Nov. 21, 1961 J. O. MURCHIE ET AL 3,009,233

METHOD OF PRODUCING ARTICLES

Original Filed Feb. 3, 1958

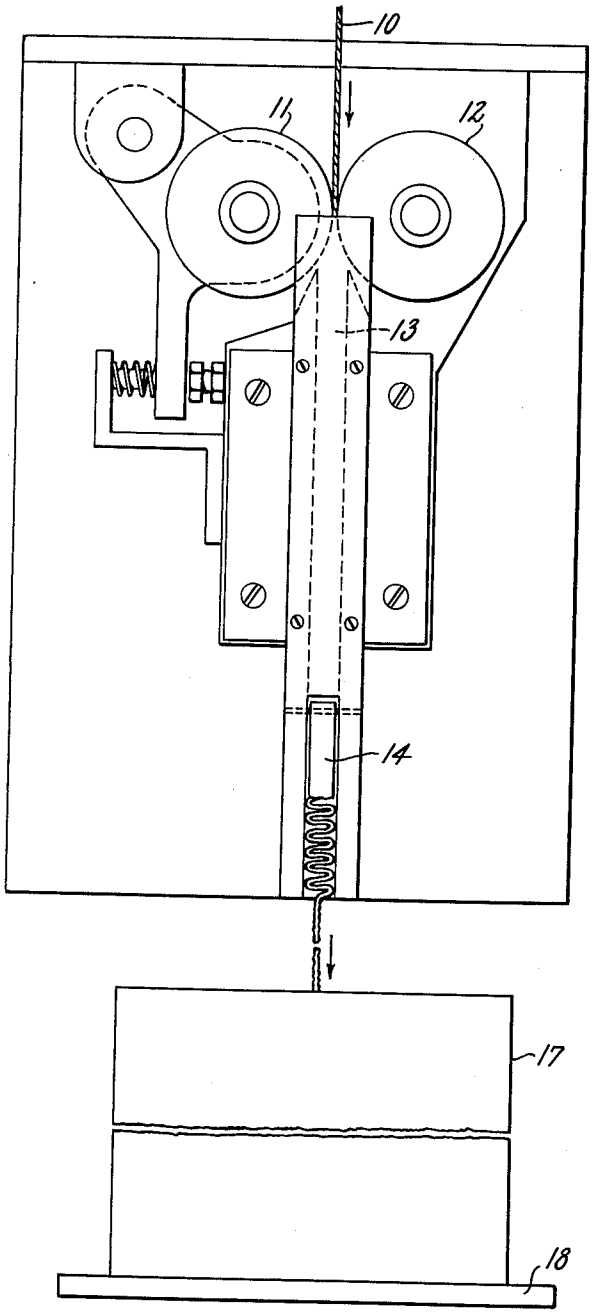


Fig. 1

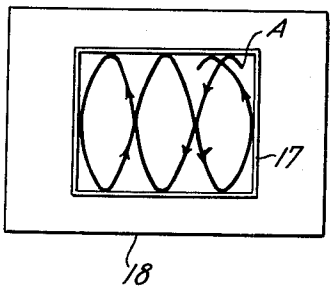


Fig. 2

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United States Patent Office 3,009,233 Patented Nov. 21, 1961

3,009,233

METHOD OF PRODUCING ARTICLES

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Original application Feb. 3, 1958, Ser. No. 712,912. Divided and this application Aug. 27, 1959, Ser. No. 836,467

3 Claims. (Cl. 28—72)

This invention relates to a method of producing a novel textured yarn.

Thermoplastic synthetic textile yarns, such as those made from polyamide, acrylic, polyesters, cellulose esters, etc. fibers are not as bulky nor as curly as is desired in such trades as the tufting and knitting industries. Efforts have been made to increase the bulk, and to improve other properties, of these yarns by crimping them.

In accordance with the present invention a spun yarn is provided in which a substantial portion of the fibers forming the yarn are crimped synthetic thermoplastic fibers of staple length. The term "staple" when applied to fibers means fibers from about 1½" to 8" long as used herein, and should be so understood throughout this specification and the appended claims. A "crimped fiber" as used herein means a fiber having a wavy appearance with from about 5 to 20 bends per inch, typically about 10 bends per inch, and this term should be so understood throughout this specification and the appended claims. Such crimped fibers are known; for example, they may be produced by crimping tow by the methods of Patent 2,311,174 or 2,747,233.

The spun yarn thus provided first is compressed longitudinally, and this causes the yarn to "bloom," i.e. causes the fibers in the yarn to spread apart diametrically. At the time the yarn blooms, the yarn is also packed into and passed through a restricted passage where the yarn is bent back and forth upon itself as it is packed into the restricted passage. The longitudinal compression of the yarn and the bending of the yarn in packing it into the restricted passage produces crimps in the yarn characterized by severe bends and curls closely and regularly spaced with from approximately 0.8 to 5.0 of these bends per inch on the average.

Where the terms "bloom" or "blossomed" are used hereinafter in this specification and the appended claims to describe a yarn, they mean a yarn in which the fibers have been spread apart by longitudinally compressing the same. Where the term "small yarn crimp" is used hereinafter in this specification and the appended claims to describe a yarn it means a yarn characterized by severe bends and curls, closely and regularly spaced and having an average of from about .8 to 5 bends per inch which are in addition to, any bends or crimp in the individual fibers.

This yarn is then deformed further by releasing it from the restricted passage and then feeding it freely toward a fixed point in space at a greater rate of speed then it is removed from that point to pile the yarn loosely on itself. This superimposes a large yarn crimp, i.e. one characterized by bends and curls, less severe than those induced in the small yarn crimp, and these bends and curls are more widely and less regularly spaced with an average of from approximately 0.05 to 2.0 bends per inch, on the crimps already induced in the yarn. When the term "large yarn crimp" is used in this specification and the appended claims it means relatively mild bends and curls which are somewhat irregular and average from approximately 0.05 to 2.0 bends per inch.

After the yarn has been given this final crimp, it is heat set, e.g., subjected to elevated temperatures below the melting point of the thermoplastic fiber and in the range of

150° F. to 300° F. for a period of from 1 minute to 4 hours.

The yarn is maintained substantially free of longitudinal tension from the time it is blossomed until after it has been heat set.

The yarn produced by this invention has many desirable characteristics not possesed by crimped yarns produced heretofore. For example, the yarn works easier on the tufting machines; it is more resilient and therefore gives better service in rugs and similar applications, and it gives up to 20 to 25% better coverage in the finished fabric, i.e., the finished fabric is covered as well using a yarn made in accordance with this invention as a fabric produced with 20 to 25% more pile but using the yarns produced heretofore.

For a better understanding of the nature of this invention, reference should be had to the following detailed description thereof when read in conjunction with the accompanying drawings wherein:

FIG. 1 is a front elevation of apparatus, with parts broken away, suitable for crimping spun yarn in accordance with this invention; and

FIG. 2 is a schematic view illustrating one plan of removing the yarn from a point fixed in space.

Referring now to the drawings, there is shown at **10** a spun yarn including thermoplastic crimped staple fibers. Yarn **10** is led between two driven metal rolls, **11** **12** having smooth surfaces. The nip of rolls **11**, **12** open downwardly into an elongated crimping chamber **13** closed at its lower end by pivoted clapper plate **14**. Plate **14** is urged by a spring (not shown) to close the lower end of chamber **13**. In principle this apparatus is the crimper shown in United States Patent 2,311,174.

Yarn **10** is compressed longitudinally by the action of driven rolls **11**, **12** and is packed in chamber **13** to induce a small yarn crimp therein within chamber **13**.

As the crimped yarn **10** is forced from chamber **13**, it falls freely into can **17** supported on a movable platform **18**. Platform **18** is moved under chamber **13** as yarn **10** is delivered therefrom; for example it may be moved in a manner such that a point A, fixed in space directly beneath chamber **13** traces over the bottom of can **17** the sinuous path shown in FIG. 2 of the drawing. The speed of movement of platform **18** is regulated so the rate of travel of point A relative to container **17** is less than the rate of delivery of yarn **10** from chamber **13**.

The following specific examples will further illustrate this invention.

Example 1

Two singles yarns, each spun with 4.6 t.p.i. **Z** and a twist multiple of 3.25 from crimped staple 15 denier nylon fibers 3 inches long and having 10 crimps per inch, were plied together with 7 turns per inch **S** and a twist multiple of 7 to produce a 2/2 cotton count yarn. This yarn was fed through two metal rolls 2" in diameter rotating at 1,721 r.p.m., and spaced in their distance of minimum spacing 1/64 inch, to a crimping chamber 9 3/16 inches long having a cross section .313 inch by .327 inch at its top and .375 inch by .360 inch at its bottom and having a hinged plate closing the bottom of the chamber.

As the yarn leaves the crimping chamber, it has an average of 3 small yarn crimps per inch. The yarn falls into a can at such a rate that 150 inches of yarn lie along a path traced by the point A which is 10 inches long. The path of point A is sinuous, and consequently bends are induced in the yarn along this path. Furthermore, since a greater length of yarn is fed into the can than the length of the path, the yarn follows this path but with numerous random bends therein which average 0.2 large yarn crimps per inch.

When the can becomes full it is then transferred to a chamber in which wet steam at 250° F. is admitted. The can remains in the chamber subject to the steam for 12 minutes.

Example 2

A blend of 35% high shrink 3 denier Orlon fibers, i.e. a stretched and non-relaxed fiber made from an acrylic polymer, having 10 crimps per inch, and 65% of regular 2 denier Orlon fibers having 10 crimps per inch is prepared in which both fibers are 2½ inch staple. This blend is spun into a 16 cotton count yarn with 9.6 t.p.i. Z and a twist multiple of 2.4. Two ends of this yarn are plied together with 4.8 t.p.i. S and a twist multiple of 1.7 to produce a 16/2 yarn.

The yarn so produced is fed through a crimping chamber and into a can under the same conditions as described for Example 1 except that the crimping chamber used did not have a hinged plate closing the chamber at its bottom.

The full can was placed in an autoclave as in Example 1 and heated for 20 minutes. The finished yarn had an average of 4.5 small yarn crimps per inch and 1.0 large yarn crimps per inch.

Several singles yarns may be plied together and crimped to form a textured yarn of this invention. The following is an example of such a yarn.

Example 3

A blend of 30% 15 denier acetate and 70% 15 denier viscose is prepared in which both fibers are three inch staple having 10 crimps per inch. This blend is spun into a yarn with 5.5 t.p.i. Z and a twist multiple of 3.50. Three ends of this yarn are plied with 7.5 t.p.i. S and a twist multiple of 8.2, to produce a 2.5/3 cotton count yarn. This yarn was crimped as in Example 1. From the crimper the yarn was guided through a funnel to fall freely from side to side of an advancing belt at a rate such that 150 inches of yarn lay along a 10 inch zig-zag path on the belt.

The belt carried the yarn through an oven heated to 300° F. at a rate such that the yarn was exposed to the heat for 2 minutes. The finished yarn had an average of 3 small yarn crimps per inch and 0.2 large yarn crimps per inch.

Especially attractive textured effects are achieved if a plied yarn in accordance with this invention having the singles and ply twist in the same direction is used. The yarn has a more curly texture and produces superior cover in use than a plied yarn where the singles and ply twist are in the opposite direction. When the singles and ply twist are in the same direction, we can use fewer turns of ply twist to get a desirable finished yarn; consequently it is cheaper to twist. The following is an example of such yarn.

Example 4

A blend of bright and dull luster fibers of 17 denier acetate having a staple length of 5 to 7 inches and about 8 crimps per inch is prepared. This blend is spun into a 1.7 cotton count yarn with 4.9 t.p.i. Z and a twist multiple of 3.8. Two ends of this yarn are plied with 2.5 t.p.i. Z and a twist multiple of 2.75 to produce a .83 cotton count yarn. This yarn was crimped as in Example 1. As the yarn leaves the crimping chamber, it has an average of 5 small yarn crimps per inch. The yarn falls into a can at such a rate that 100 inches of yarn lie along a path traced by the point A, which is 10 inches long, so that numerous random bends are induced in the yarn which average 1.0 large yarn crimps per inch. When the can becomes full, it is transferred to a chamber in which saturated steam at 220° F. is admitted. The can is exposed to this steam for 5 minutes.

A single textured yarn can be produced having some of the characteristics of this invention, although thus far we find the plied yarn to be superior. The following is an example of such a yarn.

Example 5

An 0.81 cotton count single yarn was spun with 3.25 t.p.i. Z and a twist multiple of 3.6 from crimped 8 denier bright acetate having a staple length of 5 to 7 inches and about 12 crimps per inch. The yarn was crimped as in Example 1. As the yarn leaves the crimping chamber it has an average of 4.5 small yarn crimps per inch. The yarn falls into a can at such a rate that 100 inches of yarn lie along a path 10 inches long. The yarn has an average of 1.5 large yarn crimps per inch. When the can becomes full, the yarn is heat-set as in Example 4.

This application is a division of our-copending application, Serial No. 712,912, filed February 3, 1958.

Having thus described our invention, what we claim and desire to protect by Letters Patent is:

1. A method of producing a textile yarn which comprises providing a spun yarn including thermoplastic crimped staple fibers, compressing said yarn longitudinally and packing it into a restricted passage, providing a surface, feeding said yarn longitudinally against said surface at a rate relative to a point fixed in space greater than the rate of any relative motion between said surface and said point but less than the rate of feed of said yarn along its own length, subjecting said yarn to an elevated temperature to heat-set the same, and maintaining said yarn free of tension from the time it is longitudinally compressed until it is heat-set.

2. A method of producing a textile yarn which comprises providing a plied yarn formed of two single spun yarns, each of said single yarns including thermoplastic crimped staple fibers, compressing said plied yarn longitudinally to induce a small yarn crimp in said yarn, inducing a large yarn crimp in said yarn, subjecting said yarn to an elevated temperature to heat-set the same, and maintaining said plied yarn free of tension from the time it is longitudinally compressed until it is heat-set.

3. A method of producing a textile yarn which comprises providing a spun yarn including thermoplastic crimped staple fibers, compressing said yarn longitudinally and packing it into a restricted passage, feeding said yarn longitudinally onto a moving supporting surface which moves at a rate relative to a point fixed in space less than said yarn moves relative to said point, subjecting said yarn to an elevated temperature to heat-set the same while supported on said surface, and maintaining said yarn free of tension from the time it is longitudinally compressed until it is heat-set.

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