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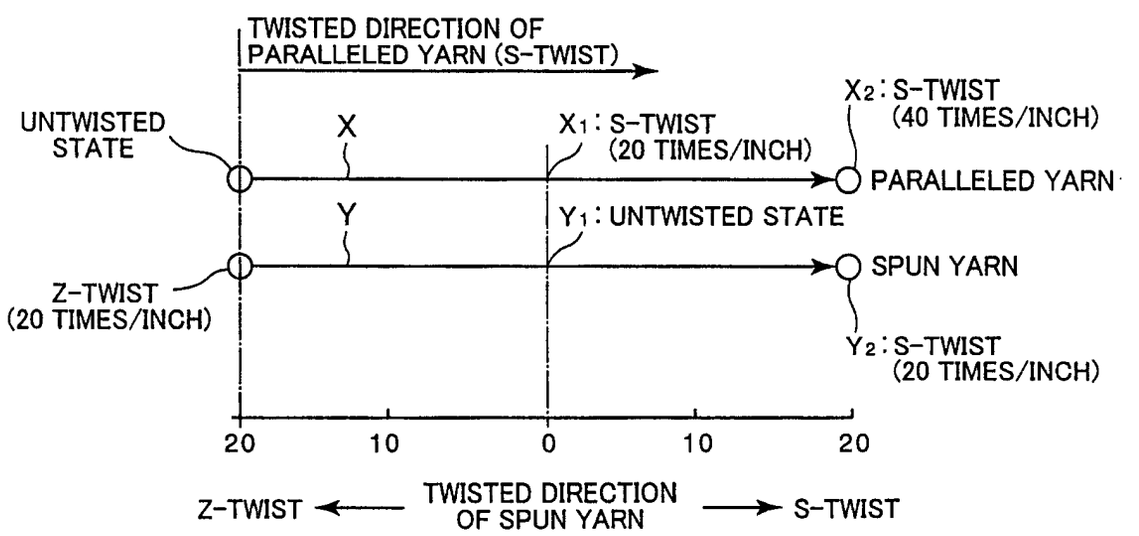
(54) COMPOSITE TWISTING AND PRODUCTION METHOD THEREFOR, AND WOVEN FABRIC AND KNITTED FABRIC USING THE COMPOSITE TWISTING

(57) A composite twist yarn is produced by twisting a spun yarn and at least one filament together. The composite twist yarn has features that the twisted direction of the composite twist yarn is substantially identical to the twisted direction of the spun yarn entwined in the composite twist yarn, and that the number of twists of the composite twist yarn is larger than that of the spun yarn entwined in the composite twist yarn. The composite twist yarn is produced by making a twisted spun yarn and at least one filament parallel to each other to a paralleled yarn, twisting the paralleled yarn in a direction reverse to the twisted direction of the spun yarn, and continuing the twisting over an untwisted point of the spun yarn.

FIG. 5



EP 1 394 297 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a novel composite twist yarn, a production method for composite twist yarn, and to a woven fabric and a knitted fabric using the composite twist yarn.

BACKGROUND ART

[0002] The following yarns are known as primary composite yarns in which spun yarns and filaments are combined with each other:

(1) a core yarn constructed such that a cotton-like substance (lump of staples) covers a core yarn consisting of a filament or filaments, and the entirety is twisted;
(2) a single-covered yarn (a double-covered yarn) constructed such that a single layer (a multi layer) of spun yarn is entwined around a core yarn consisting of a filament or filaments; and
(3) a plied yarn constructed such that two or three spun yarns and at least one (usually, one) filament are twisted with each other.

[0003] Among the above, the core yarn (1) has features that the spun yarn is exposed over the entirety of the core yarn, has a good texture, warm appearance and touch, and is categorized into a high-quality yarn. However, in producing the core yarn using a cotton spun yarn, it is required to secure a yarn strength by enhancing entwining of the fibers. Accordingly, it is desirable to use relatively long fibers exclusively as a material for the cotton spun yarn by sorting out and excluding relatively short fibers, which may lead to an exceedingly low yield of raw cotton or the like. Further, this method necessitates a sophisticated technique and facility to cover the core part of filament(s) with the spun yarn, and accordingly may raise the cost of a resultant composite yarn. In addition, production of core yarns of a fine count is extremely difficult in light of the constraint on production.

[0004] The covered yarn (2) is the one in which a spun yarn is entwined around the filament or filaments. The covered yarn has a great yarn strength, good appearance and touch. However, since it is required to entwine a single layer or a multi layer of the spun yarn around the filament(s), productivity of the covered yarn (2) as a composite yarn is low.

[0005] Since the plied yarn (3) is usually produced by making two or three spun yarns and a filament parallel to each other to a paralleled yarn, and twisting the paralleled yarn, sorting of raw cotton (removal of staples), which is required in production of the core yarn (1), is not necessary, and hence productivity of the plied yarn (3) as a composite yarn is high. Nevertheless, since the plied yarn (3) is the one in which the spun yarns and the filament are tightly twisted together, the plied yarn (3) has a stiff texture as a composite yarn and fails to provide a warm appearance and touch.

[0006] The present invention has been accomplished in view of the above problems residing in the prior art. A first object of the present invention is to provide a composite twist yarn having an improved texture, superior (warm) appearance and touch by focusing on a plied yarn that does not require sorting of raw cotton and is effective in providing a high yield and productivity as a composite yarn, to establish a novel method capable of easily producing such a composite twist yarn even with a fine count, and to provide a woven and knitted fabric having a superior appearance and touch with use of such a composite twist yarn.

[0007] Another object of the present invention is to provide a technology that enables to easily produce, with use of a twisting facility and at a low cost, a composite twist yarn which has a substantially equivalent or superior quality to the expensive core yarn produced by the conventional complex spinning facility.

DISCLOSURE OF THE INVENTION

[0008] An inventive composite twist yarn that solves the above problems is a composite twist yarn comprising a spun yarn and at least one filament, the spun yarn and the filament being twisted with each other, the twisted direction of the composite twist yarn being substantially identical to the twisted direction of the spun yarn entwined in the composite twist yarn, and the number of twists of the composite twist yarn being larger than the number of twists of the spun yarn entwined in the composite twist yarn.

[0009] Preferably, use of an elastic filament as the filament in the composite twist yarn is extremely advantageous in providing the composite twist yarn with an elasticity, as well as in terms of appearance and touch.

[0010] Another aspect of the present invention is directed to a method for producing a composite twist yarn having the above superior properties. The method comprises making a twisted spun yarn and at least one filament parallel to each other to a paralleled yarn, twisting the paralleled yarn in a direction reverse to the twisted direction of the spun yarn, and continuing the twisting in the reverse direction over an untwisted point of the spun yarn.

[0011] The inventive composite twist yarn has a great yarn strength, superior texture, appearance, and touch. Accordingly, a woven fabric and a knitted fabric produced with use of at least part of the inventive composite twist yarn has also a superior texture, appearance, and touch. Such a woven fabric and a knitted fabric are embraced in the scope of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

FIGS. 1 through 4 are illustrations showing a composite twist yarn and a method for producing the composite twist yarn according to an embodiment of the present invention.

FIG. 5 is an illustration explaining a relation between a change in a twisted direction and the number of twists with respect to a spun yarn and a paralleled yarn used as a raw material in implementing the present invention, wherein the spun yarn is denoted at B, and a filament for the paralleled yarn is denoted at M.

BEST MODE FOR CARRYING OUT THE INVENTION

[0013] In view of the above problems residing in the prior art, the present inventors have made a research and development from various viewpoints concerning a composite twist yarn which has the merits of the plied yarn (3): no need of sorting of raw cotton, securing a high yield, and feasibility in production, which has overcome the demerits of the plied yarn: stiff texture, and poor appearance and touch, and which is capable of producing a sophisticated woven and knitted fabric at a low cost.

[0014] They have found that the conventional plied yarn is usually produced by twisting two or three spun yarns and a filament together in a direction reverse to the twisted direction of the spun yarns, and the thus produced plied yarn has drawbacks such as a poor appearance and a stiff touch because the plied yarn is twisted too much by the twisting of the spun yarns. In view of this, they have proceeded with a research based on an idea that the defects of the conventional plied yarn can be overcome by establishing a technique of entwining a spun yarn with a filament while suppressing undesired tightening of the twist yarn.

[0015] In the course of the research, they have come up with an idea that undesired tightening of the spun yarn can be alleviated by a twisting process in which a single spun yarn and a filament are entwined and twisted together in a direction reverse to the twisted direction of the spun yarn, because in such a twisting process, as the twisting is proceeded, the spun yarn is untwisted, whereas twisting two or more spun yarns and a filament together fails to solve the drawback inherent to the conventional plied yarn because it is a usual practice to set the twisted direction of the twist yarn reverse to the twisted direction of the spun yarn.

[0016] Twisting a spun yarn and a filament together in a direction reverse to the twisted direction of the spun yarn, however, eventually results in untwisting of the spun yarn, and accordingly, fails to maintain the strength as a composite twist yarn. Namely, twisting the spun yarn and the filament together in the reverse direction has a limitation of its own, and a composite twist yarn having a noticeably superior property to the conventional plied yarn was unable to obtain according to this method. Particularly, twisting a spun yarn in the reverse direction to such an extent as to nullify the twist of the spun yarn, namely, to render the twisted spun yarn to a substantially untwisted state is not practically feasible in a twisting process for producing a composite twist yarn, because the spun yarn brought to such an untwisted state is returned to a state of raw cotton, and loses its strength as a yarn.

[0017] In view of the above, the present inventors further proceeded with a research in an attempt to produce a composite twist yarn having a superior appearance and touch by securing entwining of a filament and a spun yarn. As a result of the research, they have found that making a twisted spun yarn and at least one filament parallel to each other to a paralleled yarn, twisting the paralleled yarn in a direction reverse to the twisted direction of the spun yarn, and continuing the twisting of the paralleled yarn in the reverse direction over an untwisted point of the spun yarn is effective in producing a composite twist yarn having superior properties with respect to all the features of texture, appearance, and touch, while securing strength as the spun yarn and entwining of the spun yarn and the filament, and thus, come up with the present invention.

[0018] As will be clearly described in the following, the composite twist yarn produced according to the above technique has a unique twist structure as compared with the conventional and known plied yarn in that the twisted direction of the composite twist yarn is substantially identical to the twisted direction of the spun yarn in the composite twist yarn, and that the number of twists of the composite twist yarn is larger than that of the spun yarn entwined in the composite twist yarn.

[0019] In the following, features of a twisting method unique to the present invention, and a composite twist yarn produced by the twisting method are described in detail referring to the drawings illustrating one embodiment of the present invention. It should be appreciated that various changes and modifications will be apparent to those skilled in the art. Therefore, unless otherwise such changes and modifications depart from the scope of the present invention hereinafter defined, they should be construed as being included therein.

[0020] According to the embodiment of the present invention, a single spun yarn B which is twisted in a direction shown in FIG. 1 (Z-direction or Z-twist) and a filament M (monofilament or multifilament) are rendered parallel to each other to a paralleled yarn A, and the paralleled yarn A is twisted in a direction reverse to the Z-direction (namely, S-direction or S-twist), as shown in FIG. 2. As the paralleled yarn A is twisted in the S-direction, the spun yarn is gradually untwisted. As the paralleled yarn A is applied with S-twists by the number corresponding to the number of untwists of the spun yarn B, the filament M is entwined around the spun yarn B.

[0021] As the paralleled yarn A is further twisted in the S-direction to such an extent that the number of S-twists corresponds to the number of Z-twists which have been applied to the spun yarn B in its initial state before start of the S-twist, then, the spun yarn B is completely untwisted and rendered to an untwisted state. When the spun yarn B is brought to the untwisted state, the spun yarn B is turned to a raw cotton state, and the strength as the spun yarn is lost. However, whereas the spun yarn B is rendered to such an untwisted state, the filament M is entwined around the spun yarn B by the number of S-twists corresponding to the number of Z-twists applied to the spun yarn B in the initial state. Therefore, there is no likelihood that the spun yarn B in the untwisted state is loosened because the spun yarn B has its outer portion securely entwined by the filament M.

[0022] In the above, the following should be considered. Since the strength of the untwisted spun yarn B is substantially zero, the composite twist yarn relies its strength merely on the strength of the filament M, and accordingly, a sufficient strength may not be secured. In view of this, according to the embodiment of the present invention, the paralleled yarn A is continued to be twisted in the reverse direction. As the paralleled yarn A is further twisted in the reverse direction, as shown in FIG. 4, the spun yarn B is twisted in the direction (S-direction) reverse to the initially twisted direction (Z-direction). As the number of S-twists increases, the strength of the spun yarn B itself is recovered, and the filament M is further entwined around the spun yarn B, whereby the pitch of the S-twists of the twist yarn (namely, the composite twist yarn) A increases, and the strength of the composite twist yarn A increases. Thus, applying the S-twist to the paralleled yarn A to such an extent as to give a sufficient strength to the spun yarn B over the untwisted state of the spun yarn B is effective in providing the composite twist yarn with a sufficient strength.

[0023] Relations between changes in the twisted directions and the numbers of twists with respect to the spun yarn B and the paralleled yarn A are as shown in FIG. 5. Specifically, referring to FIG. 5, a relation between a change in the twisted direction and the number of twists of the paralleled yarn A is shown by the solid line X, and a relation between a change in the twisted direction and the number of twists of the spun yarn B is shown by the solid line Y. It should be noted that Z-twist (e.g. 20 times per inch) has been applied to the spun yarn B in its initial state before making a paralleled yarn A. As the paralleled yarn A is twisted in the S-direction reverse to the initially twisted Z-direction of the spun yarn B, the paralleled yarn A is applied with the S-twist, as shown by the solid line Y accompanied by untwisting of the spun yarn B. When the spun yarn B is brought to an untwisted state (see point Y_1), the paralleled yarn A is applied with S-twists (see point X_1) by the number substantially equal to the number of Z-twists which have been applied to the spun yarn B in the initial state.

[0024] Subsequently, as the S-twist is further applied to the paralleled yarn A, the spun yarn B is applied with the S-twist, opposite to the Z-twist which has been initially applied. As the S-twist is further continued, the number of S-twists to the paralleled yarn A increases, accompanied by increase of the S-twists to the spun yarn B. When the spun yarn B reaches the point Y_2 (e. g. 20 times of S-twists per inch), the paralleled yarn A reaches the point X2. At the point X_2, the paralleled yarn A is applied with the number of twists (namely, 40 times per inch) which is equal to the sum of the number of twists corresponding to the Z-twists (20 times per inch) which have been applied to the spun yarn B in the initial state and the number of twists (20 times per inch) which is additionally applied to the spun yarn B from the untwisted state.

[0025] Accordingly, the inventive composite twist yarn which has reached the point X_2 is applied in its entirety with the S-twist, in which the twisted direction of the inventive composite twist yarn is substantially identical to the twisted direction of the spun yarn B entwined in the composite twist yarn. Thus, the resultant composite twist yarn has a unique twist structure in which the twisted direction of the composite twist yarn is substantially identical to the twisted direction of the spun yarn B entwined therein, and the number of S-twists of the composite twist yarn is larger than that of the spun yarn entwined in the composite twist yarn.

[0026] Although the twisted direction of the composite twist yarn as a final product differs depending on the twisted direction of the spun yarn B in the initial state before the twisting process is initiated, according to the present invention, the twisted direction of the composite twist yarn as a final product is substantially identical to the twisted direction of the spun yarn entwined in the composite spun yarn after the twisting process is terminated.

[0027] The numbers of twists of the composite twist yarn and the spun yarn entwined therein can be optionally varied by varying the number of twists to be applied to the spun yarn B in the initial state and the number of twists to be applied to the composite twist yarn over the untwisted state of the spun yarn B. Generally, the number of twists to be applied to the spun yarn B in the initial state ranges from about 5 to 45 times per inch depending on the count of the spun yarn B. A preferred number of times of twists to be applied to the spun yarn B after the spun yarn B reaches the untwisted state generally ranges from about 5 to 45 times per inch in order to secure a strength inherent to the spun yarn B. Therefore, the total number of twists to be applied to the composite twist yarn as a final product ranges from about 5 to 90 times per inch, and the number of twists to be applied to the spun yarn B entwined in the composite twist yarn ranges from about 5 to 45 times per inch, which is about a half of the total number of twists to be applied to the composite twist yarn.

[0028] More specifically, in case of a spun yarn B of

the count No. 20, for example, the number of twists to be applied to the spun yarn B in the initial state is generally in the range of 15 to 22 times per inch, most typically around 18 times per inch. A preferred number of twists to be applied to the spun yarn B after the spun yarn B reaches its untwisted state is generally in the range of 15 to 22 times per inch (most typically, around 18 times per inch) to secure a strength inherent to the spun yarn B. Accordingly, the total number of twists to be applied to the composite twist yarn as a final product is in the range of 30 to 44 times per inch (most typically, around 36 times per inch), and the number of twists to be applied to the spun yarn B entwined in the composite twist yarn is in the range of 15 to 22 times per inch (most typically, around 18 times per inch), which is about a half of the total number of twists to be applied to the composite twist yarn.

[0029] In the embodiment of the present invention, since the strength of the composite twist yarn is remarkably increased by the increase of the number of twists of the filament, it may be possible to lessen the numbers of twists of the composite twist yarn and the spun yarn B to from about 80 to 90 % relative to the generally used respective numbers of twists thereof to secure a sufficient strength.

[0030] In the inventive composite twist yarn, there is a case that the number of twists of the composite twist yarn is remarkably larger than that of the spun yarn entwined therein. However, generally, the diameter of the filament to be entwined around the spun yarn is generally remarkably smaller than that of the spun yarn. Accordingly, even if a small-diametrical filament is tightly entwined around a large-diametrical spun yarn, there is no likelihood that the spun yarn is excessively tightened by the filament, and the outer portion of the spun yarn in the composite twist yarn is sufficiently exposed while being entwined by the filament. With this arrangement, the resultant composite twist yarn is provided with a texture, appearance, and touch similar to those of the core yarn, and a strength substantially equal to that of the plied yarn. Further, according to the embodiment of the present invention, a single spun yarn is used. Accordingly, a composite twist yarn of a fine count is easily produced, as compared with the case of producing a plied yarn with use of two or three spun yarns.

[0031] As mentioned above, the inventive composite twist yarn has the unique twist structure obtained by implementing the unique twisting method. Specifically, the inventive composite twist yarn has the features "the twisted direction of the composite twist yarn as a whole is substantially identical to that of the spun yarn entwined in the composite twist yarn" and "the number of twists of the composite twist yarn is larger than that of the spun yarn entwined therein". There is no constraint regarding the material, size and the like of the spun yarn and the filament. All the kinds of spun yarns and filaments are usable.

[0032] Specifically, the spun yarn used in the present invention includes spun yarns such as all the kinds of plant fibers, animal fibers, regenerated fibers, and synthetic fibers, not to mention most typical spun yarns derived from cotton, hemp, and wool. Further, usable is a combined filament yarn, which is a combination of at least one of the aforementioned spun yams and filaments. Generally, a synthetic or semi-synthetic filament such as polyurethane, polyamide, polyester, acryl, and rayon is used as the filament in the present invention. Alternatively, a natural filament such as silk may be used. It is desirable to use an elastic filament which has an elasticity of its own such as a filament of a polyurethane resin in order to effectively utilize the property of the elastic filament in light of the fact that the core yarn and the plied yarn are frequently used as an elastic yarn.

[0033] According to the embodiment of the present invention, it is required to use a single spun yarn in order to effectively utilize the feature of the abovementioned twisting process. Use of not less than one spun yarn may not be effective considering the feature of the present invention that an untwisted state of the spun yarn is utilized. The size of the spun yarn is not specifically limited. Any size of the spun yarn is selectable and usable depending on the use and purpose of use of the resultant composite twist yarn. It is desirable to select the number of twists of the spun yarn depending on the count of the spun yarn. The number of filaments is not specifically limited. One or more than one filament (monofilament or multifilament) may be paralleled to a spun yarn to make a paralleled yarn. Generally, one or two filaments is used, and the size (denier) thereof can be optionally varied depending on the use and purpose of use of the resultant composite twist yarn.

[0034] As mentioned above, a composite twist yarn of a fine count can be easily produced by optionally adjusting the number of twists of the composite twist yarn produced by twisting a single spun yarn and at least one filament together depending on the requirements on the resultant composite twist yarn.

[0035] The inventive composite twist yarn can be produced easily and at a low cost without the necessity of sorting out of raw cotton, which has been required in the production of the conventional composite twist yarn, and yet exhibits superior texture, appearance, and touch similar to those of the expensive core yarn, and is usable for producing sophisticated woven and knitted fabrics.

[0036] The inventive composite twist yarn has the aforementioned features. The features of the inventive composite twist yarn are effectively exhibited in its use as a raw material yarn for various woven and knitted fabrics. The weaving pattern and knitting pattern with use of the inventive composite twist yarn are not specifically limited. Any weaving pattern such as a plain weaving and a twill weaving are applicable. In case of producing a woven fabric, the inventive composite twist yarn may be used as either one of a warp yarn and a weft yarn, or as both of the warp yarn and the weft yarn. It is need-

less to say that a woven fabric can be produced by using the inventive composite twist yarn as part of a warp yarn and/or a weft yarn in combination with a conventional core yarn or the like.

[0037] In the case of a knitted fabric, the entirety of a knitted fabric can be produced with use of the inventive composite twist yarn. Alternatively, a knitted fabric may be produced with partial use of the inventive composite twist yarn in combination with the other core yarn or the like.

[0038] Specifically, since the inventive composite twist yarn has substantially equivalent or superior properties to the conventional core yarn, the features of the composite twist yarn are effectively exhibited even in a partial use thereof, not to mention its entire use for producing a woven fabric or a knitted fabric. In view of this, although the mixing ratio of the inventive composite twist yarn to the other kind of yarn is not specifically limited, the mixing ratio of the inventive composite twist yarn to the entirety of the yarns constituting a woven fabric (knitted fabric) is preferably 20% or larger, more preferably 30% or larger, and furthermore preferably 50% or larger in order to effectively utilize the features of the inventive composite twist yarn.

[0039] Use of the inventive composite twist yarn as, for example, a yarn for a jeans fabric is preferable because the resultant jeans fabric exhibits a proper elasticity and flexibility.

[0040] As an example, the present inventors produced the following composite twist yarn with use of a cotton spun yarn (cotton count No. 20, 18 times of Z-twists per inch) and an elastic filament (under the tradename "espa", product of Toyobo Co., Ltd.: 70 deniers, draft: 3.5 times) at a mixing ratio of the cotton spun yarn to the elastic filament of 93:7 (unit: %). The composite twist yarn was produced by making the cotton spun yarn and the elastic filament parallel to each other to a paralleled yarn, twisting the paralleled yarn in a direction reversed to the twisted direction of the cotton spun yarn, and continuing the twisting over the untwisted point of the cotton spun yarn up to a state where 18 times of S-twists per inch were applied to the cotton spun yarn. Thus, the composite twist yarn was applied with 36 times of S-twists per inch, and the cotton spun yarn entwined in the composite twist yarn was applied with 18 times of S-twists per inch.

[0041] The resultant composite twist yarn was bulky, exhibited an elasticity and a proper strength with the cotton spun yarn partly appearing on the surface of the composite twist yarn and the elastic filament being securely entwined around the cotton spun yarn. The composite twist yarn exhibited desirable texture, appearance, and touch similar to those of a core yarn.

[0042] The present inventors woven a jeans fabric with use of the thus produced composite twist yarn as a weft yarn and a cotton spun yarn of the count No. 7 as a warp yarn. The produced jeans fabric exhibited superior appearance and touch with an elasticity in a transverse direction thereof being secured.

EXPLOITATION IN INDUSTRY

[0043] The present invention has the aforementioned arrangement, and is advantageous in easily producing a composite twist yarn adapted for producing a woven and knitted fabric substantially equivalent or superior to a conventional core yarn in appearance and touch. The inventive method is advantageous in producing, with use of a twisting facility easily and at a low cost, a composite twist yarn having a substantially equivalent or superior quality to an expensive core yarn produced by a complex spinning facility. The present invention does not require sorting out of cotton spun yarn material (removal of staples), which has been an essential step in producing a conventional core yarn in combined use of a cotton spun yarn. With the inventive method, a composite twist yarn of a high quality can be produced at a low cost. Furthermore, according to the present invention, since a composite twist yarn of a fine count can be easily produced, applicability of the inventive composite twist yarn to a woven and knitted fabric can be broadened.

Claims

1. A composite twist yarn comprising:

a spun yarn and at least one filament, the spun yarn and the filament being twisted with each other, the twisted direction of the composite twist yarn being substantially identical to the twisted direction of the spun yarn entwined in the composite twist yarn, and the number of twists of the composite twist yarn being larger than the number of twists of the spun yarn entwined in the composite twist yarn.

2. The composite twist yarn of Claim 1, wherein the filament includes an elastic filament.

3. A method for producing a composite twist yarn comprising the steps of

making a spun yarn twisted in one direction and at least one filament parallel to each other to produce a paralleled yarn;
twisting the paralleled yarn in a direction reverse to the twisted direction of the spun yarn; and
continuing the twisting in the reverse direction over an untwisted point of the spun yarn.

4. The method of Claim 3, wherein the filament includes an elastic filament.

5. A woven fabric comprising at least part of a warp yarn and a weft yarn made of the composite twist yarn of any one of Claims 1 and 2.

6. A knitted fabric comprising at least part of a warp yarn and a weft yarn made of the composite twist yarn of any one of Claims 1 through 3.

FIG. 1

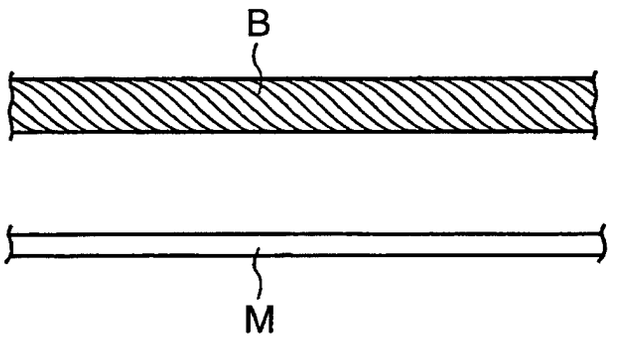


FIG. 2

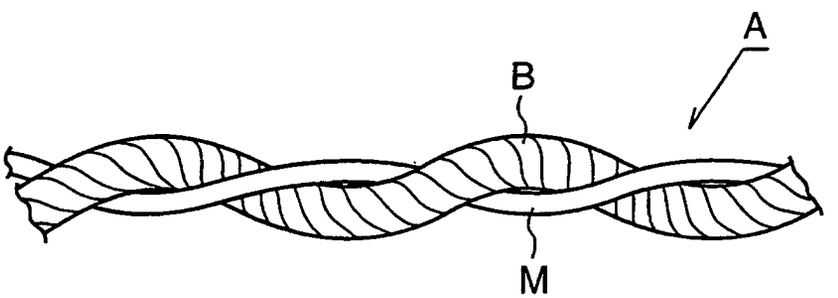


FIG. 3

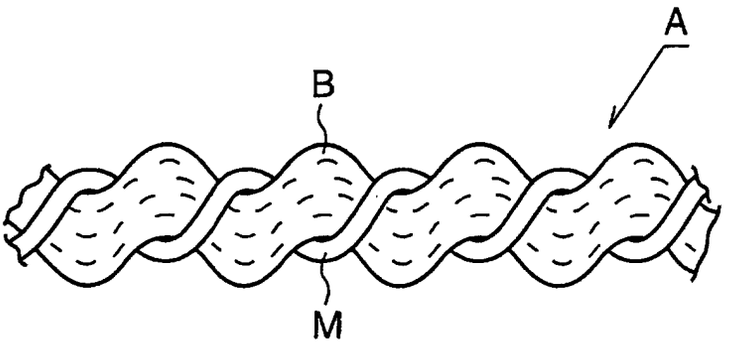


FIG. 4

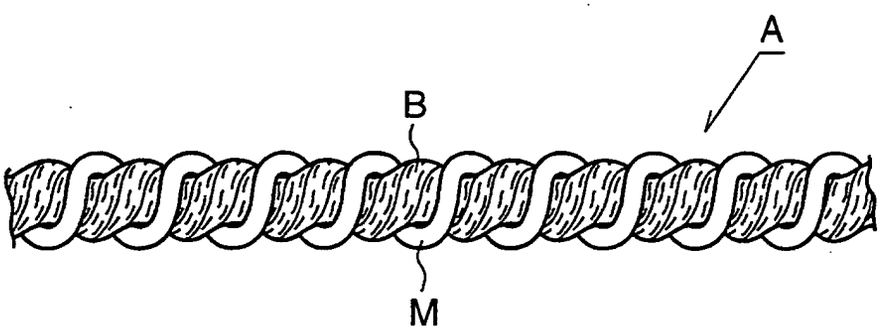
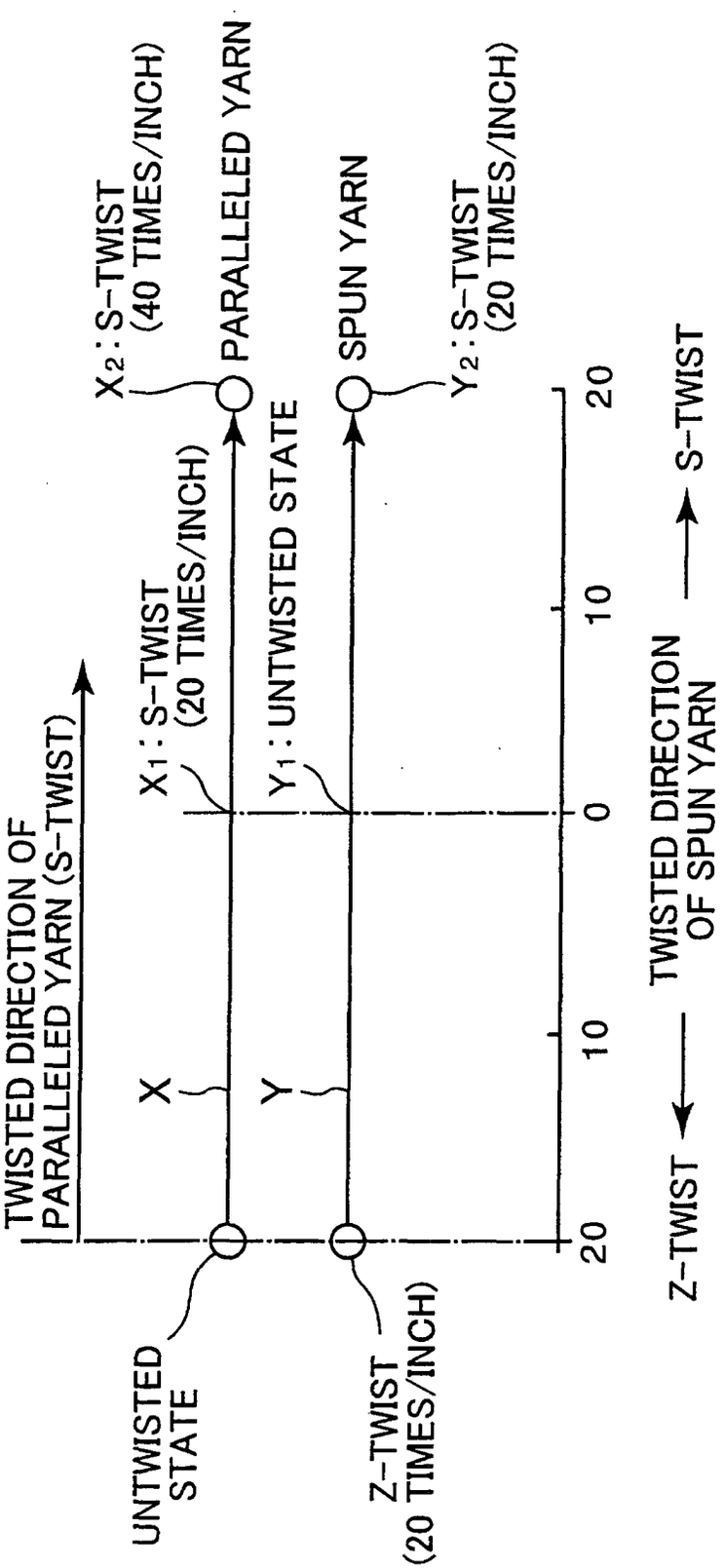


FIG. 5


TWISTED DIRECTION OF PARALLELED YARN (S-TWIST)
X
Y
X1 : S-TWIST (20 TIMES/INCH)
Y1 : UNTWISTED STATE
X2 : S-TWIST (40 TIMES/INCH)
PARALLELED YARN
SPUN YARN
Y2 : S-TWIST (20 TIMES/INCH)
UNTWISTED STATE
Z-TWIST (20 TIMES/INCH)
20
10
0
10
20
Z-TWIST
TWISTED DIRECTION OF SPUN YARN
S-TWIST

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP01/03539

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] D02G 3/26

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)
Int.Cl[7] D02G 3/00-3/48

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926-1996 Jitsuyo Shinan Toroku Koho 1996-2001
Kokai Jitsuyo Shinan Koho 1971-2001 Toroku Jitsuyo Shinan Koho 1994-2001

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.
A	JP 2000-96401 A (Asahi Chemical Industry Co., Ltd.), 04 April, 2000 (04.04.00) (Family: none)	1-6

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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Date of the actual completion of the international search	Date of mailing of the international search report
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