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3,357,076

YARN AND FABRICS HAVING STRETCH PROPERTIES

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No Drawing. Filed Dec. 27, 1965, Ser. No. 516,675
10 Claims. (Cl. 28—72)

This invention relates to yarn and fabrics made therefrom having stretch properties. It particularly relates to the preparation and utilization of wrapped elastic yarns and fabrics made from such wrapped yarns. Specifically, it relates to a method for making a composite elastic yarn wherein an elastic core strand is wrapped with a relatively inelastic synthetic filamentary strand.

It has been known in the prior art to produce fabrics which have stretch properties for use in the garment and elastic stocking industries. However, in the utilization of elastic yarns, the inherent elasticity of such yarns makes it virtually impossible to weave or knit these yarns into fabrics since the yarn tends to stretch under the processing tensions employed. Since the frictional and mechanical tensions which are placed upon the yarn in these operations are relatively uncontrollable and are variable in nature, uniformly fabricated textiles cannot be made from elastic yarns per se.

In order to overcome these difficulties, the prior art has proposed to combine with an elastic core, a non-elastic second core, wrapping this dual core with another strand which restrains the movement of the core strands in any direction during the processing sequences of weaving or knitting. Usually the inelastic core member is of the type that may be subsequently removed such as by dissolving after the yarn has been converted into a fabric.

It is obvious that this solution to the problem of converting elastic yarns into fabrics is expensive and complicated. The use of the dual core member and the additional processing step of removing the inelastic core member both involve added expense and increased cost to fabrics made via this processing scheme.

It is, therefore, an object of this invention to provide a novel elastic yarn which can be easily and inexpensively used for conversion into fabrics.

It is another object of this invention to provide a novel fabric having stretch properties.

It is an additional object of this invention to provide a method for producing elastic yarns and fabrics made therefrom by a facile and economical manner.

It is a specific object of this invention to produce an elastic yarn which has as its core member a spandex strand and as its wrapping member a polyester strand.

Other objects of the invention will appear more fully from the discussion which follows hereinbelow and from the appended claims hereto.

In accordance with this invention, a composite yarn having stretch properties is made by a method which comprises wrapping an unextended non-heatset elastic core strand with at least one wrapping strand composed of undrawn synthetic filamentary material, extending said wrapped yarn in an amount sufficient to draw said undrawn material, at least partially relaxing said extended wrapped yarn, and heatsetting said composite yarn in its partially relaxed state.

In a preferred embodiment of this invention, fabrics are produced which have stretch properties by using yarns produced as above described wholly or in admixture with other filamentary materials. In addition to having stretch properties, fabrics produced from this preferred embodiment of this invention have an extremely soft hand such as is produced from bulked yarns. Those skilled in the

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art know that conventional bulk yarns are produced by twisting a continuous filament thermoplastic yarn, heat-setting the twisted yarn, and thereafter removing the twist from the yarn. The fabric formed from these stretch yarns may be made by knitting, weaving, etc. and may be stretched in the filling or warp or in both directions.

As used herein, the terms "wrapped," "wrapping," etc. are intended to include not only the traditional wrapping operations and yarns produced therefrom but also includes the conventional twisting or doubling operations and the ply yarns produced therefrom.

The types of core strands which may be used in the practice of this invention include any filamentary material which has elastic and/or stretch properties. As used herein, the term "elastic" or "stretch" is meant to include the property whereby when a filamentary material is extended there is a recovery from this extension of at least 90%. Conventionally, these strands may be extended several hundred percent of their original length and have extremely rapid recovery. Rubber yarns and those composed of spandex are typically used and are preferred in the practice of this invention.

The synthetic filamentary material which may be used as the wrapping strand in the practice of this invention include any and all of the synthetic thermoplastic filamentary materials which need to be drawn and heatset in order to create mechanical stability. Typically, satisfactory filamentary materials include polyester fibers, polyamide fibers, acrylic fibers and the like. It is noted that each of these synthetic materials have in common the need for drawing in order to orient the molecular structure and substantially improve the mechanical properties of the fiber. It is also to be noted that it is critical in the practice of this invention that the wrapping strand used be in its undrawn state at the time it is wrapped around the core strand.

Following the wrapping operation, the yarn, or the fabric made therefrom, must be stretched in an amount sufficient to draw the undrawn wrapping strand. Usually, the stretching force which is applied should extend the wrapped yarn an amount ranging from 200% to 1000% of its original length depending upon what synthetic material was used for the wrapping strand. For example, when polyester filamentary material is used as the wrapping strand, the stretching force applied should be sufficient to extend the composite yarn an amount ranging from preferably 300% to 400% of its original length.

Another critical feature of this invention is that it is necessary for the stretched or extended composite yarn to be at least partially relaxed. That is, the extending force should be removed to an extent that the composite yarn contracts to from 10% to 90% of its extended length. Following this relaxation step, the inventive process requires that the yarn or fabric be heatset in order to stabilize the material. This heatsetting step is performed under conventional conditions which typically include a temperature of from 350° F. to 450° F., using, for example, heated cans, to supply the source of heat.

The conditions which are necessary to extend the composite yarn or fabric in an amount necessary to draw the wrapping strand include a temperature of from 200° F. to 250° F. and an extending force sufficient to draw the wrapping strand the equivalent of a draw ratio from 2.0:1 to 6.0:1.

The yarns and fabrics made in accordance with this invention will show various novelty surface effects depending upon the number of plies, turns per inch, and degree of relaxing afforded the unset but twisted and extended yarn of fabric. For example, in a twisted yarn of two plies consisting of an elastic core strand and undrawn polyester wrapping strand, a twist level of six (6)

turns per inch (t.p.i.) will produce rather large loops in the stretch composite yarn whereas a twist level of fifty (50) turns per inch (t.p.i.) will produce extremely small loops in very close increments along the stretch composite yarn. In addition, varying the degree of relaxation will produce different degrees of stretch in the yarn or fabric. Those skilled in the art will appreciate the many combinations of these variables which may be used. However, the minimum twist level or wrapping level must be such that the elastic strand is sufficiently restrained for processing through conventional knitting or weaving machinery. Preferably, the twist level in all cases will range from 6 t.p.i. to 50 t.p.i.

To further describe the invention, the following example is given.

Example

One end of a 225 denier, 36 strand yarn having 0.25 Z twist and composed of undrawn polyester was wrapped 30 Z turns per inch about a 70 denier spandex core yarn in its relaxed (not extended) and unheatset state on a conventional spinning frame. This wrapped yarn was woven as a 50 pick filling in a 40/1 cotton warp of 82 sley on a 46 inch loom. Normal tensions were used and a greige fabric having a width of 45 inches was removed from the loom.

The greige fabric produced hereinabove was divided into three portions and treated in the following manner:

(1) A first portion of the fabric was drawn to a width of 55 inches at a temperature of 220° F., and relaxed to a width of 43 inches. While in the relaxed state (43 inches width) this portion was heatset at 380° F. The resulting fabric had a stretch potential of 40% and had a terry face.

(2) A second portion of the above fabric was drawn to a width of 110 inches at a temperature of 220° F., and relaxed to a width of 48 inches. While in the relaxed state (48 inches width) this portion was heatset at 380° F. The resulting fabric had a stretch potential of 215% and had a terry face.

(3) A final portion of the fabric was drawn to a width of 110 inches at a temperature of 220° F., was not relaxed, but was heatset at 380° F. (in its 110 inches width). The resulting fabric had a knit-de-knit appearance but had less than 10% stretch potential.

It is noted from Experiment 3 hereinabove that the relaxing step is a necessary part of the inventive process.

It can also be seen that this technique furnishes a method for converting narrow fabric from a conventional loom into a very wide stretch fabric with a high resistance to creep at the maximum stretch limits. Therefore, it is noted that the stretch and recovery in fabrics made from this type of yarn is not necessarily based on the principle that there must be recovery after weaving or knitting to allow stretch in the finished fabric as would be indicated from the prior art process. It is also to be noted that this yarn can be manufactured on any conventional spinning frame without modifications because stretching and heatsetting of the core is not required.

Having described our invention, what we desire to secure by Letters Patent is:

1. Method for making a composite yarn having stretch properties which comprises wrapping an unextended, non-heatset elastic core strand with at least one wrapping strand composed of undrawn synthetic filamentary material, extending said wrapped yarn in an amount sufficient to draw said undrawn material, at least partially relaxing said extended wrapped yarn, and heatsetting said composite yarn in its partially relaxed state.

2. Method according to claim 1 wherein said elastic core strand is spandex and said synthetic filamentary material is polyester.

3. Method according to claim 2 wherein said extending is performed at a temperature of from 200° F. to 250° F. and said undrawn wrapping strand is drawn to a draw ratio of from 2.0:1 to 6.0:1.

4. Method according to claim 3 wherein said heatsetting is performed at a temperature of from 350° F. to 450° F.

5. Method for making a stretch fabric which comprises wrapping an unextended, non-heatset elastic core strand with at least one wrapping strand composed of undrawn synthetic filamentary material, forming said wrapped yarn into fabric material, subjecting the fabric to an extending force sufficient to draw said undrawn material, at least partially relaxing said extending force thereby allowing said fabric to at least partially contract from its extended direction, and heatsetting said fabric in its partially contracted state.

6. Method according to claim 5 wherein said elastic core strand is spandex and said synthetic filamentary material is polyester.

7. Method according to claim 6 wherein said extending force is applied at a temperature of from 200° F. and 250° F. and said undrawn wrapping strand is drawn to a draw ratio of from 2.0:1 to 6.0:1.

8. Method according to claim 7 wherein said heatsetting is performed at a temperature of from 350° F. to 450° F.

9. An elastic composite yarn produced by the method of claim 1.

10. A stretch fabric produced by the method of claim 5.

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