped yarn for clothing obtained in Example 2 was divided by repeating the procedure of Example 1 and twisted in S twist direction (net twist, 50 T/m) to obtain a polyamide crimped yarn for clothing having a twist factor K of 1532. A woven fabric (greige) using 40% by weight of polyamide crimped yarn for clothing was woven

by using the aligned twisted (net twist) polyamide crimped yarn for clothing and a spun yarn of 100% cotton (cotton gauge, 60/2) for the warp, and the aligned two ply yarn of false twisted nylon textured yarn comprising 68 filaments of 155 dtex and a spun yarn of 100% wool (wool gauge, 2/30) for the weft. The fabric was a twill double weave having a warp density of 52 yarns/2.54 cm and a weft density of 67 yarns/2.54 cm. The process passability in the steps of producing the woven fabric was favorable.

[0083] Next, the resulting greige was treated by normal steps of woven fabric production such as scouring, relaxing, and dry heat setting and dyed by using an acidic dye using a jet dying machine and finished by drying and dry heat setting to produce a woven fabric for clothing using the polyamide crimped yarn for clothing.

[0084] The resulting woven fabric for clothing had a crimp factor of the polyamide crimped yarn for clothing obtained by undoing the fabric of 6.0%, a lightness of 3.06, a heat retention of 28.9%, a high bulkiness, and an adequate resilience. The woven fabric had hue difference between the polyamide crimped yarn for clothing, the nylon, and the wool, hue contrast effect of to the cotton which remained undyed, and high aesthetic quality with recognizable woven organization, and accordingly, the fabric was suitable for women's clothing application, and in particular, for outer clothing.

[0085] Results of the evaluation of the woven or knitted fabrics in Examples 1 to 5 as described above are shown in Table 1.

[Table 1]

	Example 1	Example 2	Example 3	Example 4	Example 5
Total fineness (dtex)	970	940	970	940	940
Filament number	360	68	360	68	68
Monofilament fineness (dtex)	2.7	13.8	2.7	13.8	13.8
Draw ratio after boiling water treatment (%)	9.3	17	9.3	17	17
Number of interface nodes (nodes/m)	12	14	12	14	14
Monofilament cross section	Trilobal / Y-shape	Trilobal / Y-shaped, hollow	Trilobal / Y-shaped	Trilobal / Y-shaped, hollow	Trilobal / Y-shaped, hollow
Degree of irregularity	2.15	2.65	2.15	2.65	2.65
Coefficient of variation (CV) of the degree of irregularity (%)	5.35	4.16	5.35	4.16	4.16
Hollowness (%)	0	12	0	12	12
Twist factor K	3114	6132	0	9198	1532

Polyamide
crimped
yarn for
clothing

(continued)

	Example 1	Example 2	Example 3	Example 4	Example 5
Blend ratio of the polyamide crimped yarn (wt %)	100	100	50	60	40
Woven / knitted	Woven fabric	Woven fabric	Knitted fabric (circular knitting)	Woven fabric	Woven fabric
Yarn type	Warp: 970T-360f-polyamide crimped yarn Weft: 970T-360f-polyamide crimped yarn	Warp: 940T-68f-polyamide crimped yarn Weft: 940T-68f-polyamide crimped yarn	970T-360f-polyamide crimped yarn Mixed yarn of wool 90% / nylon 10%, 1/16 Wool 100% spun yarn, 2/48	Warp: 940T-68f-polyamide crimped yarn Weft: mixed yarn of acryl 60% / rayon 40%, 2/52 Weft: 33T-10f-nylon textured yarn	Warp: 940T-68f-polyamide crimped yarn Warp: cotton 100% spun yarn, 60/2 Weft: 155T-68-nylon textured yarn, /2 Weft: wool 100% spun yarn, 2/30
Twist number of polyamide crimped yarn (T/m)	Warp: S twist, 100 Weft: not twisted	Warp: S twist, 200 Weft: S twist, 200	Not twisted	Warp: S twist, 300	Warp: S twist, 50
Crimp factor	11.2	6.8	16.7	7.1	6.0
Thickness (mm)	1.25	1.61	1.35	1.25	0.95
Unit weight (g/m ²)	396	342	266	310	310
Lightness (cm ³ /g)	3.16	4.71	5.08	4.03	3.06
Heat retention (%)	21.6	23.7	34.8	28.2	28.9
Bulkiness	A	A	A	A	A
Resilience	A	A	A	A	A
Aesthetic quality	A	A	A	A	A
Process passability	A	A	A	A	A

Woven or knitted fabric for clothing

(Comparative Example 1)

[0086] Nylon 6 polymer the same as the one used in Example 1 was subjected to melt spinning by the same procedure. The spinning was conducted at a spinning temperature of 250°C using a nozzle having trilobal (Y-shaped) orifice so that the resulting yarn has a total fineness of 970 dtex, a filament number of 700, a monofilament fineness of 1.39 dtex, and a degree of irregularity of 1.45. The spinning speed was 1200 m/minute, and thermal drawing was conducted at a draw ratio of 2.4 and a draw temperature of 195°C. The drawn yarn was continuously crimped by using a known jet stuffer nozzle. After cooling the yarn on a cooling roll without winding, the yarn was drawn by applying 0.12 cN/dtex for non-manifestation of the crimps, and the yarn was passed through an interlace nozzle to provide 8 interlace nodes per meter. The yarn was then wound at 2600 m/minute.

[0087] The resulting yarn was a polyamide crimped yarn having a total fineness of 970 dtex, a filament number of 700, a monofilament fineness of 1.39 dtex, a degree of irregularity of 1.45, a CV of 5.11%, a draw ratio after the boiling water treatment of the Y-shaped cross section of 3.2%, and a number of interlace nodes of 8 nodes/m. The resulting polyamide crimped yarn was divided and twisted (net twist) by repeating the procedure of Example 1 to obtain the woven fabric having similar density and organization. The process passability in the steps of producing the woven fabric was favorable. This woven fabric was finished by repeating the procedure of Example 1. The resulting woven fabric was unsatisfactory due to the lack of the bulkiness and the resilience.

(Comparative Example 2)

[0088] Nylon 6 polymer the same as the one used in Example 1 was subjected to melt spinning by the same procedure. The spinning was conducted at a spinning temperature of 250°C using a nozzle having trilobal (Y-shaped) orifice for hollow cross section so that the resulting yarn had a total fineness of 1560 dtex, a filament number of 96, a monofilament fineness of 16.3 dtex, and a degree of irregularity of 2.65. The spinning speed was 1200 m/minute, and thermal drawing was conducted at a draw ratio of 2.4 and a draw temperature of 195°C. The drawn yarn was continuously crimped by using a known jet stuffer nozzle. After cooling the yarn on a cooling roll without winding, the yarn was drawn by applying 0.12 cN/dtex for non-manifestation of the crimps, and the yarn was passed through an interlace nozzle to provide 14 interlace nodes per meter. The yarn was then wound at 2600 m/minute.

[0089] The resulting yarn was a polyamide crimped yarn having a total fineness of 1560 dtex, a filament number of 96, a monofilament fineness of 16.3 dtex, a degree of irregularity of 2.65, a CV of 4.17%, a Y-shape cross section with hollowness of 12%, a draw ratio after the boiling water treatment of the Y-shaped cross section (with a hollowness of 12%) of 17%, and a number of interlace nodes of 14 nodes/m.

[0090] Next, the polyamide crimped yarn was divided into an adequate winding weight by using a rewinder, and T/m of net twist was applied by using a double twister in S twist direction to obtain a polyamide crimped yarn having a twist factor K of 1184. By using the resulting polyamide crimped yarn, a woven fabric having oxford organization with the warp density of 25 yarns/inc and the weft density of 30 yarns/2.54 cm was woven. No problem was found for the process passability in the steps of producing the woven fabric although the installation that could be used for the production was limited, and the productivity was unfavorable.

[0091] Next, the resulting woven fabric was finished by the same steps as those of Example 1. The resulting woven fabric suffered from excessive resilience, and the fabric was very hard and unsuitable for women's fabric, and especially for the outer clothing although the fabric had bulkiness.

(Comparative Example 3)

[0092] A woven fabric having oxford organization was woven by using a two ply yarn of false twisted nylon textured yarn comprising 36 filaments of 167 dtex having a circular monofilament cross section (degree of irregularity, 1) for the warp and the weft at the warp density of 77 yarns/2.54 cm and the weft density of 80 yarns/2.54 cm without using the polyamide crimped yarn for clothing of the present invention. The process passability in the steps of producing the woven fabric was favorable. Next, the resulting woven fabric was finished by the same steps as those of Example 1. The resulting woven fabric was unsatisfactory with insufficient bulkiness and resilience, a lightness as low as 2.08, and insufficiently recognizable woven organization.

(Comparative Example 4)

[0093] A woven fabric similar to that of the Comparative Example 3 was woven by using a two ply yarn of false twisted nylon textured yarn comprising 36 filaments of 167 dtex having a Y-shaped monofilament cross section (degree of irregularity, 1.48; CV, 5.39) for the warp and weft without using the polyamide crimped yarn for clothing of the present invention. The process passability in the steps of producing the woven fabric was favorable. Next, the resulting woven

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fabric was finished by the same steps as those of Example 1. The resulting woven fabric was unsatisfactory with insufficient bulkiness and resilience, a lightness as low as 2.24, and insufficiently recognizable woven organization.

[0094] Results of the evaluation of the woven or knitted fabrics in Comparative Examples 1 to 4 as described above are shown in Table 2.

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[Table 2]

	Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4
Total fineness (dtex)	970	1560	(167)	(167)
Filament number	700	96	(36)	(36)
Monofilament fineness (dtex)	1.39	16.3	(4.64)	(4.64)
Draw ratio after boiling water treatment (%)	3.2	16	-	-
Number of interface nodes (m)	8	12	-	-
Monofilament cross section	Trilobal/Y-shaped	Trilobal/Y-shaped	(Circular cross section)	Trilobal/Y-shaped
Degree of irregularity	1.45	3.6	(1.0)	(1.48)
Coefficient of variation (CV) of the degree of irregularity (%)	5.11	4.17	-	(5.39)
Hollowness (%)	0	0	-	-
Twist factor K	3114	1184	-	-

Polyamide crimped yarn for clothing (false twisted textured yarn used in the Comparative Example)

(continued)

	Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4
Blend ratio of the polyamide crimped yarn (wt %)	100	100	0	0
Woven / knitted	Woven fabric	Woven fabric	Woven fabric	Woven fabric
Type of the yarn	Warp: 970T-700f-polyamide crimped yarn Weft: 970T-700f-polyamide crimped yarn	Warp: 1560T-96f-polyamide crimped yarn Weft: 1560T-96f-polyamide crimped yarn	Warp: 167T-36-nylon false twisted textured yarn/2 Warp: 167T-36-nylon false twisted textured yarn/2	Warp: 167T-36-nylon false twisted textured yarn/2 Warp: 167T-36-nylon false twisted textured yarn/2
Twist number of polyamide crimped yarn (T/m)	Warp: S twist, 100 Weft: not twisted	Warp: S twist, 30 Weft: S twist, 30	-	-
Crimp factor	2.7	7.7	9.1	10.1
Thickness (mm)	0.88	2.61	0.54	0.57
Unit weight (g/m ²)	390	533	260	255
Lightness (cm ³ /g)	2.26	4.89	2.08	2.24
Heat retention (%)	18.4	22.7	16.2	17.0
Bulkiness	C	A	C	C
Resilience	C	C	C	C
Aesthetic quality	B	A	C	C
Process passability	A	C	A	A

Woven or knitted fabric for clothing

Claims

1. A polyamide crimped yarn for clothing comprising a multifilament satisfying the following conditions (1) to (3):

(1) monofilament fineness is at least 1.5 dtex and up to 25 dtex,
 (2) total fineness is least 400 dtex and up to 1500 dtex, and
 (3) the monofilament has a multilobal cross section with three or more lobes and a degree of irregularity of at least 1.5 and up to 5.5.

2. A polyamide crimped yarn for clothing according to claim 1 wherein the monofilament has a multilobal cross-section with 3 or more lobes radially extending from the center of the monofilament cross section, the degree of irregularity is at least 1.7 and up to 5.5, and the coefficient of variation (CV, %) of the degree of irregularity is less than 7.0 and at least 1.0.

3. A polyamide crimped yarn for clothing according to claim 1 or 2 wherein the monofilament is a hollow filament having a hollowness of at least 5% and up to 25%.

4. A polyamide crimped yarn for clothing according to any one of claims 1 to 3 wherein the elongation after boiling water treatment is at least 5% and up to 30%, and number of interlace nodes is at least 5 nodes/m and up to 50 nodes/m.

5. A polyamide crimped yarn for clothing according to any one of claims 1 to 4 wherein the yarn is twisted (net twist), and twist factor (K) represented by the following equation (1) is at least 300 and up to 35,000

$$\text{Twist factor } K = T \times D^{1/2} \quad \dots (1)$$

T = twist number per yarn length of 1 m, and
 D = total fineness (dtex) of the yarn.

6. A woven or knitted fabric for clothing containing the polyamide crimped yarn for clothing according to any one of claims 1 to 5.

7. A woven or knitted fabric for clothing according to claim 6 containing at least 25% by weight of the polyamide crimped yarn for clothing.

8. A woven or knitted fabric for clothing according to claim 6 or 7 wherein lightness (cm³/g) is at least 3.0 and up to 6.0, and heat retention (%) is at least 20 and up to 50.

9. A woven or knitted fabric for clothing according to any one of claims 6 to 8 produced by weaving or knitting and dyeing the yarn comprising the polyamide crimped yarn for clothing according to any one of claims 1 to 5 and at least one fiber selected from the following group consisting of natural fibers, synthetic fibers, semi-synthetic fibers, and regenerated fibers:

[groups]

natural fibers: wool, cotton, animal hair, or linen,

synthetic fibers: polyester or acryl resin which can be dyed with a cationic dye,

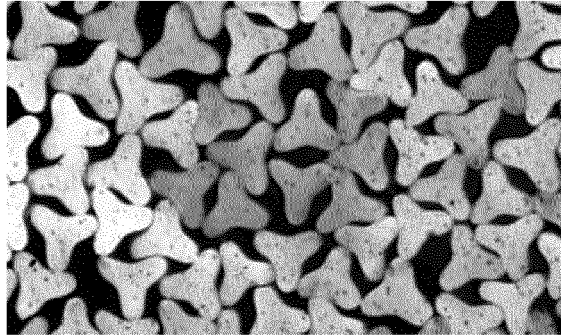
semi-synthetic fibers: acetate, and

regenerated fibers: rayon or cuprammonium rayon.

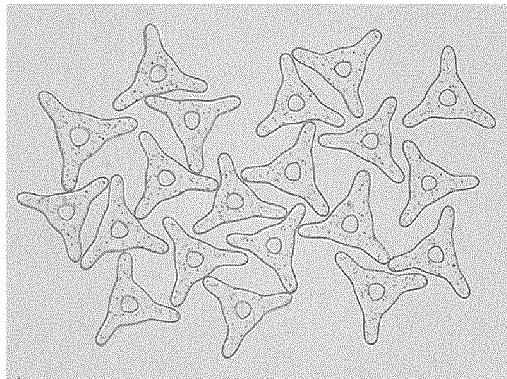
10. A woven or knitted fabric for clothing according to any one of claims 6 to 9 wherein crimp factor of the polyamide crimped yarn for clothing obtained by undoing the woven or knitted fabric for clothing is at least 2.5% and up to 25%.

11. A clothing produced by using a woven or knitted fabric for clothing according to any one of claims 6 to 10 which is a clothing selected from the group consisting of coat, cloak, jacket, skirt, one-piece dress, and dress.

【Fig. 1】



【Fig. 2】



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/078423

A. CLASSIFICATION OF SUBJECT MATTER

D02G3/22(2006.01)i, D02G3/26(2006.01)i, D03D15/00(2006.01)i, D04B1/20(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D02G3/22, D02G3/26, D03D15/00, D04B1/20, D01F6/60

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2014

Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

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 Y	JP 9-241941 A (Unitika Ltd.), 16 September 1997 (16.09.1997), claims; paragraphs [0002], [0007], [0009], [0010], [0012], [0021], [0022], [0025]; fig. 1 (Family: none)	1, 3, 4, 6-11 2
X Y	JP 43-14997 B1 (Teijin Ltd.), 24 June 1968 (24.06.1968), claims; example 1 (Family: none)	1, 4-11 2
Y	JP 2009-133025 A (Toray Industries, Inc.), 18 June 2009 (18.06.2009), claims; paragraphs [0001], [0003], [0009], [0034], [0036] (Family: none)	2

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

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"&" document member of the same patent family

Date of the actual completion of the international search
10 January, 2014 (10.01.14)Date of mailing of the international search report
21 January, 2014 (21.01.14)Name and mailing address of the ISA/
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INTERNATIONAL SEARCH REPORT

International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2000-282338 A (Toray Industries, Inc.), 10 October 2000 (10.10.2000), claims; table 1 (Family: none)	1, 4, 5 2
X Y	JP 60-231834 A (E.I. Du Pont de Nemours & Co.), 18 November 1985 (18.11.1985), claims; examples 1, 3 & US 4559196 A & EP 159635 A2 & ES 542121 A & CA 1241164 A & ZA 8502710 A	1, 4, 5 2

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REFERENCES CITED IN THE DESCRIPTION

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- JP 4214612 B [0007]
- JP 2004084080 A [0046]