

April 15, 1969

KENZO KOSAKA ET AL

3,438,193

COMPOSITE YARN AND ITS MANUFACTURING METHOD

Filed Sept. 13, 1966

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FIG. 1



FIG. 2

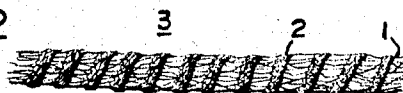


FIG. 3

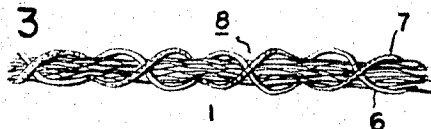
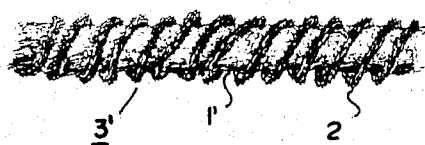


FIG. 4



FIG. 5



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FIG. 6

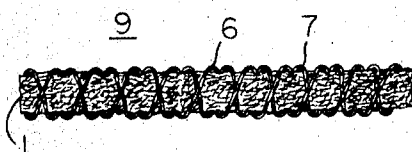


FIG. 7

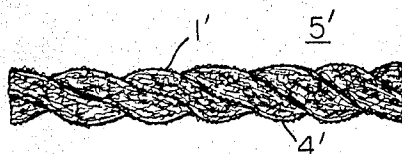
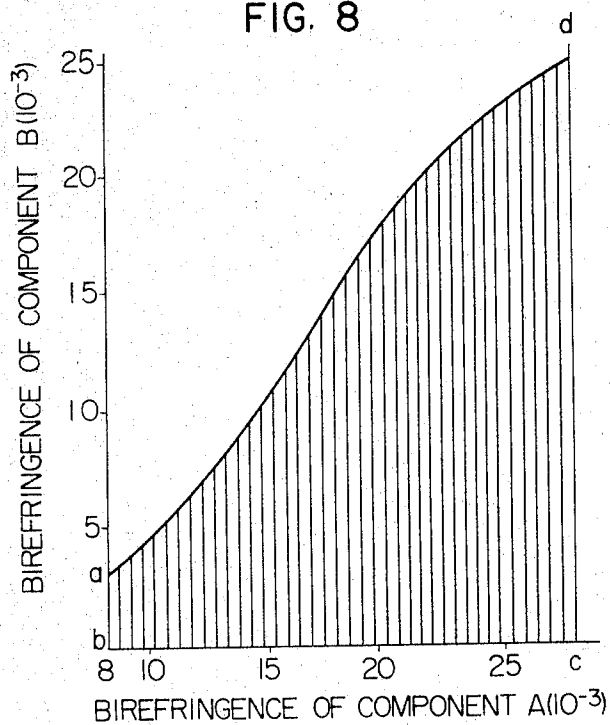


FIG. 8



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17 Claims

ABSTRACT OF THE DISCLOSURE

Composite yarn of superior elasticity and bulkiness is produced by composite spinning polypropylene components having different viscosity and birefringence characteristics, draw-twisting the composite yarn, covering the drawn yarn with one or more yarns of other fibre having low thermal shrinkage and subjecting the covered yarn to relaxation heat treatment. Alternatively two composite polypropylene yarns are twisted together and then subjected to a relaxation heat treatment.

This invention relates to composite yarns having superior elasticity and bulkiness and methods for manufacturing these. More specifically this invention relates to high elastic and bulky composite yarns comprising at least one component of composite-spun polypropylene multifilament yarn which has been shrunk and crimped by relaxation heat treatment and another component of textile yarn or yarns twisted with or covered around the component yarn of composite-spun polypropylene multifilament yarn, and methods for manufacturing these.

The term "composite-spun polypropylene filament yarn" hereinafter used refers to polypropylene multifilament yarn composed of a plurality of bi-component polypropylene filaments manufactured by melt-spinning.

Yarns having elasticity were previously manufactured by covering elastic polymer filament or rubber filament with non-elastic filament yarn or various crimped yarns of non-elastic filament yarns or spun yarn.

For example, yarn manufactured by covering elastic polymer filament with roving has superior elasticity but precise tension control of the covering operation of the roving is necessary as the elastic polymer filament which becomes the core yarn elongates even by a slight stress and in view of this, an expensive covering machine is required. Furthermore, the yarn obtained is not necessarily satisfactory from the point of view of bulkiness and particularly, there was the defect of not making it possible to obtain superior yarns from the viewpoints of softness, feel and durability.

Also, yarns having bulkiness have been manufactured by the method of mixing two kinds of fiber bundles having different thermal shrinkage and applying relaxation heat treatment after spinning or by the method of mutual intermingling of single fibers which compose the filament yarn while forming loops by injecting compressed fluid on said filament yarn, or the method of applying relaxation heat treatment to composite-spun filament obtained by extruding simultaneously two kinds of polymer having different shrinkage adhered together in the fiber spinning stage. Yarns which are manufactured by these methods have superior bulkiness but when made into products, elasticity, that is high percentage of elongation and good elastic recovery, cannot be anticipated and will not be different from the conventional spun yarn.

On the other hand, yarns having elasticity and bulkiness are usually manufactured by the method of double

twisting two crimped yarns obtained by twisting, thermosetting and untwisting filament yarns of thermoplastic synthetic fibers but this method requires many processing steps before they become yarns which are the final product and consequently, is very disadvantageous industrially and economically as the production efficiency is low.

The main object of the invention is to provide bulky composite yarns having superior uniformity and elastic property which are not found in conventional elastic yarns or bulky yarns, as described above, and a method of manufacturing these.

Another object of the invention is to provide high elastic and bulky composite yarns using composite-spun polypropylene filament yarns and a method of manufacturing these.

Still another object of the invention is to provide a method of manufacturing very elastic and bulky composite yarns at low cost and with high production efficiency.

These objects and features will become apparent from the embodiments of the invention illustrated in the drawings and examples, in which;

FIGURE 1 is an enlarged side view showing the appearance of composite-spun polypropylene filament yarn before applying relaxation heat treatment.

FIGURE 2 is an enlarged side view showing the appearance when the yarn of FIGURE 1 is used as the core yarn and another fiber yarn is wrapped around this core yarn in a constant twisting direction.

FIGURE 3 is an enlarged side view showing the appearance when the yarn of FIGURE 1 is used as the core yarn, another fiber yarn is wrapped around this core yarn in a constant twisting direction and furthermore, still another fiber yarn is wrapped around this in an opposite direction to that of the aforementioned covering yarn.

FIGURE 4 is an enlarged side view showing the appearance when two yarns of FIGURE 1 are doubled and twisted.

FIGURE 5 is an enlarged side view showing the high elastic and bulky composite yarn which is one of the yarns of this invention, obtained by applying relaxation heat treatment to the yarn of FIGURE 2.

FIGURE 6 is an enlarged side view showing the high elastic and bulky composite yarn which is one of the yarns of this invention, obtained by applying relaxation heat treatment to the yarn of FIGURE 3.

FIGURE 7 is an enlarged side view showing the high elastic and bulky composite yarn which is one of the yarns of this invention, obtained by applying relaxation heat treatment to the yarn of FIGURE 4.

FIGURE 8 is a graph showing the birefringence relation of A and B components is undrawn composite-spun polypropylene filament yarn.

In this invention at least one of the yarns of the composite yarn is composite-spun polypropylene filament yarn. Orlon Sayelle (registered trademark) which is composed of acrylic fiber is well-known as this type of composite fiber which is obtained by extruding simultaneously two kinds of polymers having different thermal shrinkage adhered to each other in the fiber spinning stage.

The crimping property of composite-spun acrylic fibers is very good but this cannot be used for attaining the objective of the invention as an especially good yarn cannot be obtained from the point of view of elasticity, particularly, repeated elastic recovery at high extension.

Practical composite-spun polypropylene filament yarn which is used as the main material for attaining the objective of the invention was not known previously but the present applicant succeeded in producing practical composite-spun polypropylene filament yarn which is uniform at low cost and high production efficiency.

One example of the method of manufacturing such a composite-spun polypropylene filament yarn is described below. That is, this is manufactured from two kinds of propylene polymers, one of which is a polymer (A) having intrinsic viscosity $[\eta]_i$ of 14–30 and birefringence of a 8×10^{-3} and the other polymer (B) having intrinsic viscosity $[\eta]_i$ of 0.8–30, and the birefringence of (B) made so that it falls within the area which is vertically shaded in FIGURE 8. (a, b, c, d, zone)

It was found that this composite-spun polypropylene filament yarn has good crimpable property and at the same time, it has superior elasticity, and furthermore, superior bulkiness, softness and durability can be bestowed to this filament yarn without losing its crimpable property and elasticity which it originally possesses by wrapping another fiber yarn around this filament yarn and thus, resulted in the present invention.

As is apparent from FIGURES 1 to 7, the very elastic and bulky composite yarn can be obtained by covering another fiber yarn around the aforementioned composite-spun polypropylene filament yarn or by twisting together two said polypropylene filament yarns and then applying relaxation heat treatment but concretely, these can be obtained by the following manufacturing methods.

(1) The method of covering with another fiber yarn in a constant twisting direction of the aforementioned composite-spun polypropylene filament yarn as the core yarn and then applying relaxation heat treatment.

(2) The method of covering another fiber yarn in a constant twisting direction around the aforementioned composite-spun polypropylene filament yarn as the core yarn, and covering further another fiber yarn in an opposite twisting direction to that of the aforementioned covering yarn and then applying relaxation heat treatment.

(3) The method of twisting together two of the aforementioned composite-spun polypropylene filament yarn with another fiber yarn having low thermal shrinkage and then applying relaxation heat treatment.

(4) The method of covering another fiber yarn in a constant twisting direction around the aforementioned composite-spun polypropylene filament yarn as the core yarn and then applying relaxation heat treatment in a state of controlled shrinkage of said core yarn.

(5) The method of covering another fiber yarn in a fixed twisting direction around the above-mentioned composite spun polypropylene filament yarn as the core yarn, and covering further another fiber yarn in an opposite twisting direction to that of the above-mentioned covering yarn and then applying relaxation heat treatment in a state of controlled shrinkage of said core yarn.

(6) The method of twisting together two of the aforementioned composite-spun polypropylene filament yarns and then applying relaxation heat treatment.

(7) The method of twisting together two of the above-mentioned composite-spun polypropylene filament yarns and then applying relaxation heat treatment in a state of controlled shrinkage of the filament yarns.

In all of the aforementioned manufacturing methods, yarns manufactured from above-mentioned as undrawn filament can be used as the composite-spun polypropylene filament yarn. However, in case of method 3 above, it is desirable to adjust the polymer component and spinning condition beforehand so that a large shrinkage of the drawn filament of said undrawn polypropylene filament yarn of at least 15% is obtained by the subsequent relaxation heat treatment. The words "undrawn filaments" means the filament produced by a melt-spinning process before the so-called drawing process.

Silk, acetate rayon or protein filament yarns, various synthetic filament yarns such as polyamide fibers, polyester fibers, polyolefin fibers, acrylic fibers and polyvinyl alcohol fibers independently, or as yarns of these obtained by twisting together or crimped yarns of these, in case of continuous filament yarns, natural fibers or regenerated cellulose yarns such as cotton, viscose rayon, and

staples of the aforementioned synthetic fibers independently or as mixed-spun of these fibers, in case of spun yarns, can be used as the other fiber yarn for manufacturing the composite yarn of the invention.

However, in order to obtain good covering effect, it is necessary for the yarns to have thermal shrinkage below 10% for all yarns in order to obtain good bulkiness.

There is no special restriction on the kind of machine for covering the aforementioned polypropylene filament yarn with another fiber yarn and a conventional covering apparatus can be used as it is. Also, a conventional doubling and twisting machine can be used for twisting two yarns together.

The number of twist of covering or doubling of yarns differs somewhat in accordance with the thermal shrinkage of the core yarn used but good composite yarn can be obtained from the point of view of bulkiness and elasticity when the number of twist calculated on the basis of 180 denier is the range of 200–500 t./m. in case the thermal shrinkage of the core yarn is 15% and 100–300 t./m. in case the thermal shrinkage of the core yarn is 50%.

Dry heat or wet heat can be used as the medium for relaxation heat treatment of composite yarns but the use of steam is more effective as treatment can be carried out uniformly in a short time. Also, a range of 80–150° C. is desirable as the treating temperature as good shrinkage and crimp cannot be obtained at below 80° C. while there is a possibility of degradation of fibers at above 150° C.

Relaxation treatment referred to here is a treatment in a condition in which complete shrinkage of the filaments can be obtained by the heat treatment, in which, the composite yarn taken from a reel was treated in a heated medium, for instance. If products which do not require particularly high bulkiness are to be produced, relaxation heat treatment is carried out in a state of controlled shrinkage of said filaments, in which, for instance, the circumferential length of a reel supporting the composite yarn is shortened by certain predetermined length from an original winding condition, while the composite yarn is supported by the reel, and then the composite yarn is treated in a heated medium, so as to provide the composite yarn with a controlled condition for developing the shrinkage of the composite yarn.

The invention is described with examples but it is to be understood that the invention is not restricted to the examples only.

EXAMPLE 1

Polypropylene components with intrinsic viscosities $[\eta]_i$ of 1.8 (A component) and 1.4 (B component) when measured in a tetralin solution of 135° C. were composite-spun at a temperature of 270° C. using a spinneret for composite spinning. The intrinsic viscosity $[\eta]_i$ and birefringence (Δn) of the A and B components in the undrawn filament obtained were as follows:

	$[\eta]_i$	Δn
A component.....	1.59	17.5×10^{-3}
B component.....	1.31	12.1×10^{-3}

This undrawn yarn was drawn to 4.5 times with a draw-twister and then taken up on a pirn. As a result, potentially crimpable yarn 1 (180 d./60 f.) of composite-spun polypropylene filament having boiling water shrinkage of 27.5% was obtained. This yarn had the appearance shown in FIGURE 1.

Around this yarn 1 as the core, crimped polypropylene filament yarn 2 of 75 d./36 f. was twisted in the S direction with a number of twist of 300 t./m. and as a result, the composite yarn 3 shown in FIG. 2 was obtained. The above-mentioned crimped polypropylene filament yarn 2 was manufactured by the conventional false twist method.

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Next, relaxation heat treatment of the yarn was carried out with superheated steam of 130° C. for 30 minutes with this yarn in a tension free state and as a result, high elastic and bulky composite yarn 3' which is soft and has good handling quality, and good bulkiness and an extension of about 210%, as shown in FIGURE 5 was obtained.

The yarn of this example is suitable for bulky knitted goods such as bulky socks and bulky sweaters.

EXAMPLE 2

Potentially crimpable yarn of composite-spun polypropylene (180 d./60 f.), the same as the yarn obtained in Example 1, was used as the core yarn and around this yarn, two mixed-spun yarns 6, 7 of polyester fiber and cotton (blending rate 65% polyester and 35% cotton, 60/1's cotton count, boiling water shrinkage 3.5%) were covered simultaneously using a double covering apparatus with a twisting number of 250 t./m. in such a way that with one yarn twisted in the S direction and the other in the Z direction, by which composite yarn 8 having the shape shown in FIGURE 3 was obtained.

Next, relaxation heat treatment was applied to this yarn in a tension free state with superheated steam of 130° C. for 20 minutes, whereby high elastic and bulky composite yarn 9 having high bulkiness and superior elastic recovery was obtained. The appearance of the yarn produced looks like a fancy yarn comprising the aforementioned two mixed-spun yarns 6 and 7 spirally surrounding the aforementioned polypropylene filament yarn 1', as shown in FIGURE 6.

EXAMPLE 3

A spun yarn of polyacrylonitrile fiber having a potentially shrinkable property was prepared. The number of count of the spun yarn before bulky treatment was of 2/36's metric count and the first twist of yarn was Z-twist of 325 t./m. and the second was S-twist of 225 t./m. A bulky yarn having boiling water shrinkage of 1.5% was obtained by applying bulky treatment by steam of 100° C. for 30 min.

Potentially crimpable yarn (180 d./60 f.) of composite-spun polypropylene filament same as that obtained in Example 1 was twisted together with the bulky spun yarn of polyacrylonitrile fiber by a conventional doubling and twisting machine. The number of twists of the doubled twisted yarn of 250 t./m. in the Z twisting direction and next the twisted yarn was heat treated at relaxed condition with superheated steam of 120° C. for 30 minutes. As a result, high elastic and bulky composite yarn was obtained. Further, it was noticed that the yarn produced had an excellent handling feeling like spun yarn and an elegant silky luster.

EXAMPLE 4

Polypropylene components with intrinsic viscosity $[\eta]_t=1.4$ when measured in tetralin solution of 135° C. was heat-melted at 240° C. (A component) and 280° C. (B component), and composite-melt spun at 240° C. using a spinneret for composite spinning, and the intrinsic viscosity $[\eta]_t$ and birefringence (Δn) of A and B components of the undrawn yarn obtained were as follows:

	$[\eta]_t$	Δn
A component.....	1.35	16.2×10^{-3}
B component.....	1.21	9.2×10^{-3}

This undrawn filament was taken up with a pirn after drawing it to the draw ratio of 5.0 with a draw-twister and as a result, potentially crimpable yarn of composite polypropylene filament (90 d./30 f.) having shrinkable property of 25.5% boiling water shrinkage in boiling water was obtained.

A polyamide filament yarn of 30 d./10 f. produced by a conventional melt spinning and drawing method was twisted around the core yarn of the above-mentioned

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polypropylene composite-spun filament yarn with number of twist of 380 t./m. of S-twist by a conventional covering apparatus.

Next, relaxation heat treatment was applied to this yarn with superheated steam of 130 C. for 25 minutes at a restricted relaxed condition so that the aforementioned composite-spun polypropylene filament yarn shrinks 18% and as a result, very elastic and bulky composite yarn having superior bulkiness and elastic recovery was produced. Further the aforementioned polyamide filament yarn had the appearance of fancy yarn fixed in loop form around the aforementioned polypropylene yarn.

The yarn of this example is suitable for hand knitting yarn and various knitting yarns.

EXAMPLE 5

Before applying relaxation heat treatment to the very elastic and bulky composite yarn obtained by the method of Example 4, this was covered further with filament yarn of triacetate (75 d./20 f.) with twist of 310 t./m. in the Z direction.

Next, relaxation heat treatment was applied to this yarn in a state of controlled shrinkage with superheated steam of 115° C. for 20 minutes and as a result, very elastic and bulky composite yarn with good bulkiness and elasticity in which the two filament yarns of polyamide filament and triacetate filament are fixed spirally around the composite-spun polypropylene filament yarn in which crimp is developed was obtained.

EXAMPLE 6

Potentially crimpable filament yarn 1 of composite-spun polypropylene filament (50 d./15 f.) obtained by the method of Example 1 with only the number of holes of the spinneret changed and potentially crimpable filament yarn 4 of composite-spun polypropylene filament (90 d./30 f.) the same as that obtained by the method of Example 4 were twisted together with number of twist of 200 t./m. in the Z twisting direction using a conventional doubling and twisting machine doubler and as a result, double-twisted yarn having the shape shown in FIGURE 4 was obtained.

Next, relaxation heat treatment was applied to this yarn in the tension free state with superheated steam of 130° C. for 30 minutes and as a result, high elastic and bulky composite yarn 5' having superior bulkiness and elasticity than the aforementioned two polypropylene filament yarns 1', 4' with crimp developed mutually intertwined was obtained as shown in FIGURE 7. The breaking elongation of this yarn was 250% and the elastic recovery when 50% elongation was repeated 10 times was 87%.

EXAMPLE 7

The yarn before the relaxation treatment in Example 6 was heat-treated under restricted relaxed conditions by superheated steam of 130° C. for 20 minutes so that the composite-spun-polypropylene filament yarn can be shrunk up to 15%. The resulting yarn 5' composed of twined two crimped yarns had superior bulkiness, elasticity and softness, and an elegant fancy appearance as shown in FIG. 7. The breaking elongation of this yarn was 180% and the plastic deformation was 93%. The plastic deformation was measured by a test wherein the test piece of yarn was provided with repeating extension of 50% to the original length of the test piece and the plastic deformation of the yarn after 10 times extensions was measured. The yarn of this example is suitable for clothing such as elastic fabrics and various knitted goods.

As explained in the above examples, the very elastic and bulky composite yarn of this invention has good elasticity, superior bulkiness and softness; the composite yarn can be manufactured easily and with high efficiency using the conventional covering apparatus without any modification; as explained in Examples 2 and 4, it is possible to obtain yarn having fancy feel; and color effect by dyeing

beforehand the other yarns which are used for covering the composite-spun polypropylene multifilament yarn; the yarn of this invention is suitable for different kinds of clothing such as elastic fabric, sports wear and bulky socks; and yarn having fancy feel is suitable as hand knitting yarn and general interior decoration. Obviously many modifications and variations concerning this invention are possible in the light of the above teachings. It is therefore, to be understood that this invention may be practiced otherwise than as described.

What is claimed is:

1. Method for manufacturing composite yarn having high bulkiness and superior elasticity, which comprises providing composite-spun polypropylene filament yarn having potentially crimpable property by relaxation heat treatment at the temperature from 80° C. to 150° C. as a core yarn; composite filaments of said core yarn having polypropylene components of different characteristics; covering another textile yarn around said core yarn; said covering yarn having lower heat shrinking characteristics than said core yarn; then applying said heat treatment under relaxed condition to said covered composite yarn, whereby said core yarn develops stable crimps having superior elasticity and said composite covered yarn develops high bulkiness.

2. Method for manufacturing composite yarn having high bulkiness and superior elasticity, which comprises, providing composite-spun polypropylene filaments yarn having potentially crimpable and highly shrinkable properties by relaxation heat treatment at the temperature from 80° C. to 150° C., as a core yarn; composite filaments of said core yarn having polypropylene components of different characteristics; covering another textile yarn around said core yarn; said covering yarn having lower heat shrinking characteristics than said core yarn; then applying said relaxation treatment to said covered composite yarn, whereby said core yarn shrinks and develops crimps having superior elasticity and said composite yarn develops high bulkiness.

3. Method for manufacturing composite yarn having high bulkiness and superior elasticity, which comprises, providing composite-spun polypropylene filament yarn having potentially crimpable property by relaxation heat treatment at the temperature from 80° C. to 150° C. as a core yarn; composite filaments of said core yarn having polypropylene components of different characteristics; covering another textile yarn in a constant twisting direction around said core yarn; said covering yarn having lower heat shrinking characteristics than said core yarn; then applying said relaxation treatment to said covered composite yarn, whereby said core yarn develops crimps having superior elasticity and said composite yarn develops high bulkiness in the manner that said other textile yarn is helically covered around said crimped core yarn in a constant twisting direction.

4. Method for manufacturing composite yarn having high bulkiness and superior elasticity, which comprises, providing composite-spun polypropylene filament yarn having potentially crimpable property by relaxation heat treatment at the temperature from 80° C. to 150° C., as a core yarn; composite filaments of said core yarn having polypropylene components of different characteristics; covering a first textile yarn in a constant twisting direction around said core yarn; covering a second textile yarn in an opposite twisting direction to that of said first yarn; said covering yarns having lower heat shrinking characteristics than said core yarn; applying said relaxation heat treatment to said double covered composite yarn, whereby said core yarn develops stable crimps and said covered composite yarn develops high bulkiness in the manner that one of said covered textile yarns is helically covered around said crimped yarn in a constant twisting direction as an inner covered yarn and the other of said covered textile yarn is helically covered around said crimped yarn and inner covered yarn in an opposite twisting direction.

5. Method for manufacturing composite yarn having high bulkiness and superior elasticity, which comprises, providing composite-spun polypropylene filament yarn having potentially crimpable and high shrinkable properties by relaxation heat treatment at the temperature of 80° C. to 150° C., as a core yarn; composite filaments of said core yarn having polypropylene components of different characteristics; double-twisting another textile yarn, having low shrinkable property by heat treatment, with said core yarn; then applying relaxation treatment to said double-twisted yarn; whereby said core yarn shrinks and develops crimps having superior elasticity and said composite yarn develops high bulkiness in the manner that said other textile yarn covers said shrunk and crimped core yarn.

6. Method for manufacturing composite yarn having high bulkiness and superior elasticity, which comprises, providing composite-spun polypropylene filament yarn having potentially crimpable and shrinkable properties by relaxation heat treatment at the temperature of 80° C. to 150° C., as a core yarn; composite filaments of said core yarn having polypropylene components of different characteristics; covering another textile yarn in a constant twisting direction around said core yarn; then applying relaxation heat treatment in a state of controlled shrinkage of said core yarn; whereby said core yarn develops crimps and said other textile yarn develops high bulkiness in the manner that said another textile yarn is helically covered around said core yarn.

7. Method for manufacturing composite yarn having high bulkiness and superior elasticity, which comprises, providing composite-spun polypropylene filament yarn having potentially crimpable and shrinkable properties by relaxation heat treatment at the temperature from 80° C. to 150° C., as a core yarn; composite filaments of said core yarn having polypropylene components of different characteristics; covering a first textile yarn in a fixed twisting direction around said core yarn; covering a second textile yarn in an opposite twisting direction to that of said first covered yarn; applying relaxation heat treatment in a state of controlled shrinkage of said core yarn to said double covered composite yarn, whereby said core yarn develops crimps having superior elasticity and said covered composite yarn develop high bulkiness in the manner that one of said covered textile yarn is helically covered around said core yarn in a constant twisting direction as an inner covered yarn, the other of said covered textile yarn is helically covered around said core yarn and inner covered yarn in an opposite twisting direction.

8. Method for manufacturing composite yarn having high bulkiness and superior elasticity, which comprises, doubling two composite-spun polypropylene filament yarns having potentially crimpable property by relaxation heat treatment at the temperature of 80° C. to 150° C.; composite filaments of each of said yarns having polypropylene components of different characteristics; twisting said doubled yarns; then applying said relaxation treatment to said double twisted yarn, whereby said two polypropylene filament yarns develop crimps and twine together.

9. Method for manufacturing composite yarn having high bulkiness and superior elasticity and softness, which comprises, doubling two composite-spun polypropylene filament yarns having potentially crimpable property by relaxation heat treatment at the temperature from 80° C. to 150° C.; composite filaments of each of said yarns having polypropylene components of different characteristics; twisting said doubled yarns; then applying relaxation treatment in a state of controlled shrinkage of said composite yarn, whereby said two polypropylene filament yarns develop crimps and twine together.

10. Method for manufacturing composite yarn according to claim 1, further characterized by said composite-spun polypropylene filament yarn being spun from two

kinds of propylene polymers having the characteristic that in undrawn filament one of component (A) of said composite-spun filament has an intrinsic viscosity of from 1.4 to 3.0, and a birefringence from 8×10^{-3} to 27×10^{-3} , the other component (B) has an intrinsic viscosity of from 0.8 to 3.0 and a birefringence within a range shown by the zone *a, b, c, d* in FIGURE 8 which is determined in accordance with the birefringence of component (A) in the undrawn filament.

11. Method for manufacturing composite yarn according to claim 2, further characterized by said composite-spun polypropylene filament yarn being spun from two kinds of propylene polymers having the characteristic that in undrawn filament one component (A) of said composite-spun filament has an intrinsic viscosity of from 1.4 to 3.0 and a birefringence from 8×10^{-3} to 27×10^{-3} , the other component (B) has an intrinsic viscosity of from 0.8 to 3.0 and a birefringence within a range shown by the zone *a, b, c, d* in FIGURE 8 which is determined in accordance with the birefringence of component (A) in the undrawn filament.

12. Method for manufacturing composite yarn according to claim 5, further characterized by said composite-spun polypropylene filament yarn being spun from two kinds of polypropylene polymers having the characteristic that in undrawn filament one of components (A) of said composite-spun filament has an intrinsic viscosity of from 1.4 to 3.0 and a birefringence from 8×10^{-3} to 27×10^{-3} , the other component (B) has an intrinsic viscosity of from 0.8 to 3.0 and a birefringence within a range shown by the zone *a, b, c* and *d* in FIGURE 8 which is determined in accordance with the birefringence of component (A) in the undrawn filament.

13. A method according to claim 1, in which said core yarn prior to being covered with said textile yarn is twist drawn to approximately five times its length.

14. A method according to claim 4, in which said core yarn prior to being covered with said textile yarn is twist drawn to approximately five times its length.

15. Composite yarn having high bulkiness and superior elastic property, comprising; at least one composite-spun polypropylene filament yarn having crimps, as a core yarn; composite filaments of said yarn having polypropyl-

ene components of different characteristics, and another textile yarn helically covered around said core yarn in a constant twisting direction.

16. Composite yarn having high bulkiness and superior elastic property, comprising: at least one composite-spun polypropylene filament yarn having crimps, as a core yarn; composite filaments of said yarn having polypropylene components (A) and (B) of different characteristics, another textile yarn (C) helically covered around said core yarn in a constant twisting direction; and a further textile yarn (D) helically covered around said core yarn and other textile yarn (C) in an opposite twisting direction to the twisting direction of said textile yarn (C).

17. Composite yarn having high bulkiness and superior elastic property, comprising; two composite-spun polypropylene filament yarns having crimps and twined with each other, composite filaments of each of said yarns having polypropylene components of different characteristics.

References Cited

UNITED STATES PATENTS

2,766,505	10/1956	Weiss	57—157 XR
2,777,310	1/1957	Comer	57—140
3,061,998	11/1962	Bloch	57—140
3,098,347	7/1963	Smith	57—152
3,107,972	10/1963	Pitzl	
3,111,805	11/1963	Boyer	57—140
3,115,745	12/1963	Lathem et al.	57—163

FOREIGN PATENTS

225,080	5/1962	Austria.
218,395	3/1958	Australia.
950,429	2/1964	Great Britain.
979,083	1/1965	Great Britain.

STANLEY N. GILREATH, *Primary Examiner*.

W. H. SCHROEDER, *Assistant Examiner*.

U.S. Cl. X.R.

28—72; 57—140, 160; 264—103, 168, 171