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METHOD AND APPARATUS FOR TREATING AND
DRAWING SYNTHETIC FILAMENT YARNS
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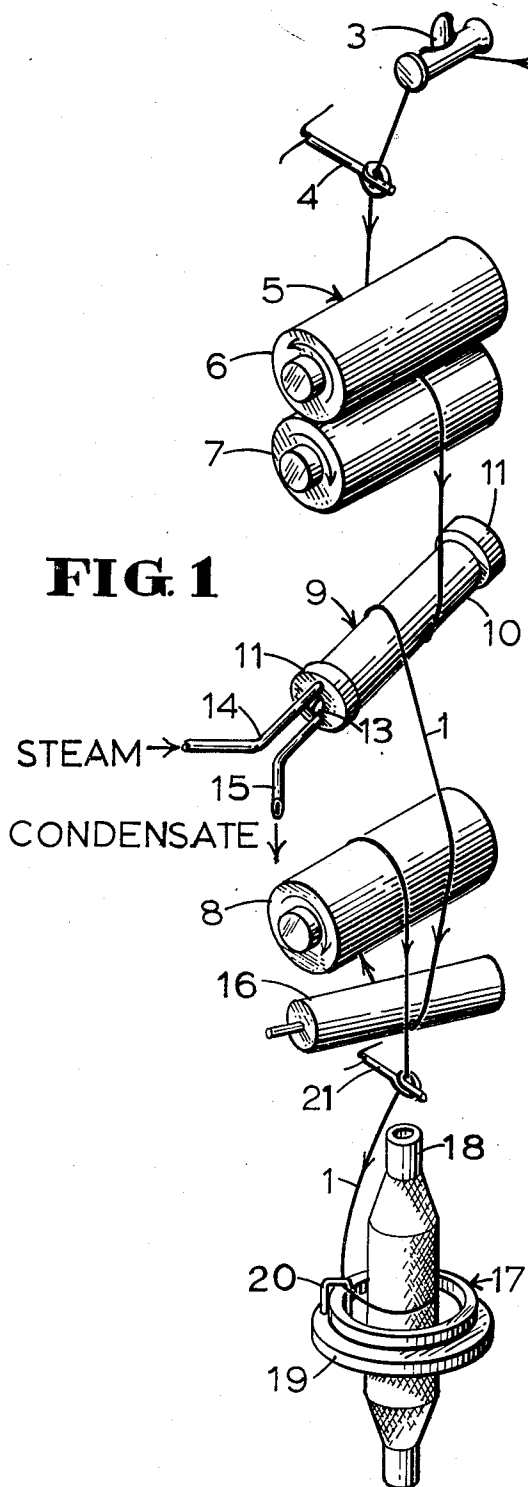


FIG. 1

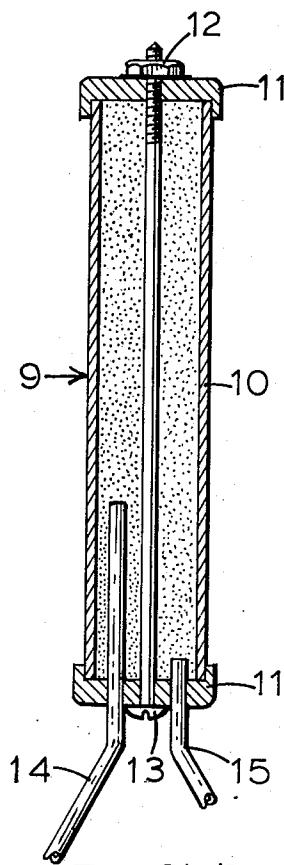


FIG. 2

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METHOD AND APPARATUS FOR TREATING AND DRAWING SYNTHETIC FILAMENT YARNS

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5 Claims. (Cl. 57—55.5)

This invention relates to a method and apparatus for treating and drawing synthetic filament yarns formed from a thermoplastic polymer such as nylon. More particularly, this invention relates to a novel method and apparatus of the above type utilizing porous means to steam treat and to localize the stretch point of yarn, concurrently, for improving drawing performance and reducing the incident of yarn breakage during the drawing process.

Newly formed nylon yarn produced by melt spinning is known to have relatively low strength. To increase its tensile strength undrawn yarn is stretched or drawn whereby molecules forming the yarn are aligned or oriented in the general direction of the yarn axis. In usual practice, a feed roll and a draw roll, driven at different peripheral speeds relative to each other and geared to a predetermined draw ratio, are employed to draw yarn. Usually, a brake device is positioned between the feed and draw rolls to localize the stretching point of the yarn.

Yarn drawn in the usual manner is subjected to high stresses and frequently the drawing load applied exceeds the breaking load of the yarn, in which case, the yarn is broken, generally, in the vicinity of the brake device. Yarn breakage interrupts the drawing process and causes costly delay in operation.

To overcome the problem of yarn breakage within a draw zone, vapor in the form of steam applied to the yarn at the localized stretch point will produce beneficial changes therein, improving its drawing performance such that the frequency of yarn breakage is reduced.

It is an object of this invention to provide novel apparatus for drawing and steam treating synthetic textile yarns formed of a thermoplastic polymer such as nylon, whereby the draw performance of the yarn is improved. It is another object to provide apparatus of the type utilizing unitary brake means, formed of a porous material resistant to abrasion, to establish a steam zone thereabout and to fix the stretch point of yarn within a draw zone. Another object is to provide novel apparatus for treating and drawing yarn including porous brake means adapted to receive steam interiorly thereof and to discharge condensate therefrom. Another object is to provide a novel method of treating textile yarns with a fluid medium at the localized stretch point thereof to incorporate beneficial changes in the properties of the yarn for improving the latter's drawn performance. Another object is to provide a method of treating nylon yarn with steam to render the yarn more resistant to breaking by passing the yarn through a steam zone at the point of localized stretching thereof. A still further object is to provide a novel method and apparatus for simultaneously steam treating and drawing synthetic textile yarns formed from a thermoplastic polymer such as nylon by simple and inexpensive means to minimize yarn breakage.

According to the invention, a novel method and apparatus for treating and drawing yarn that accomplishes the above objects are provided. In general, the apparatus embodying the invention comprises two spaced rolls, each positively driven at different peripheral speeds relative to each other, and brake means interposed in the path of a yarn laced between the rolls, said brake means being formed of a porous material resistant to abrasion having an inlet and an outlet therein for conducting steam from

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a suitable source thereto and removing condensate therefrom, respectively. Preferably, the slower positively driven roll cooperates with a corresponding rotatable roller arranged in parallel and contacting relation therewith to provide a feed roll assembly for imparting an initial predetermined rate of travel to a yarn passed between the rolls of the assembly, and preferably, a spacer roll is positioned near the faster positively driven roll to prevent yarn wrapped around the spacer roll and the faster driven roll from becoming superimposed. It will be noted that, when the inlet of said brake means is pressurized with steam, said brake means will provide a steam zone or area thereabout since steam will pass through the pores of the wall of the brake means and escape into the surrounding atmosphere. In general, the novel method for drawing and treating nylon yarn comprises delivering yarn at one rate of speed to a draw zone, simultaneously localizing the stretch point of the yarn and passing the yarn through a steam area within the draw zone, withdrawing the yarn at a second higher rate of speed from the draw zone, and taking up the yarn in an orderly manner whereby the drawing performance of the yarn is improved and the incident of yarn breakage is reduced.

Other objects and advantages of the present invention will become apparent from a study of the following specification, claims, and drawing wherein:

FIGURE 1 is a schematic view showing, in perspective, the novel apparatus comprising the invention in operative arrangement; and

FIGURE 2 is a longitudinal sectional view of the draw pin 9, shown in FIGURE 1, drawn to a larger scale.

In the several figures in the drawing like parts are designated by the same reference numerals for reasons of simplicity and convenience.

Referring to the drawing, the novel apparatus for treating and drawing yarn embodying the invention is shown in FIGURE 1 with the respective components thereof arranged in the positions in which they would ordinarily be suitably mounted on a framework, omitted for purposes of simplicity. An undrawn filament yarn 1, of polymeric composition such as nylon and supplied from a supply package or bobbin 2, is shown laced within the novel apparatus according to the method of the invention to be explained hereinafter.

A snubbing bar 3 of conventional type may be suitably mounted near bobbin 2 to assist in maintaining an orderly and uniform supply of yarn. A pigtail guide 4 is positioned below bar 3 and serves to guide the yarn in its downward path to a feed roll assembly 5.

The feed roll assembly 5 includes a pair of parallel rotatably mounted corresponding rolls 6 and 7, roll 7 being driven by suitable power means, not shown, at a predetermined rate of speed. Rolls 6 and 7 have peripheral surface contact therebetween so as to nip the yarn passed between the rolls for imparting an initial rate of speed or travel, corresponding to the speed of driven roll 7, to the yarn and to cause roll 6 to rotate correspondingly with roll 7 but, in a reverse direction therefrom.

A draw roll 8 is rotatably mounted below feed roll assembly 5 and is driven by suitable power means, not shown, at a higher peripheral rate of speed than that of roll 7, and applies a stretching or pulling force to the yarn when the latter is laced from the feed roll assembly 5 to and around roll 8. Drawing or stretching produces molecular orientation within and increases the tensile strength of the yarn.

An elongated, preferably hollow, member or draw pin 9, FIGURE 2, fixedly mounted at the end nearest roll 8 as shown in the drawing, is interposed in the path of yarn 1 intermediate the feed roll assembly 5 and the roll

8, and serves to localize the stretching point of the yarn when the latter is pulled therearound. Member 9 includes a tubular element 10 formed of a porous material resistant to abrasion and a pair of end caps 11 having transverse openings therethrough. End caps 11 are held in tightly clamped relation on the ends of element 10 by a nut 12 having screw-threaded engagement with one end of an elongated bolt 13 extending axially through element 10 and end caps 11.

The ends of a pair of lines or pipes, 14 and 15, extend into the interior of draw pin 9 at the mounting end thereof through respective transverse openings through the wall of one of the caps 11. Line 14 is normally supplied with steam from a suitable source, the steam flowing into the interior of element 10 and forming a steam zone surrounding the immediate exterior area of the draw pin by passing through the pores in the wall of element 10. Line 15 is provided to carry off condensate forming in the interior of element 10 and preferably, does not extend inwardly thereof as far as line 14 does so as to prevent accumulation of condensate within element 10.

Draw pin 9 is normally mounted in an inclined position in relation to the axis of roll 7 to prevent the wraps of yarn passed around member 9 from becoming superimposed and is positioned so that line 15 is below line 14 to permit condensate to flow by gravity to line 15.

Draw pins of the ordinary solid wall type are generally manufactured from a material resistant to abrasion bearing the trademark Alsimag, the principal ingredient of the material being aluminum oxide or titanium dioxide. Alsimag is here mentioned as one material from which tubular element 10 may be manufactured since Alsimag can be produced in a porous form while still retaining the quality of abrasion resistance.

Preferably, an inclined rotatable spacer roll 16 suitably mounted at one end thereof and positioned near draw roll 8 is provided to prevent the yarn from wrapping in superimposed manner on draw roll 8.

A ring twisting assembly 17 is provided to collect the yarn and comprises a pirn 18 adapted to be rotated by suitable means and a vertically reciprocable spinning ring 19 carrying a ring traveler 20 adapted to revolve freely about the pirn 18 as the yarn is twisted a desired amount and wound on the pirn.

A guide 21 is interposed between draw roll 8 and assembly 17 to guide the yarn to the assembly 17.

In operation, line 14 is pressurized with steam from a suitable source. Yarn 1 is withdrawn from one end of bobbin 2 and threaded conventionally around snubber bar 3, then led through pigtail 4, and passed between rolls 6 and 7 of assembly 5, the yarn being caught or nipped between rolls 6 and 7 and given an initial traveling speed corresponding to the predetermined speed of driven roll 7.

From assembly 5 the yarn is delivered to and led around draw pin 9 a desired number of turns. In passing around draw pin 9, the yarn passes through a controlled steam area surrounding pin 9 since the steam supplied to line 14 will enter draw pin 9 and flow to the exterior thereof through the pores of element 10. The steam acts to plasticize and condition the yarn for improving its drawing performance. From draw pin 9 the yarn is directed to and around draw roll 8 and spacer roll 16, collectively, a desired number of turns for imparting a greater speed of travel to the yarn since roll 8 is driven at a higher predetermined speed than roll 7 and according to a predetermined draw ratio. Due to the differential rates of peripheral speeds of rolls 7 and 8, a high stress is applied to the yarn whereby the latter is attenuated, the attenuation being concentrated or localized at the pin 9 which serves as a brake. Treating the yarn with steam at the pin 9 reduces the likelihood of the yarn being broken at this point since steam applied to the yarn substantially simultaneously while stretching the yarn improves the latter's extensibility characteristic.

From roll 8 the yarn is threaded through guide 21 and is collected in the usual manner on pirn 18 of the ring twisting assembly 17 after being passed through the ring traveler 20.

Thus, the invention, as described, provides a novel method and apparatus to steam treat a synthetic yarn while at the same time drawing the yarn, by simple and inexpensive means.

It will be understood that the invention is not to be limited to the specific embodiment shown and described herein, except as defined in the appended claims.

Having described the invention, the following is claimed:

1. Apparatus for treating and drawing yarn, said apparatus comprising in combination stationary porous snubbing means formed of a material resistant to abrasion and having pores of a perviousness to permit flow of steam therethrough, conduit means associated with said porous snubbing means for supplying a treating agent interiorly thereof, the treating agent normally flowing through said pores in said porous snubbing means to the exterior thereof to form a treating zone thereabout, feed roll means for forwarding the yarn longitudinally at one rate of speed to said porous snubbing means, draw roll means for withdrawing the yarn from said porous snubbing means at a second increased rate of speed for stretching the yarn, said yarn normally being laced to slidably engage said porous snubbing means so as, simultaneously, to localize the stretch of the yarn and to uniformly treat the yarn by direct application of the treating agent thereto.

2. Apparatus for treating and drawing yarn as claimed in claim 1 wherein said porous snubbing means comprises a porous snubbing pin.

3. Apparatus for treating and drawing yarn, said apparatus comprising in combination a hollow porous draw pin formed of a material resistant to abrasion and having pores of a perviousness to permit flow of steam therethrough, a supply conduit having communication with the interior of said hollow porous draw pin and normally being charged with a supply of steam for delivering steam to said hollow porous draw pin, the steam normally flowing through said pores in said hollow porous draw pin to the exterior thereof to form a steam zone thereabout, a discharge conduit having communication with the interior of said hollow porous draw pin and serving to remove condensate from the interior thereof, feed roll means for advancing said yarn longitudinally at one rate of speed to said hollow porous draw pin, draw roll means for withdrawing the yarn from said hollow porous draw pin at another rate of speed faster than said one rate of speed for stretching the yarn, said yarn normally being laced to frictionally engage said hollow porous draw pin so as, simultaneously, to localize the stretch of the yarn and to treat the yarn by direct application of steam thereto.

4. Apparatus for treating and drawing yarn, said apparatus comprising in combination, a draw pin having a tubular member formed of a porous material resistant to abrasion and having pores of a perviousness to permit flow of steam therethrough, a pair of end caps each arranged at a respective end of said tubular member, clamping means for securing said end caps on said tubular member, a supply conduit having communication with the interior of said tubular member and normally being charged with a supply of steam for conducting steam to said tubular member, a discharge conduit having communication with the interior of said tubular member and serving to remove condensate from the interior thereof, feed roll means for advancing said yarn longitudinally at one rate of speed to said draw pin, draw roll means for withdrawing the yarn from said draw pin at another rate of speed faster than said one rate of speed for stretching the yarn, said yarn normally being laced to frictionally engage said tubular member so as, simultaneously, to localize the stretch of the yarn and to treat

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the yarn by direct application of steam thereto, and an inclined spacer roll positioned near said draw roll means for preventing the yarn from wrapping in superimposed manner on said draw roll means.

5. A method for treating with steam synthetic filament yarn undergoing snubbing comprising delivering the yarn at a first rate of speed to a draw zone, withdrawing the yarn at a second increased rate of speed from said draw zone so that the yarn is stretched a predetermined amount within said draw zone, snubbing the travel of the yarn between said delivery and withdrawal points by slidable engagement with a stationary porous surface, applying steam directly and uniformly to the yarn through said porous surface at the point of said slidable engagement of the yarn therewith, and taking the yarn up in an

orderly manner after being withdrawn from said draw zone.

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