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MANUFACTURE OF CREPE YARNS AND FABRICS FROM NYLON

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This invention relates to the manufacture of crepe yarns from nylon and the production of creped fabrics therefrom.

Field of invention

Numerous types of yarns which can be treated to crepe or which can be woven into textiles and then treated so as to form a crepe-like fabric have been produced in the past. Many types of filaments and yarns, both from natural and artificial sources, have been tested for this use. Some of these have resulted in the production of crepe fabrics of satisfactory types, while many others have been unusable because the materials produced therefrom were too uneven, possessed undesirable drape or handle, or were otherwise unsatisfactory.

With the widespread acceptance and availability of nylon yarns and filaments numerous attempts have been made to make crepe yarns and fabrics from these artificial filamentary products. However, these attempts in the past have been generally unsuccessful since they have not given fabrics having a uniform and deep pebble crepe, such as is characteristic of viscose rayon or silk crepe fabrics.

Objects

A principal object of this invention is the provision of new crepe yarns of nylon and crepe fabrics made therefrom. Still further objects include:

(1) A process for the manufacture of crepe fabrics from nylon filamentary products;

(2) The provision of nylon-containing fabrics which have a uniform and deep pebble crepe;

(3) The provision of nylon yarn filaments and the like which can be used in the production of such creped fabrics;

(4) The provision of fabrics containing nylon filaments or yarns which have pronounced creping properties;

(5) The provision of improvements in the methods for producing creped nylon fabrics which make it possible to obtain fabrics having a more uniform and, at the same time, higher degree of crepe than has been possible heretofore;

(6) The provision of new improvtments in the treatment and formation of nylon yarns.

Still further objects and the entire scope of applicability of the present invention will become apparent from the detailed description given hereinafter; it should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

General description

These objects are accomplished according to the present invention by the manufacture of nylon crepe yarns through a combination of filament-treating steps which include.

(*a*) Twisting nylon yarn;

(*b*) Setting the twist therein;

(*c*) Heating the twisted and set yarn for at least 15 minutes to a temperature up to 300° F.;

(*d*) Conditioning the yarn, and then

(*e*) Untwisting the yarn.

This results in the production of nylon yarns which have a pronounced creping effect. The resulting yarns are woven into fabrics, preferably in certain desirable patterns and manners, either alone or in combination with other filaments, such as viscose or acetate rayon to form a textile material. Such textile material is then treated, e. g., by boiling off, to form a final crepe fabric having a uniform, deep pebble effect.

In the past, various methods have been tried to treat nylon yarns so as to obtain products which could be formed into crepe fabrics. These previous methods have included various twisting operations, solvent treatments or the like, but have been generally unsuccessful because the fabrics ultimately produced therefrom when creped were uneven or possessed otherwise undesirable characteristics. It has been surprisingly found that, when the special combination of steps, as outlined above, however, are applied to nylon yarns, invariably these yarns can be woven into the fabrics and will produce satisfactory crepe-like materials.

A more complete understanding of the important details and features of the present invention may be had by reference to the following illustrative examples of actual operations in accordance with the invention.

EXAMPLE I

This example illustrates the production of a nylon crepe fabric consisting of nylon and acetate rayon yarns.

Two ends of 70/3.5/34 semi-dull nylon that is, 70 denier, 34 filament nylon yarn having 3.5 turns therein are plied with Z-twist at 60 turns to the inch and wound onto iron heads. The yarn in this form is placed into steam cabinets and subjected for 1.5 hours to a mixture of air and steam having a wet bulb temperature of 138° F. and a dry bulb temperature of 145° F.

The yarn is wound from the iron heads, after the steaming operation, onto collapsible cylinders over end at 200 yards per minute with an average tension of 25 to 35 grams. The cylinders and the yarn are then subjected to an aqueous atmosphere in an autoclave at a temperature up to 300° F. for 45 minutes, after which they are removed and allowed to drain. Thereafter, the yarn still wound on the collapsible cylinders was placed in a conditioning chamber and subjected for 24 hours to a relative humidity of 60% to 70% and a temperature of about 65° to 75° F.

After the conditioning, the yarn is redrawn, unrolling, from the collapsible cylinder onto two 7/8" head winder spinner bobbins. Thereafter, the yarn is untwisted on a regular uptwister to give a finished twist of three turns per inch in the S-twist direction.

This yarn is then copped unrolling and thereafter woven as the fill in a plain weave fabric using 75/50 bright acetate rayon as the warp. The woven fabric is boiled off, producing a finished textile having a uniform and deep pebble crepe effect.

EXAMPLE II

The process of Example I is repeated, using a single end of 70/34 dull nylon, i. e., 70 denier, 34 filament nylon yarn twisted with a Z-twist of sixty turns per inch. After the setting, treating and conditioning steps, the

treated yarn is untwisted to a final S-twist of five turns per inch.

This yarn is sized with 2% of a synthetic resin base on a conventional single end sizing machine. Thereafter, the sized yarn is woven with a plain weave as the fill with a 75/50 bright acetate rayon yarn warp. The sized yarn is found to weave and handle somewhat better than the unsized yarn of Example I. The woven fabric is boiled off and found to exhibit the same creping and crimping characteristics as the fabric of Example I.

EXAMPLE III

This example illustrates the formation of a series of crepe nylon yarns.

The procedure of Example I is repeated with modifications in the yarn and degree of twist to produce five different yarns of two ends each. The yarn characteristics are as follows:

Yarn Type	Initial Twist	Final Twist
70/.5/34 bright	60-S	5-Z
70/.5/34 bright	60-Z	5-S
40/.5/34 semi-dull	40-Z	5-S
40/.5/34 semi-dull	40-Z	20-Z
40/.5/34 semi-dull	40-Z	10-Z

In each case the resulting nylon crepe yarn is woven into fabrics as in the case of Example I and then boiled off. Each yarn produces a creped fabric having a uniform and deep pebble effect.

EXAMPLE IV

This example illustrates the formation of a series of single end nylon crepe yarns. The procedure of Example I is repeated, except that yarns of a single end are treated with different twists. The particular yarns and twists employed are given in the following table.

Yarn Type	Initial Twist	Final Twist
70/34 Dull	60-Z	5-S
70/34 Dull	60-S	5-Z
70/34 Dull	60-S	25-S
70/34 Dull	60-Z	25-Z
70/34 Dull	60-Z	40-Z
70/34 Dull	60-Z	30-Z
70/34 Dull	60-Z	20-Z
70/34 Dull	60-Z	10-Z
70/34 Dull	60-Z	5-Z

Each of these yarns is woven with a plain weave into a fabric as the fill using a 75/50 bright acetate warp. After boiling off, each of the different fabrics is found to possess an attractive, uniform and deep pebble crepe.

EXAMPLE V

The process of Example I is repeated for preparing the nylon yarn which is thereafter woven as the filling in either a 40 or 70 denier nylon warp. The woven fabric is boiled off and found to exhibit the same creping and crimping characteristics as the fabric of Example I.

EXAMPLE VI

The process of Example I is repeated using a 90 end construction of 40/13 nylon twisted with a Z-twist of 60 turns per inch, with a final S-twist of 7 turns per inch. A single end 70/34 nylon yarn twisted with a Z-twist of 60 turns per inch and a final S twist of 5 turns per inch is similarly treated.

The treated 90 end 40/13 nylon yarn was used for the warp threads while the treated single end 70/34 nylon yarn was used for the filling. The woven fabric is boiled off and found to exhibit creping action both in the warp and filling.

EXAMPLE VII

The process of Example I is repeated using a combination yarn of finished 30/10 nylon twisted with an S-twist of 65 turns per inch and a final Z-twist of 7 turns per inch, in combination with a 75/50 bright acetate twisted with a Z-twist of 28 turns per inch. The treated combination yarn is woven into fabric, boiled off and found to exhibit excellent creping and crimping characteristics.

Detailed description

As will be apparent from the examples given above, various degrees of twist, both initially and after the intermediate steps of the process, may be applied with successful results to the nylon yarns. For most satisfactory results, it is desirable to unwind the yarn after the intermediate treatment at least twenty turns per inch, which, as indicated, may result in the yarn ending up with a twist in the opposite direction from the initial twist. Preferably, at least thirty turns per inch and especially thirty to sixty turns per inch are used in the initial twist.

As illustrated by the examples, the process is applicable to all types of textile nylon yarns either of the single end or multiple end type and of a large variety of sizes and can include any denier of filament nylon or combination of deniers. The examples show the use of 70/34 dull, 40/.5/34 semi-dull, 70/3.5/34 semi-dull and similar representative nylon yarns. The treated nylon can be used in combination with other synthetic fibers. Examples of other nylon yarns which may be so treated include:

Yarn Type	Initial Twist	Final Twist
20/7 Semi-Dull Nylon	75-S	10-Z
20/7 Semi-Dull Nylon	75-Z	10-S
20/7 Semi-Dull Nylon	75-S	40-S
20/7 Semi-Dull Nylon	75-Z	40-Z
30/10 Semi-Dull Nylon	65-S	7-Z
30/10 Semi-Dull Nylon	65-Z	7-S
40/13 Semi-Dull Nylon	60-S	7-Z
40/13 Semi-Dull Nylon	60-Z	7-S
40/13 Semi-Dull Nylon	60-S	35-S
40/13 Semi-Dull Nylon	60-Z	35-Z
210/34 Bright Nylon	50-S	5-Z
210/34 Bright Nylon	50-Z	5-S

Two or more ends of any of the above denier in filament counts may be processed in the same manner.

The setting of the initial twist in the yarns is accomplished by a steaming operation at a temperature of 135° to 155° F. in an atmosphere having a relative humidity of 50 to 100% for a period of at least one-half hour, preferably a temperature of 145° to 150° F., a time of one-half to 8 hours, especially 1 to 2 hours, and a relative humidity of 70 to 90% is used. Satisfactory humidity conditions can be determined by the wet bulb temperature of the treating atmosphere which should be from 130° to 155° F. for dry bulb temperature of 135° to 155° F.

Following the setting operation, the yarn is preferably wound upon cylinders. Collapsible cylinders are best for this purpose, but satisfactory results have also been obtained, using size cylinders or the like.

The next step after setting is to expose the yarn to a high temperature above 190° F. and preferably a temperature in the neighborhood of 300° F. for at least 15 minutes. This step may be carried out under dry or wet bulb temperature conditions in either a steam chest or autoclave. Best results are obtained when a temperature above 195° is used for a period of 15 minutes to 3 hours and, 30 to 60 minutes, is the preferred range.

After this treatment, the yarn is conditioned by subjecting it for about 8 to 72 hours to air having a relative humidity of 50 to 80% at a temperature of 60° to 80° F. This is preferably accomplished after the treated yarn is redrawn from the cylinders onto the spinner bobbins and best results come from treatment for 18 to 30 hours at a temperature of 65° to 75° F. and a relative humidity of 60 to 70%.

After this conditioning operation, the yarn is subjected to the untwisting so as to unwind at least twenty turns per inch. This can be accomplished on any suitable appa-

ratus, such as a regular up-twister, using any satisfactory container or holding means for the yarn.

It is possible to use the final untwisted yarn unsized, but easier weaving and handling, without any detriment to the creping and crimping power of the yarn is obtained if the yarn is sized prior to weaving. This can be accomplished using any of the known sizing machines and sizing compositions. Examples of usable sizing materials include polyvinyl alcohol (Elvanol), polymethylcrylic acid (Tyze), polyacrylic acid (orthocryl or acrysol) and PM–90.

The examples illustrate the weaving of fabrics using these new crepe yarns as filling with acetate rayon warp. While these new yarns are generally used as the filling, they may also be satisfactorily employed as the warp and may be used alone or in combination with other natural or synthetic filaments, such as viscose rayon, cotton, linen, vinylchloride filaments, Orlon, silk, or the like.

The creping power of these new yarns is so satisfactory that they may be woven into a large variety of different types of weaves and give desirable creped fabrics. A plain weave may be employed or the known crepe weaves may also be used as well as other types of patterns which will be apparent to those skilled in this art. Examples of especially useful patterns are: plain weaves, granite weaves, satins or combinations of any of the above weaves, loose type tricot stitches, such as plain regular jersey stitch, semi-stabilize stitch, stabilize stitch, or swami.

After the weaving of the yarn into a suitable fabric is accomplished, the transformation of the material into a crepe fabric may be accomplished in several different ways. The preferred procedure is to immerse the fabric in a bath of hot water or soap solution for about 5 to 30 minutes which is usually sufficient to effect the transformation.

After the crepe fabric is formed in accordance with this invention, it may be stabilized by frame setting with heat, or when all nylon fabrics are used, it is set on a conventional hot roll type machine, with temperatures up to 425° F. The fabric can be dyed or otherwise treated or handled in the same manner as other crepe fabrics and the crepe effect which the fabrics possess is substantially permanent under normal conditions of use.

Conclusions

This invention provides a series of steps for the treatment of nylon yarns and similar filamentary products so as to produce yarns which may be woven by themselves or in combination with other natural or synthetic yarns or filaments into fabrics which can subsequently be treated to form creped textiles having a uniform and deep pebble effect. Although testing and other treating procedures have been applied to nylon yarns heretofore, in an attempt to produce crepe yarns, it appears that the particular combination of steps, as described herein, have provided for the first time a method for making nylon yarns which may be successfully formed into crepe fabrics.

I claim:

1. A method of making a crepe yarn, at least partially of nylon, which comprises twisting a yarn, setting the twist therein by heating the twisted yarn for at least one-half hour to a temperature between about 135° and 155° F. in an atmosphere of relative humidity of at least 50%, then treating the yarn by heating it for at least 15 minutes to a temperature of between 190° to 300° F., conditioning the yarn for at least 8 hours at a temperature of 60° to 80° F. in a medium of 50% to 80% relative humidity, and then untwisting the yarn.

2. A method of making nylon yarns for use in the formation of creped fabrics which comprises twisting together a plurality of ends of nylon with at least 30 turns per inch, setting the twist therein by heating the twisted yarn for ½ to 8 hours in air having a dry bulb temperature of 135° to 155° F. and a wet bulb temperature of 130° to 155° F., then treating the yarn by heating it in an aqueous medium for 15 minutes to 3 hours at a temperature between 190° and 300° F., conditioning the yarn for 8 to 72 hours in air having a relative humidity of 50% to 80% and a temperature of 60° to 80° F., and then untwisting the yarn at least 20 turns per inch.

3. A method of making nylon yarn for use in the formation of creped fabrics which comprises twisting together a plurality of ends of nylon with between 40 and 60 turns per inch, setting the twist therein by heating the twisted yarn for 1 to 2 hours in air having a dry bulb temperature of 135° to 155° F. and a wet bulb temperature of 130° to 155° F., then treating the yarn with a steam aqueous medium for 30 to 60 minutes at a temperature of 195° to 300° F., conditioning the yarn in air having a relative humidity of 50% to 70% and a temperature of 65° to 75° F. for 18 to 30 hours, and then untwisting the yarn at least 20 turns per inch.

4. A method of making nylon yarn for use in the formation of creped fabrics which comprises twisting together a plurality of plied ends of nylon with between 40 and 60 Z turns per inch, setting the twist therein by heating the twisted yarn for 1 to 2 hours in air having a dry bulb temperature of 135° to 155° F. and a wet bulb temperature of 130° to 155° F., winding up the set yarn and placing the wound yarn in an aqueous medium having a temperature of 190° to 212° F. for 30 to 60 minutes, withdrawing the yarn from said medium and placing it in air having relative humidity of 50% to 70% and a temperature of 65° to 75° F., keeping the same in said air for 18 to 30 hours, and untwisting the yarn to leave a finished twist of between 20 Z turns per inch and 5 S turns per inch.

5. A method of making a textile material capable of being transformed into a creped fabric which comprises weaving a yarn as produced by the process of claim 1 into a fabric.

6. A method of making a creped fabric which comprises twisting a nylon yarn, setting the twist therein, then heating the twisted, set yarn at least 15 minutes to a temperature of from 190° to 300° F., thereafter conditioning the yarn for at least eight hours at a temperature of 60 to 80° F. in a medium of 50% to 80% relative humidity, untwisting the yarn, weaving the yarn into a fabric, and then boiling off the fabric forming a uniform and pebble crepe therein.

7. A method of making a crepe fabric which comprises twisting a nylon yarn, setting the twist therein by heating the twisted yarn for at least ½ hour to a temperature between 135° and 155° F., in air having a relative humidity of at least 50%, treating the yarn by heating it for at least 15 minutes to a temperature of between 190° and 212° F. in an aqueous medium, conditioning the yarn for at least 8 hours at a temperature of 60° to 80° F. in air having a relative humidity of 50% to 80%, untwisting the yarn, weaving the yarn into a fabric, and then immersing the fabric in boiling water, forming a uniform and pebble crepe therein.

8. A method of making a crepe fabric which comprises twisting together a plurality of nylon yarns with between 40 and 60 turns per inch, setting the twist therein by heating the twisted yarn for ½ hour to 8 hours in air having a relative humidity of 50% to 100% and a temperature of 135° to 155° F., then treating the yarn by heating it in an aqueous medium having a temperature of 195° to 300° F. for 15 minutes to 3 hours, conditioning the yarn by subjecting it to air having a relative humidity of 50% to 80% and a temperature of 60° to 80° F. for 8 to 72 hours, untwisting the yarn at least 20 turns per inch, weaving the yarn into fabric and then immersing the woven fabric in boiling water to form a uniform and pebble crepe therein.

9. A method of making crepe fabric which comprises twisting together a plurality of plied ends of nylon with

between 40 and 60 turns per inch, setting the twist in said yarn by heating it for 1 to 2 hours in air having a dry bulb temperature of 135° to 155° F., and a wet bulb temperature of 130° to 155° F., winding up the set yarn and immersing the wound yarn in water having a temperature of 195° to 212° F. for 30 to 60 minutes, withdrawing the yarn from the water and placing it in air having a relative humidity of 50% to 70% and a temperature of 65° to 75° F., keeping the yarn in said air for 18 to 30 hours, untwisting the yarn at least 20 turns per inch, weaving the nylon yarn into fabric and then creping the fabric by immersing it in boiling water forming a uniform and pebble crepe therein.

10. A method of making crepe yarns which comprises twisting a nylon yarn combined with an acetate yarn, setting the twist therein by heating the twisted yarn for at least one-half hour to a temperature between 135° to 155° F., in an atmosphere of relative humidity of at least 50%, then treating the yarn by heating it for at least 15 minutes to a temperature of between 190° to 300° F., conditioning the yarn for at least 8 hours at a temperature of 60° F. to 80° F. in a medium of 50% to 80% relative humidity, and then untwisting the yarn.

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