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METHOD OF PRODUCING AN ELASTIC CORE YARN

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Fig. 1.

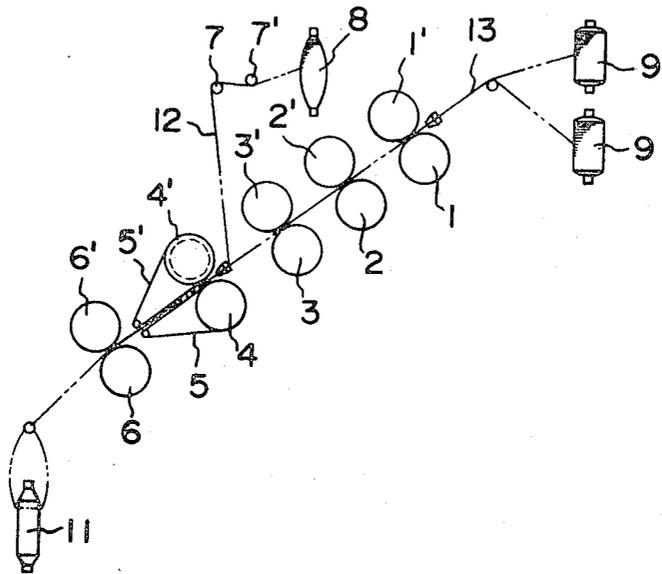
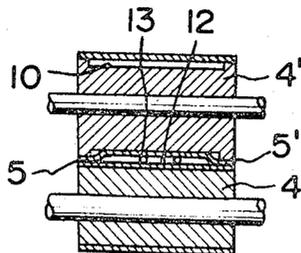


Fig. 2.



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**METHOD OF PRODUCING AN ELASTIC CORE YARN**

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4 Claims. (Cl. 57-163)

The present invention relates to a method of producing core yarn using an elastic thread as the core.

Recently, various methods have been developed, in which by using a spinning frame the core is constituted from an elastic thread and any short fibers are wound around the core. For example, a method has been known, in which in a spinning process to obtain a spinning thread by spinning out any fibers to form the skin a drafted elastic thread to form the core is fed from the rear side of a nip point of front rollers and both threads are doubled and wound to effect a spinning, thereby an elastic core yarn is obtained.

However, in this process, it is necessary to provide an apparatus for drafting the elastic core thread in addition to the part for drafting the sliver for skin and still it is necessary to provide an apparatus for drafting again the the core yarn after spinning, so that the installation tends to become large. The thread thus obtained is not sufficiently stable in form and is not sufficiently set in elongation. It has heretofore been difficult to spin out elastic core yarn without drafting the core.

After various investigations on the method of manufacturing a sufficiently elongated set core yarn by spinning the elastic yarn to be used as the core without drafting, while doubling with the other short fibers, the inventors have arrived at the invention.

The object of the invention is to provide a method of producing core yarn using an elastic core thread stable in form as the core in which by using the spinning frame, the second rollers of which have an apron type draft mechanism, the core is formed by the elastic thread and the other short fibers are wound around the core to effect spinning, which comprises feeding the core yarn to the rear side of the apron draft zone without positively drafting the elastic yarn in the draft zone.

For a better understanding of the invention reference is taken to the accompanying drawings, in which

FIG. 1 shows a diagram of an example of mechanism for spinning the core yarn according to the invention; and

FIG. 2 shows an enlarged sectional view of an apron type draft mechanism shown in FIG. 1.

The spinning frame shown in FIG. 1 is a five line system spinning frame consisting of back rollers 1, 1', fourth rollers 2, 2', third rollers 3, 3', second rollers 4, 4' having an apron type draft mechanism, having aprons 5, 5', and front rollers 6, 6'.

Firstly, spinning fibers to form a layer of skin which are wound on bobbins 9, 9' as roving 13, are supplied in one or several threads and drafted between each roller in the same manner as a conventional spinning frame.

On the other hand, elastic thread 12 to form the core is wound on bobbin 8, from which the elastic thread is delivered, fed to the rear side of the apron of the second rollers through tension control guides 7 and 7' and combined with the roving for skin to cover the elastic thread between said apron or between the second rollers and the front rollers without drafting positively and then twisted, after which the twisted threads are wound up on the bobbin 11.

In this case, the elastic thread to form the core, after being delivered from the bobbin is passed through to the tension control guides only and fed directly to the rear

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side of the second rollers, so that positive draft by means of draft roller is not imparted to the elastic thread.

The tension of the elastic thread is usually less than 0.8 g./d., and when the tension of said elastic thread is more than 1.3 g./d., the doubling effect of the roving and the elastic thread is decreased and excellent core yarn can not be obtained.

Furthermore, it is important that the elastic thread fed to the rear side of the second roller is not drafted positively between said apron draft zone or between the second rollers and the front rollers and particularly it is desirable to suppress the tension to 0.2 g./d. To this end, as seen in FIG. 2, it is necessary that the second rollers are constituted in such a manner that the top roller 4' has a recess 10 in the center portion and in the nip point some degree of space is formed between the center portion of the apron and the surface of the top roller or between the surfaces of the top roller and bottom roller to nip thread having a size more than some degree, but substantially not to nip a fine thread.

In the draft zone having such a construction it is important that the roving is drafted, but the position to supply the elastic thread to form the core is not behind the nip point of the front rollers, but behind the second roller having the apron draft mechanism, and in this point, the elastic thread is supplied in such a manner that the short fibers such as roving are doubled sufficiently with the elastic thread.

The reason why the second roller having the apron draft mechanism is selected as described above, is to increase the doubling effect of the elastic thread to form the core and the short fibers such as roving and by selecting such a draft mechanism, after the doubling, the elastic yarn is not substantially drafted, but only the spinning fiber is highly drafted, thereby the effect is obtained.

As the elastic thread to be used in the invention, use may be made of filament yarn having a high elastic elongation, such as a usual filament of polyurethane and polyolefin etc. and it is preferable to use polyurethane elastomeric thread set to an elongation of less than 150% by stretching the polyurethane elastomer having a molecular weight of 200 to 800, preferably, 500 to 5,000, and segment of melting point of less than 80° C. which comprises reaction product of three components of a polymeric diol, an organic isocyanate and a chain extender of a diol to a stretch ratio less than the breaking elongation and then heat treating the elastomer at a temperature within the range of less than the melting point or resolving temperature of the elastomer and more than 50° C.

In the case of using a usual elastic thread as the core it is possible to obtain the core yarn having a stable form and a comparatively set elongation.

Furthermore, core yarn obtained by using elongation set polyurethane elastomeric thread as the core is very low in elongation and stable in form, but it is possible to obtain core yarn having a comparatively high elongation by heat treating again the core yarn at a temperature within the range of more than 50° C. and below the melting point or the resolving temperature of polyurethane elastomer under non-tension, after the spinning or further after weaving, because said elastomeric thread recovers the original elastic elongation.

Moreover, said polyurethane elastomeric thread varies the elongation set condition depending upon the heat setting time and when the time of treatment for the heat set is more than one second and less than several minutes, the elongation is recovered by a further heat treatment, but when the time of treatment is more than 30 minutes, even if a further heat treatment is carried out, the elongation is not recovered. Accordingly, by selecting polyurethane elastomeric threads heat set for appropriate time as the core, a core yarn having a high elongation or a

core yarn having a low elongation can be produced optionally.

Furthermore, as the short fiber for the skin, use may be made of natural fibers and artificial fibers and the like and roving or sliver is used depending upon the draft ratio of the spinning frame used. They are fed in one thread or several threads simultaneously.

In the practice of the invention, a draft mechanism to draft the elastic thread to form the core is not necessary, but the conventional spinning frame can be used as such, thereby the core yarn used as the core can be produced simply and inexpensively.

Moreover, the draft control of the elastic thread was difficult, because the elongation is high, but such an operation is not necessary. The core yarn thus obtained has a low elongation and good covering property of the layer of skin by means of other fibers and is stable in the form, so that it is suitable to produce knitted goods and woven fabrics.

The invention will be explained further in detail by the following examples:

EXAMPLE 1

A core yarn having the core of an elastic thread was spun under the following spinning condition.

Spinning condition

Core: Elastic thread of polyurethane, d./10 filaments	40
Skin: Fibers of polyester, 2 roves—	
Roving weight	g./m. × 2 0.6
Fiber length	mm 89
Size of fiber	denier 3
Draft: Draft of roving for skin—	
Between back rollers 1, 1' and fourth rollers 2, 2'	1.08
Between fourth rollers 2, 2' and third rollers 3, 3'	1.19
Between third rollers 3, 3' and second rollers 4, 4'	1.13
Between second rollers 4, 4' and front rollers 6, 6'	27.96
All draft	40.6

The spinning frame used was a five line system spinning frame, and the gauge between the top roller and the apron of the second rollers was 2 mm.

Worsted count of yarn	30's
Number of twist	t./m. 672
Twist constant	122.5

The characteristics of the core yarn thus obtained are as follows:

Elongation	percent 19.1
Single strand break factor	g 408

EXAMPLE 2

Spinning condition

Core: Elastic thread of polyurethane, d./10 filaments	40
Skin: Fibers of polyester, 2 roves—	
Roving weight	g./m. × 2 0.6
Fiber length	mm 89
Size of fiber	denier 3
Draft: Draft of fiber for skin—	
Between back rollers 1, 1' and fourth rollers 2, 2'	1.08
Between fourth rollers 2, 2' and third rollers 3, 3'	1.19
Between third rollers 3, 3' and second rollers 4, 4'	1.13
Between second rollers 4, 4' and front rollers 6, 6'	27.96
All draft	40.6

The spinning frame used was a five line system spinning frame, and the gauge between the top roller and the apron of the second rollers was 2 mm.

Worsted count of yarn	20's
Number of twist	t./m. 478
Twist constant	107.0

The characteristics of the core yarn thus obtained are as follows:

Elongation	percent 19.1
Single strand break factor	g 492

EXAMPLE 3

Spinning condition

Core: Elastic thread of polyurethane, d./10 filaments	40
Skin: Fibers of polyester, 2 roves—	
Roving weight	grain/30 yd. × 2 130
Fiber length	mm 51
Size of fiber	denier 2
Draft: Draft of fiber for skin—	
Between third rollers and second rollers	1.46
Between second rollers and front rollers	19.78
All draft	28.90

The spinning frame used was a five line system spinning frame, and the gauge between the top roller and the apron of the second rollers was 2 mm.

Worsted count of yarn	36's
Number of twist	t./m. 743
Twist constant	124.0

The characteristics of the core yarn thus obtained are as follows:

Elongation	percent 18.0
Single strand break factor	g 340

EXAMPLE 4

Spinning condition

Core: Elastic thread of polyurethane, d./10 filaments	40
Skin: Fibers of polyester, 1 rove—	
Roving weight	grain/30 yd. × 1 330
Fiber length	mm 51
Size of fiber	denier 2
Draft: Draft of fiber for skin—	
Between third rollers and second rollers	1.51
Between second rollers and front rollers	21.52
All draft	32.6

The spinning frame used was a three line system spinning frame, and the gauge between the top roller and apron of the second rollers was 0.8 mm.

Worsted count of yarn	32's
Number of twist	t./m. 743
Twist constant	131.0

The characteristics of the core yarn thus obtained are as follows:

Elongation	percent 18.2
Single strand break factor	g 402

EXAMPLE 5

Polyurethane elastomer consisting of polyethylene adipate, ethylene glycol and diphenylmethane 4,4'-diisocyanate was spun according to a conventional method into an elastic thread having 105 denier/10 filaments (elongation: 420% and recovery ratio by 50% elongation: 98%). The elastic thread was cold drawn to 300%, taken up on a bobbin under a tension and heat set in silicon oil heated up to 140° C. for 10 seconds to provide a core thread. In case of carrying out a core spinning by using the core

thread thus obtained, if the core thread was introduced behind the front rollers, covering property of the core thread was not sufficient and the core thread was partially exposed. However, according to the method of the present invention, if the core thread was supplied to the rear side of the apron draft zone, positive draft was not applied on the elastic thread and the covering property was excellent, and the core yarn without any exposed part of the core thread was obtained.

Spinning condition and property of the core yarn are as follows:

Core: 35 d./10 filaments.

Skin: Fibers of polyester, 2 roves—

Roving weight	g./m	0.6
Fiber length	mm	89
Size of fiber	denier	3

Draft: Draft of fiber for skin—

Between back rollers and third rollers	1.28
Between third rollers and second rollers	1.01
Between second rollers and front rollers	31.71
All draft	40.99

The spinning frame used was a four line system spinning frame, and the gauge between the top roller and the apron of the second rollers was 2 mm.

Worsted count of yarn	30's
Number of twist	t./m 672
Twist constant	122.5

The characteristics of the core yarn thus obtained are as follows:

Elongation	percent	18.0
Single strand break factor	g	408

In case of treating the above core yarn with hot water at 100° C. for 15 minutes, shrinking percentage was 45% and elongation 68%.

EXAMPLE 6

An elastic thread having 100 d./10 filaments of polyurethane elastomer consisting of polytetramethylene glycol, diphenyl diisocyanate and diamino diphenylmethane (mole ratio 2:3:1) was treated in hot water bath at 100° C. for 30 minutes while drafting 30.0%, and cooled in a drawn condition to set the elongation and taken up on a bobbin to provide a core thread.

Then, the core yarn was spun under the following spinning condition:

Core: Elastic thread of said polyurethane, d./10 filaments	48
Skin: Fibers of polyester, 2 roves—	
Roving weight	grain/30 yd 130
Fiber length	mm 51
Size of fiber	denier 2
Draft: Draft of fiber for skin—	
Between back rollers and middle rollers	1.46
Between middle rollers and front rollers	19.78
All draft	28.90

The spinning frame used was a three line system spin-

ning frame, and the gauge between the top roller and the apron of the second rollers was 2 mm.

Worsted count of yarn	36's
Number of twist	t./m 744
Twist constant	124.0

The characteristics of the core yarn thus obtained are as follows:

Elongation	percent	20.0
Single strand break factor	g	364

In the above examples, the tensile strengths were determined by using pendulum type tensile tester (constant-rate-of-traverse class machine), the experimental length of yarn being 50 cm. and the speed of traverse being 30 cm./min.

What we claim is:

1. A method of producing core yarn using an elastic thread as the core, which comprises drafting roving in a roller drafting zone, feeding an elastic thread directly to the rear side of an apron drafting zone together with the drafted roving, doubling the elastic thread with the roving from the roller drafting zone without drafting the elastic thread, and spinning both the elastic thread and the roving.

2. A method as claimed in claim 1 which comprises feeding the elastic thread while maintaining tension less than 0.2 g./d.

3. A method as claimed in claim 1 which comprises spinning out the elastic thread and the roving without drafting the elastic thread but drafting highly the roving in the apron draft zone.

4. A method as claimed in claim 1 which comprises feeding as the core polyurethane elastomeric thread set to an elongation of less than 150% by stretching polyurethane elastomer having a molecular weight of 200 to 800 and segment of melting point of less than 80° C. and comprising the reaction product of three components of a polymer diol, an organic isocyanate and a chain extender of diol to a stretch ratio less than the breaking elongation, and then heat treating the elastomer at a temperature within the range of less than both the melting point and the breaking temperature of the elastomer and more than 50° C.

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