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METHOD AND APPARATUS FOR FIBRILLATING SYNTHETIC THERMOPLASTIC YARN

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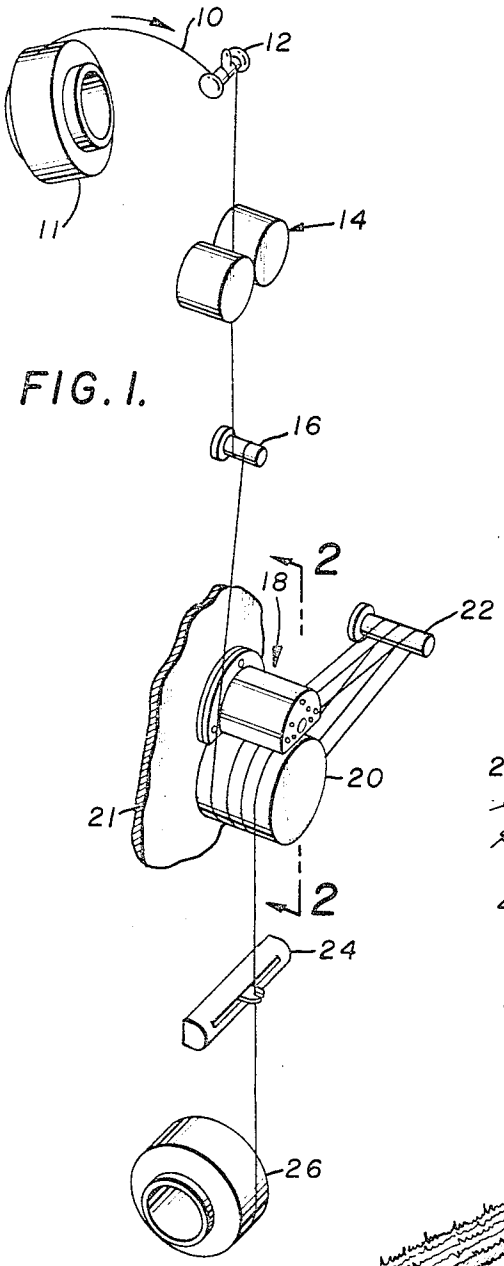


FIG. 1.

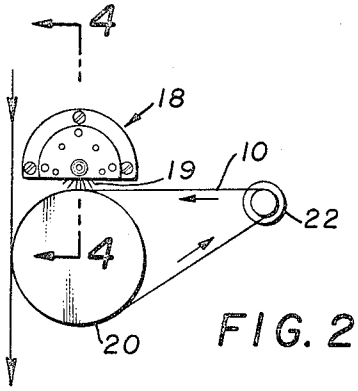


FIG. 2.

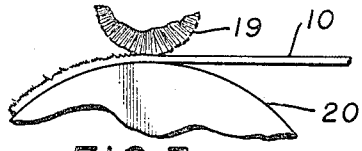


FIG. 3.

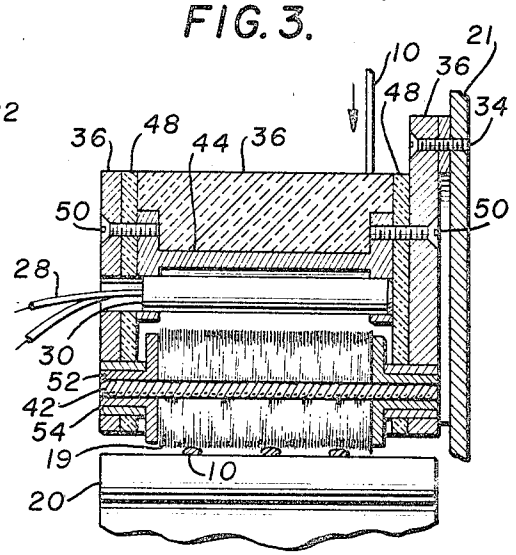


FIG. 4.

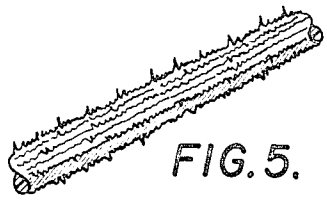


FIG. 5.

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METHOD AND APPARATUS FOR FIBRILLATING SYNTHETIC THERMOPLASTIC YARN

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ABSTRACT OF THE DISCLOSURE

A method of texturing synthetic thermoplastic yarn by passing it under tension into and out of contact with the bristles of a molten-thermoplastic-wettable, heated, rotatable brush. The surface of the yarn melts and adheres to the bristles when in contact therewith. When the yarn pulls out of contact with the bristles, small fibrils are formed on the yarn surface which, upon cooling, solidify to form permanent fibrils.

This invention pertains to fibrillating the surface of synthetic thermoplastic yarn by a new process employing a novel heated brush as an integral part of the process.

Among the yarns upon which the inventive process can be practiced, those yarns made of the synthetic thermoplastics nylon and polyester are particularly well-adapted for such processing.

Nylon is a long-chain synthetic polymeric amide having recurring amide groups as an integral part of the main polymer chain, which is capable of being formed into a filament in which the structural elements are oriented in the direction of the axis. Specific types of nylon include nylon - 66 (polyhexamethylene adipamide), nylon - 6 (polymeric 6 - aminocaproic acid), nylon - 610 (polyhexamethylene sebacamide), nylon - 4, nylon - 7, nylon-11, etc., and fiber forming copolymers thereof.

Polyester is a long-chain synthetic thermoplastic polymer of at least 85 percent by weight of an ester of a dihydric alcohol and terephthalic acid.

Yarns made from synthetic thermoplastics, such as nylon and polyester, have found wide commercial acceptance. These yarns are durable and strong. Yet, they also have properties that are not quite as desirable, such as rather high sheen, poor cover and poor hand.

An object of this invention is to provide a process for decreasing the luster and improving the hand and cover of synthetic thermoplastic yarn.

Another object of the invention is the provision of new and improved apparatus for improving the hand, cover, and reducing the luster of synthetic thermoplastic yarn.

Other objects will become apparent from the following descriptive material.

Briefly stated, these objects are achieved in the provision of a process for producing fibrils on the surface of synthetic thermoplastic yarn. A yarn source is provided. Yarn from the yarn source is passed, while under tension into and out of contact with the bristles of a molten-polymeric-wettable, heated, rotatable brush. The bristles are heated to a temperature at least as high as the melting point of the yarn. At the point of bristle-yarn contact, the yarn is melted. Molten yarn temporarily adheres to the bristles. As the bristles and yarn pull away from each other, small fibrils of molten yarn are formed on the yarn surface. These fibrils are then cooled thus causing them to solidify thereby forming small permanent fibrils on the yarn surface. The yarn is then collected in an orderly manner.

Apparatus useful in practicing the inventive process comprises a rotatably mounted brush whose bristles are wettable by molten synthetic thermoplastics. Means are

provided for heating the brush to a temperature above the melting point of the yarn. Means are provided for forwarding the yarn past and in contact with the bristles of the brush. Support means are provided for rotatably mounting said brush.

In the drawing:

FIGURE 1 schematically shows an embodiment of the inventive process;

FIGURE 2 is an elevational view in accordance with view line 2—2 of yarn being fibrillated by the process of the invention;

FIGURE 3 is an enlarged elevational view showing the crux of the invention, that is, the actual forming of filaments on the yarn surface at the point of yarn and brush contact;

FIGURE 4 is a sectional view of heated brush assembly 18 taken along section line 4—4 in FIG. 2; and

FIGURE 5 is a perspective view of yarn fibrillated in accordance with the invention.

To aid in clearly understanding the invention reference should be made to the drawing. In FIG. 1 yarn 10 is withdrawn from spin cake 11 and passed about snubber guide 12. Yarn 10 is then advanced at a predetermined peripheral rate of speed by nip rolls 14. Yarn 10 is stretched between nip rolls 14 and draw roll 20 rotating at a peripheral rate of speed greater than that of the nip rolls. The stretching is localized by draw pin 16 about which the yarn is wrapped. To keep apart the yarn wraps about draw roll 20, yarn 10 is passed around separator roll 22. As the yarn moves over the surface of draw roll 20 it comes into contact with the bristles of a heated brush contained in heated brush assembly 18. Both heated brush assembly 18 and draw roll 20 are mounted on support 21. The heated brush (reference numeral 19 in FIG. 2) is rotated by its contact with draw roll 20. From draw roll 20 yarn 10 is passed on to bobbin 26. The yarn is evenly distributed on the bobbin by yarn traverse 24.

FIG. 2, viewed in accordance with view line 2—2, is an elevational view of the crux of the invention. As yarn 10 passes about draw roll 20 the heated bristles of brush 19 are pressed into contact therewith. As can more clearly be seen in FIG. 3 when the bristles of brush 19 come into and then break contact with yarn 10 fibrils are formed on the surface thereof. The bristles are heated to a temperature higher than the melt temperature of the yarn. Therefore, at the points of bristle-yarn contact the yarn will be melted. The molten yarn will temporarily adhere to the bristles. As the yarn and bristles pull away from each other the molten yarn will continue to adhere to the bristles until they have parted to a point where the adhering molten yarn pulls completely away. In this process tiny fibrils are raised on the yarn surface. Upon cooling, which is accomplished by ambient air, to below melting temperature the fibrils solidify, thereby producing permanent fibrils.

To produce fibrillation at several points on the yarn circumference, if monofilament, or circumferences, if multifilament, removed from one another the yarn must be rotated about its axis. The separator roll shown in FIGS. 1 and 2 accomplishes this result. As the yarn is passed each time about the draw roll and separator roll, the separator roll rotates the yarn about its own axis. Therefore, the point of yarn-bristle contact will be different for each pass up to a limit of about four. That is, once the yarn makes about four wraps the yarn will have approximately completely rotated and the first circumferential point of brush-yarn contact will be again fibrillated. Three passes generally fibrillate the yarn quite well. To express it another way, with each wrap about the draw and separator rolls the points of bristle-yarn contact will be displaced from each other about the yarn circumference.

It is, of course, quite apparent that if the temperature-yarn speed relationship is not properly adjusted the heated bristles will tend to break the yarn. As a lower limit, no matter what the yarn speed, bristle temperature must be greater than the melt temperature of the particular thermoplastic yarn being fibrillated. When bristle temperature is increased the yarn speed must be proportionally increased. Conversely, when the temperature drops, but not below yarn melting temperature, the yarn speed can be reduced.

In FIG. 4 heated brush assembly **18** is attached to support **21** by mounting screw **34**. Heated bristles **19** are bound in place by brush shaft **42** mounted in brush flange **52**. Brush flange **52** rotates on bearings **54** mounted in bearing retainer **48**. The brush is heated by electrical heater **30** (one of a plurality, usually four) to which current is fed by electrical leads **28**. The heater is mounted in heater retainer **44** fixed by retainer screws **50**. The heater and brush are insulated from the ambient atmosphere by insulation **36**.

A perspective view of monofilament yarn processed in accordance with the invention is shown in FIG. 5. The fibrils in actual yarn are extremely short in proportion to the diameter of the yarn trunk. Even so, considerable improvement in hand and cover and considerable decrease in luster are obtained by raising these small fibrils.

It is easy to see that advantages are realized by practicing the instant process employing the novel apparatus described herein. It is possible to economically decrease the luster of synthetic yarn while improving hand and increasing cover.

The invention has been described by reference to specific illustrations and embodiments. Nevertheless, it should be understood that it is to be limited only by the scope of the appended claims.

What is claimed is:

1. A method for producing fibrils on the surface of synthetic thermoplastic yarn comprising:

(a) providing a yarn source;

(b) passing said yarn while under tension into and out of contact with the bristles of a molten thermoplastic-wettable heated rotatable brush, said bristles being heated to a temperature at least as high as the melting point of said yarn thus melting said yarn at the points of bristle-yarn contact thereby causing said yarn to temporarily adhere to said bristles thus producing molten fibrils on said yarn;

(c) cooling said molten fibrils to below their melting point thereby bringing about their solidification; and

(d) collecting said yarn in an orderly manner.

2. The method of claim **1** wherein the synthetic thermoplastic yarn is nylon-66.

3. A method for producing fibrils on the surface of synthetic thermoplastic yarn comprising:

(a) providing a yarn source;

(b) passing said yarn while under tension into and out of contact with the bristles of a molten thermoplastic wettable heated rotatable brush, said bristles being heated to a temperature at least as high as the melting point of said yarn thus melting said yarn at the points of bristle-yarn contact thereby causing said yarn to temporarily adhere to said bristles thus producing molten fibrils on said yarn;

(c) cooling said molten fibrils to below their melting point thereby bringing about their solidification;

(d) rotating said yarn about its own axis;

(e) repeating the procedure of step (b);

(f) repeating the procedure of step (c); and

(g) collecting said yarn in an orderly manner.

4. The method of claim **3** wherein bristle-yarn contact is repeated at least three times and wherein the points of bristle-yarn contact will be displaced from each other about the yarn circumference.

5. The method of claim **3** wherein the synthetic thermoplastic yarn is nylon-66.

6. Apparatus for producing fibrils on the surface of yarn formed from a synthetic thermoplastic, comprising, in combination;

(a) a rotatably mounted brush wettable by said synthetic thermoplastic in the molten state;

(b) means for heating said brush to a temperature above the melting point of said synthetic thermoplastic;

(c) means for forwarding said yarn past and in contact with the bristles of said brush; and

(d) support means for rotatably mounting said brush and for mounting said heating means.

7. The apparatus of claim **6** wherein the heating means and rotatable brush are partially insulated from the ambient atmosphere.

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