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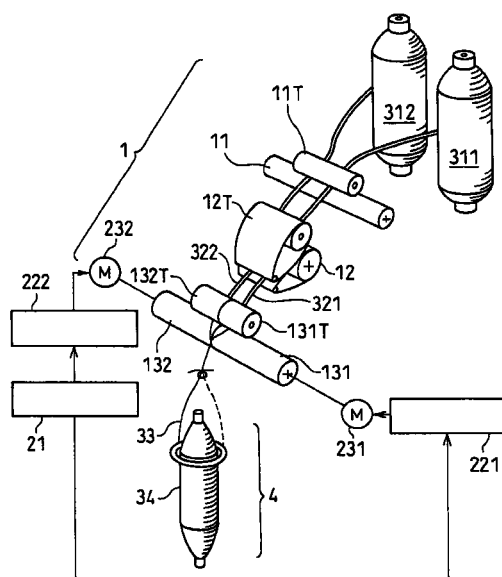
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(54) **Composite yarn and method of manufacturing same**

(57) A composite yarn and a method at manufacturing same are disclosed which make it possible to produce a fine spun twisted union yarn (33) with natural grandrelle-like patterns. In particular, a manufacturing method of a fine spun twisted union yarn (33) is disclosed where the feed rate or feeding time of one of two fiber bundles (321, 322) is varied according to a 1/f fluctuation, and the one fiber bundle is spun and twisted with the other fiber bundle, so that the one fiber bundle appears and disappears alternately on the periphery of the spun twisted union yarn (33).

**Fig. 1**



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## Description

**[0001]** The present invention relates to a composite yarn and a method of manufacturing same.

**[0002]** In accordance with the recent diversification of consumer needs, an appeal to aesthetic senses and sensibilities is expected of the yarns used for clothing. One of the yarns that satisfies this condition is grandrelle yarn. It is manufactured by mixed spinning, twisting, air-jet spinning, or the like. However, all these methods produce either regular or random patterns in structure and are not capable of producing any natural patterns creating the feel of something handmade.

**[0003]** The object underlying the present invention is to provide grandrelle-like yarns with natural patterns creating the feel of some handmade material. A further object of the present invention is to provide a method of manufacturing such a yarn.

**[0004]** According to a first aspect of the present invention, a composite yarn is provided comprising two fiber bundles of short fibers which are drafted into a fine spun twisted union yarn, wherein one of the fiber bundles appears and disappears alternately on the periphery of the fine spun twisted union yarn along the length of the yarn, and the respective length of an appearing part or a disappearing part varies according to a  $1/f$  fluctuation.

**[0005]** According to a second aspect of the present invention, a method of manufacturing a composite yarn in a fine spinning process is provided, in which two fiber bundles of short fibers are drafted into a fine spun twisted union yarn by using a fine spinning machine, wherein the feed rate of one fiber bundle is varied by a  $1/f$  fluctuation and the one fiber bundle is twisted with the other fiber bundle.

**[0006]** According to a third aspect of the present invention, a method of manufacturing a composite yarn in a fine spinning process is provided, in which two fiber bundles of short fibers are drafted into a fine spun twisted union yarn by using a fine spinning machine, wherein the feed rate of at least one fiber bundle is divided into two stages, namely a high feed-rate stage and a low feed-rate stage, wherein the feed rate in one stage is varied by the time pitch of a  $1/f$  fluctuation, and the one fiber bundle is twisted with the other fiber bundle.

**[0007]** According to the invention, the object is solved in an advantageous and satisfying manner. The yarn creating the feel of some handmade material can readily be manufactured at an industrial scale.

**[0008]** The above and other objects and the attended advantages of the present invention will readily become apparent with reference to the following detailed description when considered in conjunction with the accompanying drawings, wherein:

Fig. 1 is a perspective diagrammatic view of a fine spinning machine for manufacturing a composite

yarn with a  $1/f$  fluctuation;

Fig. 2(A) to 2(C) are diagrammatic views explaining the manufacturing method and the structure of composite yarn when the feed rate of one fiber bundle is varied with a  $1/f$  fluctuation; and

Fig. 3 shows diagrammatic views explaining the method of manufacturing composite yarn when the feed rate of two fiber bundles is varied with a  $1/f$  fluctuation.

## Detailed Description of the Invention

### Fine spinning machine

**[0009]** A fine spinning machine is a suitable apparatus which can produce a composite yarn from two fiber bundles of roving. For example, as shown in Fig. 1, the machine drafts a first roving 311 and a second roving 312 in a draft section 1, feeds a first fiber bundle 321 of the roving 311 and a second fiber bundle 322 of the second roving 312, respectively, to front rollers 131 and 132, spins and twists them into a fine spun twisted union yarn 33 by means of a spindle section 4, and winds the obtained yarn 33 on a bobbin 34.

**[0010]** The draft section 1 comprises the following components: a back roller 11, a back top roller 11T, a middle roller portion comprising a middle roller or an apron 12 and a middle top roller or a top apron 12T, front rollers 131 and 132, as well as front top rollers 131T and 132T. In such an arrangement, the pairs of rollers 131 and 131T on the one hand and 132 and 132T on the other hand are mounted one beside the other and are driven by independent driving sources as explained in more detail below.

### Roving

**[0011]** For roving, any of the following short fibers or their combinations can be used: natural fibers such as cotton, hemp, silk, and wool; regenerated fibers such as rayon, cupra, and high-strength regenerated cellulose fibers, for example a material available under the trade-name "Tencel"; and synthetic fibers such as nylon and polyester, and for the two fiber bundles of roving, the short fibers or their combinations having different colors or having different dyeing property can be used, and the color of each fiber can be its original color or a dyed color.

### Driving of front rollers

**[0012]** The front rollers 131 and 132 are so designed and adapted as to draft fiber bundles, and they are driven and controlled independently of each other. As shown in Fig. 1, the front rollers 131 and 132 are provided, for example, with front top rollers 131T

and 132T attached to and pressing against them. The front rollers 131 and 132 are driven independently of each other by a first motor M 231 and a second motor M 232, wherein the respective front top rollers 131T and 132T follow them.

**[0013]** The motors M 231 and M 232 are respectively controlled by controllers 221 and 222. Also, the controllers 221 and 222 are connected to a generator 21 providing a  $1/f$  fluctuation signal. Hence, the controllers 221 and 222 are adapted to drive the motors at a normal constant speed or at a modified speed varying by a  $1/f$  fluctuation.

**[0014]** Thus, the controllers 221 and 222 are adapted to perform control, for example in such a way that the fiber bundle from the one roving is fed with a speed corresponding to the  $1/f$  fluctuation signal, while the fiber bundle from the other roving is fed at a normal constant speed or standard speed. When spinning and twisting the fiber bundles 312 and 322 leaving the front rollers 131 and 132 controlled by the controllers 221 and 222, a fine spun twisted union yarn 33 with a  $1/f$  fluctuation is produced.

#### $1/f$ fluctuation

**[0015]** In this context, the expression " $1/f$  fluctuation" is defined and understood as a power spectrum, with a frequency component  $f$ , which is proportional to  $1/f^k$ , wherein  $k$  is approximately 1, and as a power spectrum which is similar to the above.

**[0016]** Accordingly, a  $1/f$  fluctuation signal is of the type wherein, when its power spectrum is analysed in a time series, the intensity is almost inversely proportional to the frequency  $f$  or directly proportional to  $1/f$ .

**[0017]** Such a  $1/f$  fluctuation signal corresponds to fluctuations in the basic rhythm of a human body, such as heart beats, and the application of  $1/f$  fluctuation signals makes it possible to produce grandrelle-like patterns and materials which create a sense of handmade unevenness.

**[0018]** Considering the situation under a different aspect, if a human body receives the same stimuli continuously, he will get tired of it rather soon. Conversely, the human body feels discomfort if the stimulations were to change too suddenly. However,  $1/f$  fluctuations provide intermediate stimuli between the two opposite types and create a comfortable feeling (see, for example, Japanese Patent Laid-Open No. 7-243137).

**[0019]** Such a  $1/f$  fluctuation signal can be determined from a numerical sequence, which in turn is obtained by performing arithmetic operations on a random number sequence with a predetermined number of coefficients. Also, it can be prepared by a well-known method using a computer or the like (see, for example Japanese Patent Laid-Open No. 7-243137).

#### Description of the Preferred Embodiments

a) First alternative where the feed rate of fiber bundles is varied by a  $1/f$  fluctuation.

**[0020]** As shown in Fig. 1 of the drawings, two fiber bundles having different colors from the rovings 311 and 312 are supplied and pass through a normal back roller 11 with associated back top roller 11T and a middle roller 12 with associated middle top roller 12T, or corresponding aprons. Then, two corresponding fiber bundles 321 and 322 are fed to front rollers 131 and 132, that operate independently of each other, and to front top roller 131T and 132T that follow the respective front rollers 131 and 132.

**[0021]** The one fiber bundle is drafted with its feed rate varied by a  $1/f$  fluctuation while the other fiber bundle is fed at a constant feed rate. As an example of a  $1/f$  fluctuation, the surface speed of the front roller 132 is varied by a  $1/f$  fluctuation, while the surface speed of the front roller 131 is kept at a constant feed rate of  $V_0$ .

**[0022]** The  $1/f$  fluctuation signal is set to change, for example, within a variable range of the predetermined feed rate, for example between 1.00 and 1.25.

**[0023]** If the surface speed of the front roller 132 that drafts the fiber bundle 322 is 1.00 with respect to the front roller 131, see the portion L in Fig. 2(A), the fiber bundles 321 and 322 are fed at the same speed; hence, they appear at almost equal intervals when twisted with each other, as shown for example in Fig. 2(B).

**[0024]** In contrast, if the surface speed of the front roller 132 that drafts the fiber bundle 322 is 1.25 with respect to the surface speed of the front roller 131, see portion M in Fig. 2(A), the fiber bundle 322 becomes thinner and longer than the fiber bundle 321. When the two fiber bundles 321 and 322 are twisted with each other, the fiber bundle 322 is exposed when winding itself around the periphery of the produced fine spun twisted union yarn 33, as shown for example in Fig. 2(C).

**[0025]** Therefore, the speed difference between the front roller 131 and the front roller 132 is zero in portion L and is at maximum in portion M, where control is performed without changing the controller 221 of the front roller 131.

**[0026]** When driving the front roller 132 with a rotation speed which is varied with a  $1/f$  fluctuation signal, as shown diagrammatically in Fig. 2(A) between the corresponding extremes, such a control combines the two fiber bundles 321 and 322 into a fine spun twisted union yarn 33 having a natural grandrelle-like pattern with a  $1/f$  fluctuation varying between the patterns of portion L and portion M as indicated in Fig. 2(A). In this case, when the two fiber bundles having different dyeing property are used, the fibers can be dyed in advance or dyed after the fine spun twisted union yarn 33 has been produced.

b) Second alternative where the feed rate of fiber bundles is varied by the time pitch of  $1/f$  fluctuation.

**[0027]** As shown in Fig. 1 of the drawings, two fiber bundles having different colors from the rovings 311 and 312 are supplied and pass through a normal back roller 11 with associated back top roller 11T, and a middle roller 12 with associated middle top roller 12T or corresponding aprons. Then, two fiber bundles 321 and 322 are fed to the front rollers 131 and 132, that operate independently of each other, and to front top rollers 131T and 132T that follow the respective front rollers 131 and 132.

**[0028]** The feed rate of at least one fiber bundle is alternately varied between two stages, with the feeding time pitch in one stage being varied by a  $1/f$  fluctuation. Regarding the other fiber bundle, either its feed rate may be kept constant or its feeding time pitch may be varied by a  $1/f$  fluctuation opposite to that of the first fiber bundle.

**[0029]** When the feeding time pitch of the two fiber bundles is varied by a  $1/f$  fluctuation, the surface speed of the front roller 132 can be set at 1.25 as opposed to a surface speed of 1.00 for the front roller 131 in one stage; and the surface speed of the front roller 132 can be set at 1.00 as opposed to a surface speed of 1.25 for the front roller 131 in the other stage. This situation is shown diagrammatically in Fig. 3 of the drawings. In this way, at least in one stage, the feeding type is varied at a pitch of  $1/f$  fluctuation.

**[0030]** When the surface speed of the front roller 131 is 1.25, then the fiber bundle 321 becomes thinner and longer than the fiber bundle 322 of the front roller 132 rotating at a surface speed of 1.00. Accordingly, the fiber bundle 321 from the roving 311 is exposed when winding itself around the periphery of the fine spun twisted union yarn 33 produced thereby, as shown at J in Fig. 3.

**[0031]** Conversely, if the surface speed of the front roller 131 is 1.00 and the surface speed of the front roller 132 is 1.25, then the fiber bundle 322 becomes thinner and longer than the fiber bundle 321, and the fiber bundle 322 from the roving 312 winds itself around the periphery of the bicomponent filament yarn 33 produced thereby as shown at K in Fig. 3.

**[0032]** The patterns of fine spun twisted union yarn 33 produced in such a manner are shown in the lower portion of Fig. 3. Such fine spun twisted union yarn 33 are produced wherein the rotation of the front rollers 131 and 132 is controlled in such a manner that the exposed portion of one fiber bundle 321 will be approximately 20 mm long, and with the feeding time varied at a pitch of  $1/f$  fluctuation in time periods indicated at t1, t2, t3, t4 etc. in the stage when the surface speed of the front roller 132 is 1.25.

**[0033]** In this manner, fine spun twisted union yarn 33 is obtained by spinning and twisting the two fiber bundles 321 and 322 with each other resulting in a yarn

33 having a  $1/f$  fluctuation. In other words, it has a natural grandrelle-like pattern instead of a regular or random pattern.

**[0034]** In this case, too, when the two fiber bundles having different dyeing property are used, the fibers can be dyed in advance or dyed after the fine spun twisted union yarn 33 has been produced.

**[0035]** The fine spun twisted union yarn 33 can further be used to obtain woven or knitted fabrics having a natural grandrelle-like pattern with a  $1/f$  fluctuation. When two fiber bundles having different dyeing property are used, dyeing can also be carried out after a woven or knitted fabric has been produced by using the fine spun twisted union yarn 33.

**[0036]** It is readily apparent that the invention provides considerable advantages in practice. On the one hand, it is possible to produce a composite yarn with natural grandrelle-like patterns. On the other hand, the use of such a composite yarn according to the present invention makes it possible to obtain textiles having a natural grandrelle-like pattern creating a comfortable feel, instead of a regular or random pattern.

**[0037]** It is readily apparent that the composite yarn according to the invention has the advantage of wide commercial utility.

**[0038]** It should be understood, however, that the specific form of the invention described above is intended to be representative only, as various modifications within the scope of these teachings will be apparent to those skilled in the art.

## Claims

1. A composite yarn comprising two fiber bundles (321, 322) of short fibers which are drafted into the fine spun twisted union yarn (33), wherein one of the fiber bundles (321, 322) appears and disappears alternately on the periphery of the fine spun twisted union yarn (33) along the length of the yarn (33), and the respective length of an appearing part or a disappearing part varies according to a  $1/f$  fluctuation.
2. A method of manufacturing a composite yarn in a fine spinning process in which two fiber bundles (321, 322) of short fibers are drafted into a fine spun twisted union yarn (33) by using a fine spinning machine (1, 4), wherein the feed rate of one fiber bundle (321, 322) is varied by a  $1/f$  fluctuation, and the one fiber bundle (321, 322) is spun and twisted with the other fiber bundle (322, 321).
3. A method of manufacturing a composite yarn in a fine spinning process in which two fiber bundles (321, 322) of short fibers are drafted into a fine spun twisted union yarn (33) by using a fine spinning machine (1, 4),

wherein the feed rate of at least one fiber bundle (321, 322) is divided into two stages, namely a high feed-rate stage and a low feed-rate stage, wherein the feed rate in one stage is varied by the time pitch of a  $1/f$  fluctuation, and the one fiber bundle (321, 322) is spun and twisted with the other fiber bundle (322, 321).

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Fig. 1

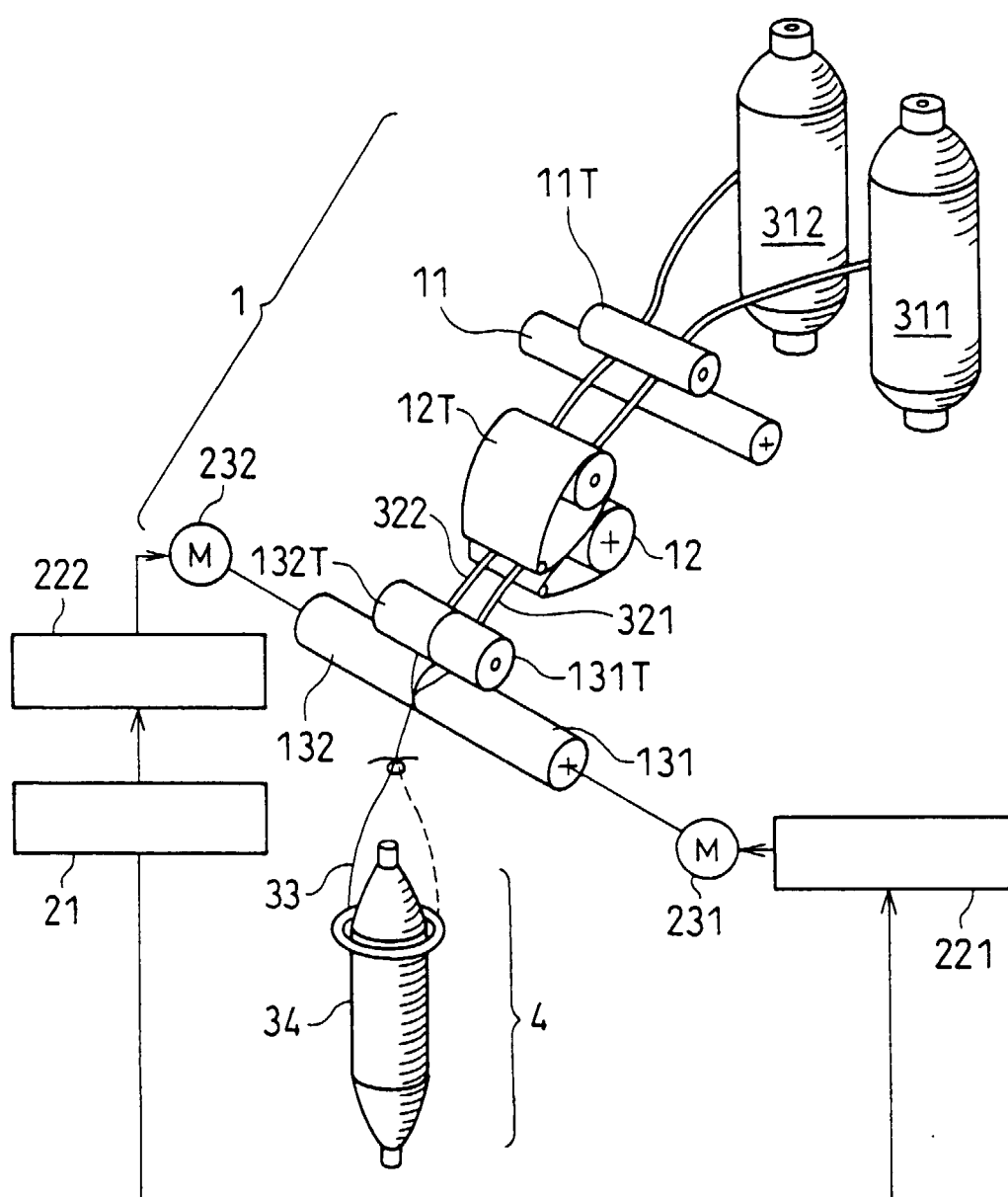


Fig. 2

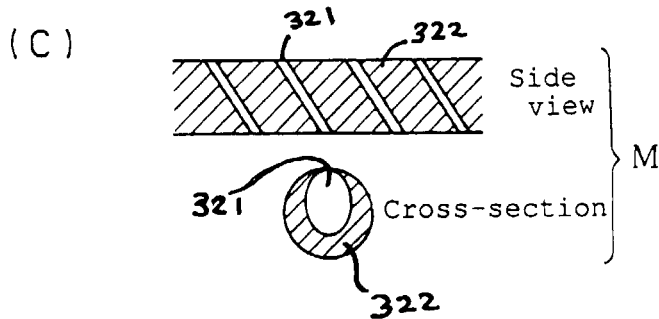
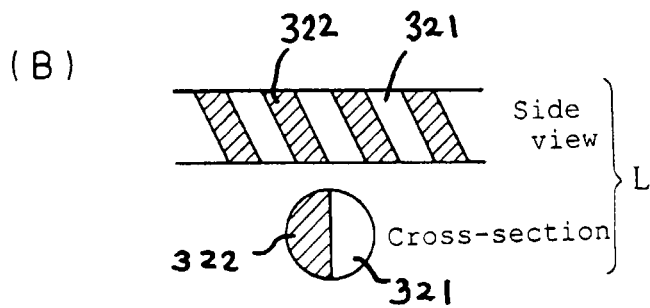
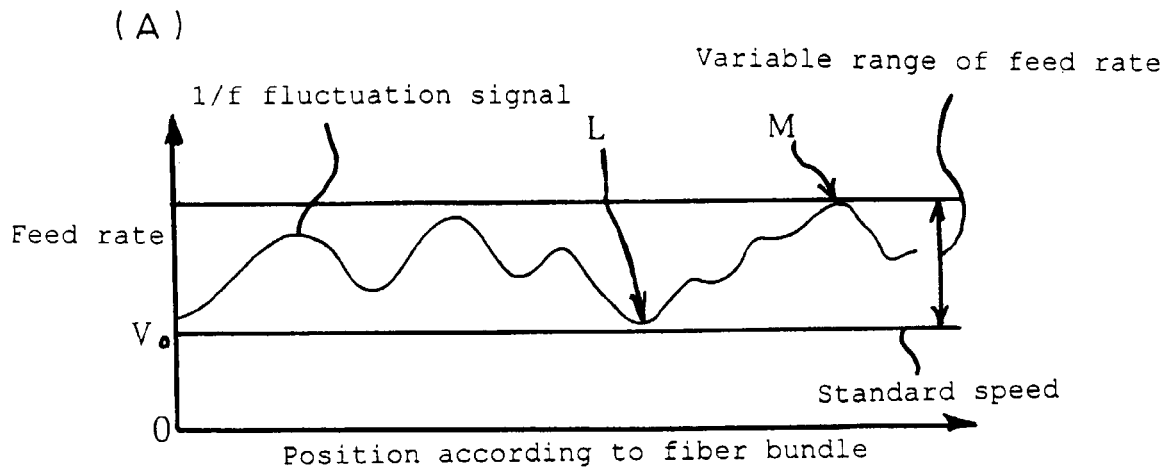
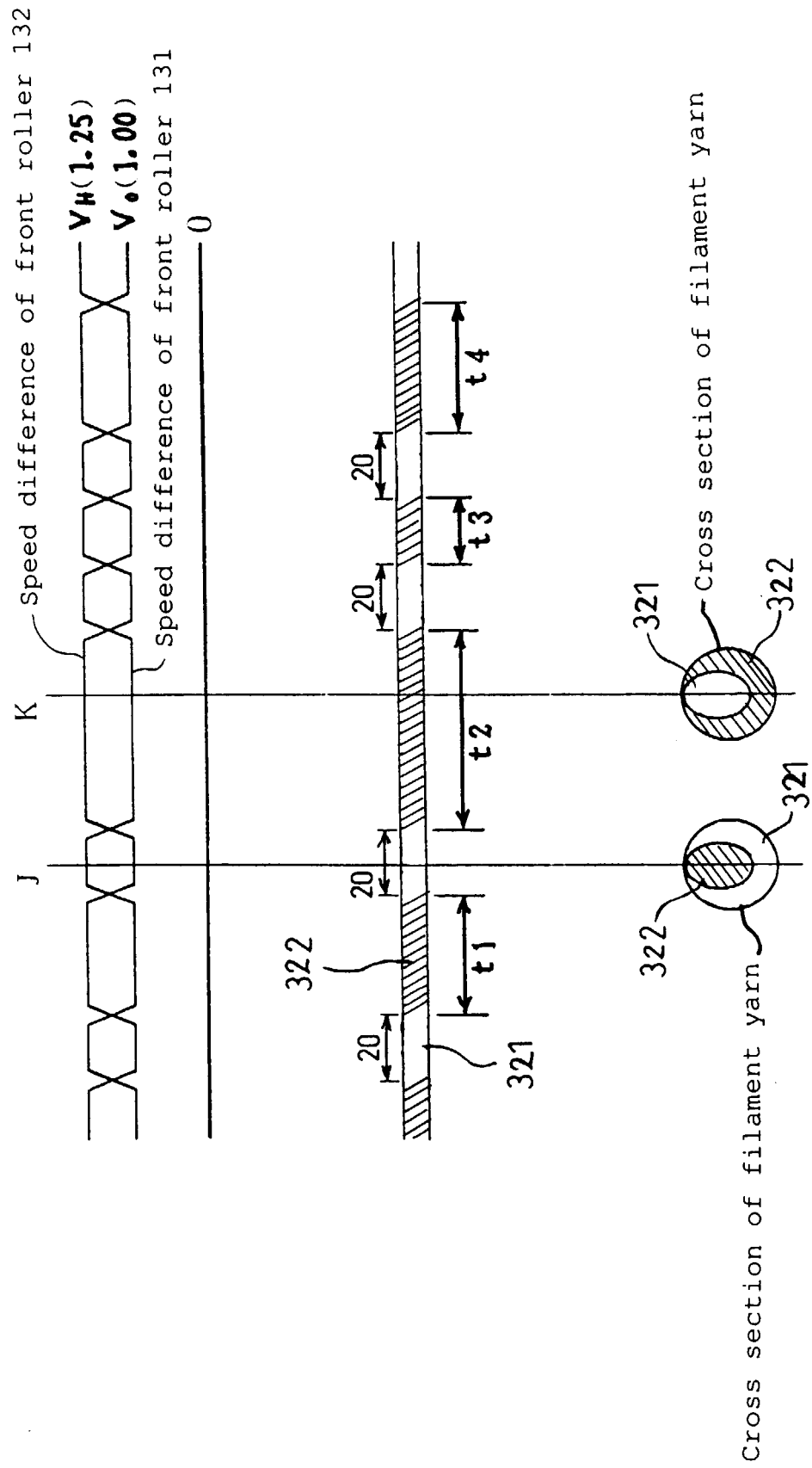


Fig. 3





European Patent  
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# EUROPEAN SEARCH REPORT

Application Number  
EP 00 10 2785

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                    |                                  |                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Citation of document with indication, where appropriate, of relevant passages                                      | Relevant to claim                | CLASSIFICATION OF THE APPLICATION (Int.Cl.7) |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | US 4 041 690 A (LAMBERT JR JOHN WESLEY)<br>16 August 1977 (1977-08-16)<br>* the whole document *                   | 1-3                              | D01H5/36<br>D02G3/34                         |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | EP 0 754 787 A (MUSHA TOSHIMITSU ;NISSHIN SPINNING (JP))<br>22 January 1997 (1997-01-22)<br>* the whole document * | 1-3                              |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | US 3 205 648 A (JAMES L. LOHRKE)<br>14 September 1965 (1965-09-14)<br>* the whole document *                       | 1-3                              |                                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                    |                                  | TECHNICAL FIELDS SEARCHED (Int.Cl.7)         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                    |                                  | D01H<br>D02G                                 |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                    |                                  |                                              |
| Place of search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                    | Date of completion of the search | Examiner                                     |
| THE HAGUE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                    | 7 June 2000                      | Henningsen, O                                |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone<br/> Y : particularly relevant if combined with another document of the same category<br/> A : technological background<br/> O : non-written disclosure<br/> P : intermediate document</p> <p>T : theory or principle underlying the invention<br/> E : earlier patent document, but published on, or after the filing date<br/> D : document cited in the application<br/> L : document cited for other reasons</p> <p>&amp; : member of the same patent family, corresponding document</p> |                                                                                                                    |                                  |                                              |

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 10 2785

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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07-06-2000

| Patent document<br>cited in search report |   | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---|---------------------|----------------------------|---------------------|
| US 4041690                                | A | 16-08-1977          | US 4130984 A               | 26-12-1978          |
| EP 0754787                                | A | 22-01-1997          | JP 2860455 B               | 24-02-1999          |
|                                           |   |                     | JP 9031766 A               | 04-02-1997          |
|                                           |   |                     | CN 1140773 A               | 22-01-1997          |
|                                           |   |                     | DE 69605488 D              | 13-01-2000          |
|                                           |   |                     | US 5752295 A               | 19-05-1998          |
| US 3205648                                | A | 14-09-1965          | NONE                       |                     |