

[54]	STRAND TREATMENT	2,098,422	11/1937	Keen et al.....	242/156.2
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[*] Notice: The portion of the term of this patent subsequent to Aug. 25, 1981, has been disclaimed.

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Related U.S. Application Data

[62] Division of Ser. No. 386,489, July 31, 1964, Pat. No. 3,317,977.

[52] U.S. Cl. 242/45, 242/156.2
[51] Int. Cl. B65h 59/02, B65h 59/38
[58] Field of Search 242/156.2, 156, 147, 45, 242/75.43, 75.4, 75.53; 137/82

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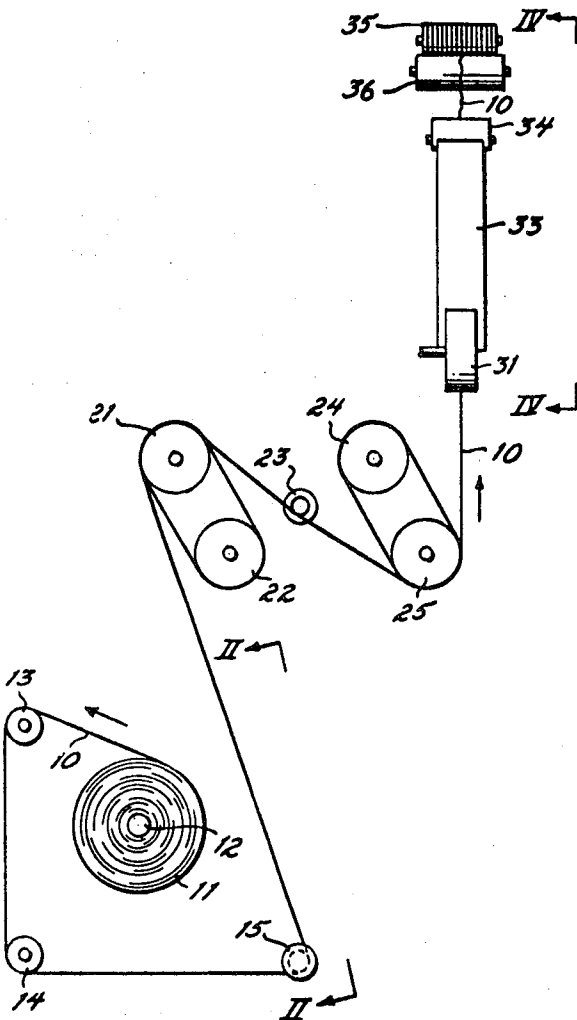
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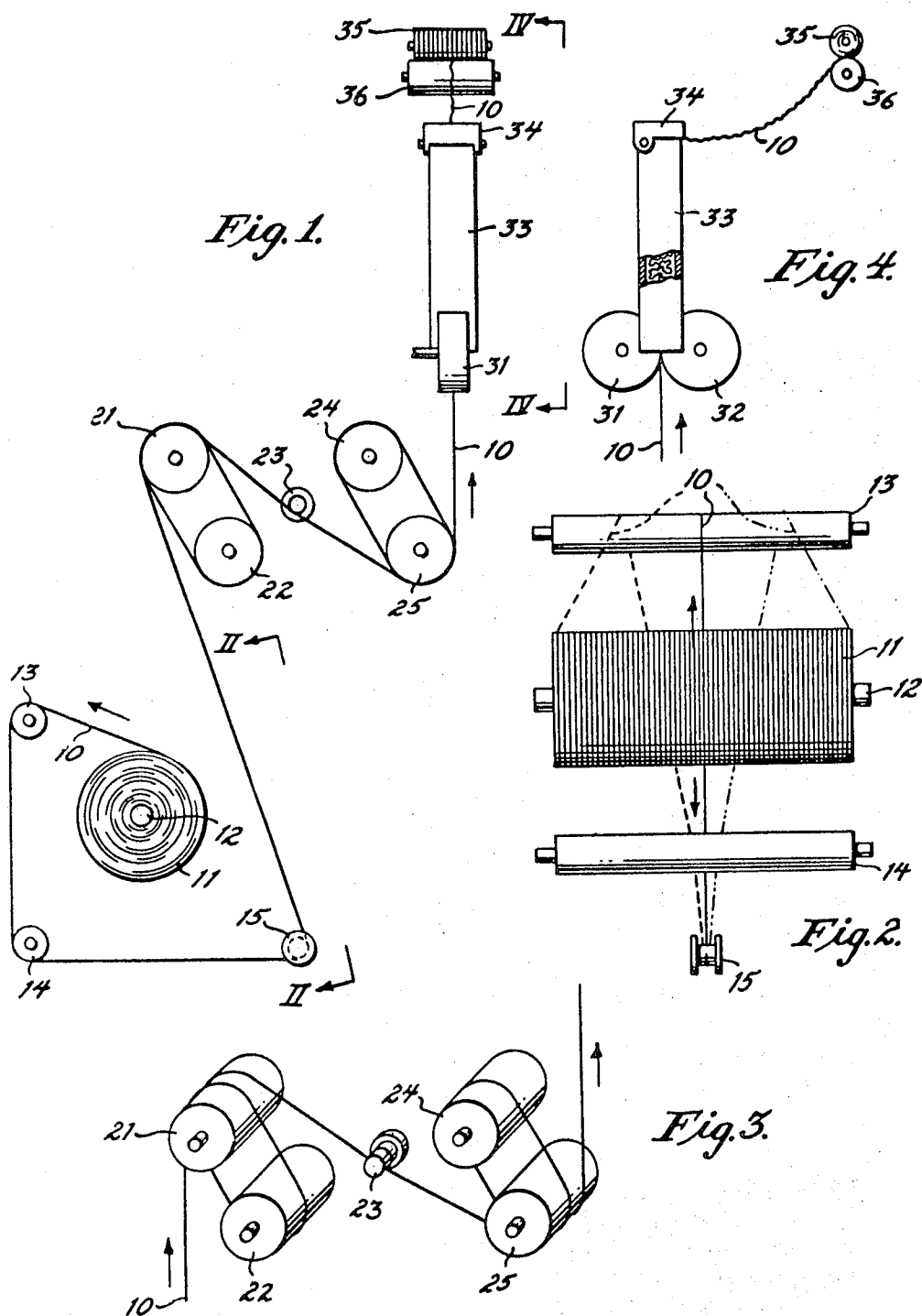
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[57] ABSTRACT

Tension in a textile strand being unwound from a traverse-wound package is equalized by passing the strand sequentially about portions of a plurality of rolls near the package, a friction-free guide, and a pair of variably spaced rolls whose spacing controls braking of the package.

2 Claims, 6 Drawing Figures





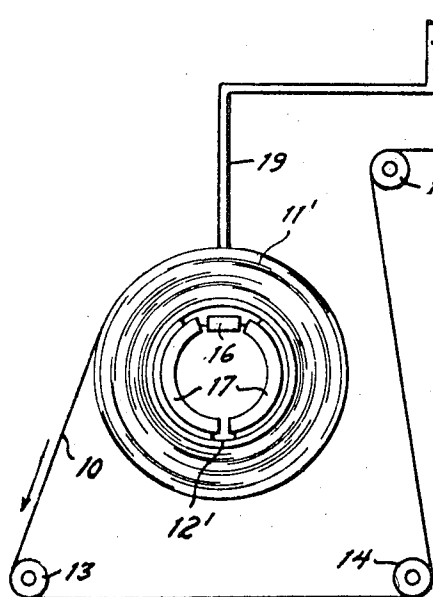


Fig. 5.

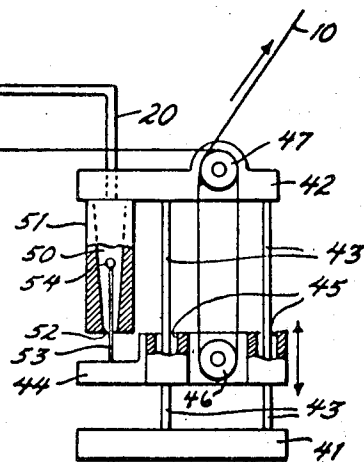
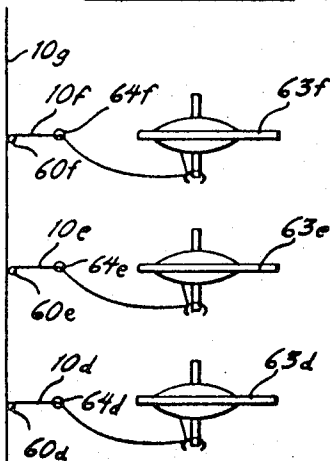
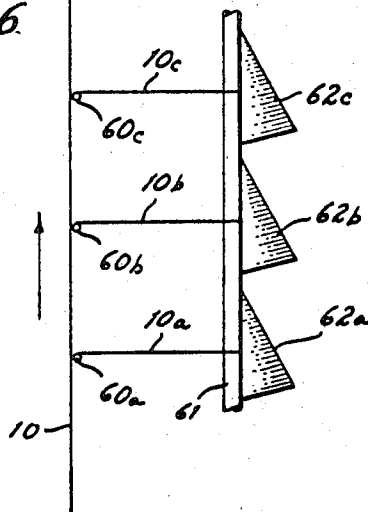


Fig. 6.



STRAND TREATMENT

This application is a division of my copending application Ser. No. 386,489 filed 31 July 1964, now Pat. No. 3,317,977 which was a continuation-in-part of my prior application Ser. No. 216,447 filed Aug. 13, 1962, now U.S. Pat. No. 3,145,947.

This invention relates to unwinding of textile strands from traverse-wound packages and minimization of tension variations therein, especially macromolecularly orientable strands to be drawn or attenuated to increased length to increase the orientation thereof, or oriented strands to be crimped.

As is well known, it is difficult to unwind a strand at constant tension from a traverse-wound package because the length of unwound yarn at the center of the traverse pattern or wind is less than that on either side of the center. At the reversal of the wind, at each end of the package, a tension maximum occurs, while at the center of the wind a tension minimum occurs. It is not usually practicable to vary the rotational speed of the package to compensate for these variations, and conventional compensating devices, such as weighted or spring-biased arms or guides, introduce additional variations while possibly smoothing out the extremes mentioned. Unevenly drawn and, at least in some instances, unevenly crimped textile strands exhibit, when subsequently dyed, undesirable irregularities of dye take-up, manifested as variations in color or shade.

A primary object of the present invention is minimization of tension variations in textile strand being unwound from a traverse-wound package.

An object is presentation of orientable textile strand to a drawing system at essentially uniform tension.

Another object is elimination of relatively undrawn portions from textile strands unwound from traverse-wound packages.

An object is improved preparation of textile strands for uniform dyeability.

A further object is improved crimping of textile strands unwound from a traverse-wound package.

Other objects of this invention, together with means and methods of attaining the various objects, will be apparent from the following description and the accompanying drawings.

FIG. 1 is a side elevation of apparatus useful according to this invention.

FIG. 2 is a front elevation of strand-unwinding components, of the same apparatus, taken at II — II of FIG. 1;

FIG. 3 is a perspective view of strand-drawing components of the same apparatus;

FIG. 4 is a front elevation, partly in section, of strand-crimping components of the same apparatus taken at IV — IV of FIG. 1;

FIG. 5 is a side elevation, partly in section, of a modification of strand-unwinding apparatus according to this invention; and

FIG. 6 is a largely schematic view of the separate treatment of individual component strands, after unwinding.

In general, the objects of the present invention are accomplished by pulling a textile strand, which may comprise a plurality of separable component strands, from an unreeling traverse-wound package over a plurality of rolls mounted for rotation on axes paralleling the package axis and through tension control means be-

fore drawing or crimping (or both) of the strand. The invention contemplates a continuous unwinding of multi-component textile strand, as above, and separation thereof into individual component strands for windup, with or without twisting, packaging, etc.

FIG. 1 shows, in side elevation, apparatus useful according to this invention. Subsequent views show various portions of the same apparatus in front elevation. In all views the showing is relatively diagrammatic or schematic, in that the associated supporting and driving apparatus and related parts, which are of conventional design and construction, are omitted in the interest of clarity.

Package 11 of textile strand, from which strand 10 is shown as unreeling, is mounted for rotation on axle 12 suitably supported. Mounted on axes parallel thereto are roll 13 located above and behind (v. FIG. 2) the package, roll 14 located below and behind the package, and roller guide 15 located ahead of and below the package and centered from end to end thereof.

The components shown in FIG. 3 as well as in FIG. 1 comprise a strand-drawing system and include first pair of rolls 21, 22 and second pair of rolls 24, 25, together with fixed draw pin 23 located between the two pairs of rolls. At least one roll (preferably both) in each pair of rolls is driven, and the surface speed of the second pair is greater than that of the first pair so that strand travelling through the system is extended by contact therewith. The strand is shown as making at least a complete wrap around rolls 21, 22 as a set, a turn about the draw pin, and then a wrap or more around rolls 24, 25 as a set. The ratio of suitable surface speeds depends upon the degree of macromolecular orientation of the incoming strand and the composition of the strand; as an example, a ratio of about four to one (a 4x draw) is often employed for strands of polyamide, such as 66 nylon.

The components shown in FIG. 4 as well as in FIG. 1 comprise a crimping system including specifically a stuffer-crimper, of which the major components are a pair of stuffing rolls 31, 32 and a stuffing chamber 33, which has a longitudinal bore therethrough and has pivoted cap 34 at the top or opposite end from the rolls. Strand 10 entering the nip of the rolls is stuffed into the chamber, from which its exit is impeded by the cap (which may be weighted or spring-biased) and thereby crimped as its entrance into the chamber is impeded by the accumulation of strand therein. Part of the front wall of chamber 33 is cut away in FIG. 4 to reveal a portion of the strand accumulation therein (shown rather stylized, for clarity). Strand 10 expelled in crimped form from the top of the chamber is shown as being wound up under relatively relaxed condition onto bobbin or similar package 35 driven by contact with drive roll 36.

The drawing and crimping systems and components shown in FIGS. 3 and 4, as well as in FIG. 1, are conventional as such, and the present invention is directed particularly to the preceding portion of FIG. 1 as such and in combination with one or more of those other systems and components, as well as to other features described below.

It will be apparent that as strand 10 is unreeled from package 11 the locus of departure of the strand from the package reciprocates from end to end of the package, as suggested in FIG. 2 by the solid line (representing strand 10 unreeling from the midportion of the

package) and the unlike broken lines (representing the extreme positions of the traverse-wound strand) at the extreme left and right top edges of the package. Intermediate positions may be readily visualized but are omitted from the view in the interest of clarity.

Roller guide 15, which is flanged like a pulley, is rotatable but is located at a relatively fixed position along its axis, being centered from end to end of strand package 11. As the strand unreels from the package and about rolls 13, 14 and the roller guide, the strand traverses the successive rolls to a successively decreasing extent as compared with the full traverse thereof on the package itself. FIG. 2 shows that the resistance offered by each roll to the strand results in a difference between the angle at which the strand first contacts the roll and the angle at which it leaves the roll. Even at the straight-ahead or mid-traverse position, the strand (although not so shown because to do so might render the operation less evident) usually will occupy somewhat different positions on the rolls because of time lag in movement of the strand therealong.

To effect this arrangement whereby the strand traverses to a reduced extent, a plurality of rolls located as shown smoothes out the tension changes characteristic of a strand unreeled from a traverse-wound package. The strand should come into sufficient contact with each roll to affect the course of the strand therealong, as distinguished from a minor degree of contact that merely deflects the strand from a straight-line path. In general it is desirable that the strand pass through at least (in total) a right angle of arc from leaving the package until encountering the roller guide. No practical advantage attends operation with any more than a full circle of such arc, and the preferred angle is generally about midway between such maximum and the mentioned minimum.

It is apparent from FIGS. 1 and 2 that the rolls 13 and 14 are on axes parallel to one another and to the axis of strand package 11; it is also apparent from FIG. 1 that the three axes, when viewed end-on, form the corners of a triangle. Such arrangement is conducive to the desired movement of the strand back and forth along the roll surfaces. Of course, more than two rolls may be used, arranged so that their axes and that of the package, when viewed end-on, are located at the corners of a polygon other than a triangle. The arrangement should be such that the minimum contact angle per roll is about one hundred degree of arc divided by the number of such rolls.

The pulling force to unreel the strand may be furnished by the rolls of the drawing system or, in the event of the unreeling of an already drawn strand to be crimped, by one or more rolls in or associated with the crimper itself. Alternatively it may be provided by additional rolls or other strand-forwarding means (not shown) and even by such means as windup. The rolls corresponding to illustrated rolls 13 and 14 need not be driven, although they may be (especially if massive) at a rate compatible with that of subsequent rolls. The unwinding package normally will be braked slightly, and the roller guide will be completely free-running.

FIG. 5 shows, in side elevation (partly broken away) enlarged package 11' on a support having at the visible end drum 12' furnished with brake cylinder 16 and adjacent pair of brake shoes 17 actuatable against the inside of the drum. Fluid line 19 from main line 18 supplies the brake cylinder. Strand 10 unreels from

package 11' and passes about rolls 13 and 14 and roller guide 15 as in the first embodiment. The strand then passes through tension control means effective to actuate braking of the unwinding package. Fixed base 41 thereof has fixed headpiece 42 supported thereabove on vertical columns 43 (two visible). Midpiece 44, which is partly cut away to show vertical bores 45 therein surrounding the respective vertical columns, has roll 46 extending laterally therefrom (toward the viewer) below and essentially parallel to roll 47 extending in like manner from headpiece 42, both rolls preferably being free-running. Fluid line 20 from main line 18 passes through the headpiece and enters compartment 51 depending therefrom. Rising into the compartment, which is partly cut away to show conical bore 50, through opening 52 in the bottom thereof is valve stem 53 rising from midpiece 44 and carrying ball 54 on the upper end. Strand 10 passes about pair of rolls 47 and 46, preferably in several wraps therearound, and continues on therefrom to subsequent treatments, e.g., drawing and/or crimping.

It will be apparent from a consideration of FIG. 5 that an increase in tension in strand 10 passing about pair of rolls 46 and 47 will tend to raise midpiece 44, thereby raising valve stem 53 and locating ball 54 further from opening 52, through which fluid injected from fluid line 20 into conical bore 50 of compartment 51 bleeds away at a rate determined by the distance of the ball therefrom. The resulting increased bleeding rate lowers the fluid pressure supplied to brake cylinder 16 through connecting fluid line 19, thereby reducing the pressure of brake shoes 17 against drum 12' and reducing the drag on the strand (and, thus, the tension therein). Upon decrease in the strand tension, the midpiece tends to settle to a lower level, thereby decreasing the fluid bleed rate and reducing the braking pressure. Thus, the tension control means assists in reducing tension variations, the degree of its effect being adjustable conveniently by varying the number of wraps of strand about rolls 46 and 47 or the weight of midpiece 44 (or both) and further adjustment being available by varying the taper of conical bore 50 of compartment 51, if desired.

Strand 10, especially, if a relatively low-twist or zero-twist multifilament yarn, may be separated into individual component strands of several filaments or only one each (i.e., monofilament) for windup, twisting, packaging, etc. As shown in FIG. 6, strand 10 is subdivided into seven component strands: 10a through 10g; component strands 10a through 10f pass about respective guides 60a through 60f, and component strand 10g continues on. Drive roll 61 rotates conical packages 62a, 62b, and 62c onto which component strands 60a, 60b, and 60c are wound. After passing also through respective ring guides 64d, 64e, and 64f, component strands 60d, 60e, and 60f are taken up by twister assemblies 63d, 63e, and 63f. Remaining component strand 10g may go on toward similar or other processing location and apparatus, such as that previously illustrated or any other that is suitable.

The present invention is beneficial in eliminating tension variations in strand presented to a drawing system or a crimping system (or both) or subjected to other tension-dependent treatment, especially for separation into individual component strands after such treatment as for windup, twisting, packaging, etc. Strand so treated, when subsequently dyed, is free from objec-

tionable irregularities characteristic of uneven drawing (or crimping) or other introduction of strain variation by intermittent or varying extensional stresses. Additional advantages will be recognized by and accrue to those who practice this invention, which although described by way of example above is defined and circumscribed only by the following claims.

The claimed invention:

1. In apparatus for strand treatment comprising means for supporting a package of textile strand rotatably for unreeling, means for braking rotation of the package, and strand-tension control means including a source of fluid under pressure, means connecting the fluid source to the braking means, a plurality of rolls adapted to receive the strand thereabout, one of the rolls being mounted for movement toward and away from another of the rolls in accordance with increase and decrease in tension of strand wrapped thereabout, valve means responsive to such roll movement, means connecting the fluid source to the valve means, the valve means being effective at increasing strand tension and accompanying decreasing roll separation to bleed fluid away from the source at an increasing rate and thereby lessen the braking of the package-supporting means and being effective at decreasing strand tension and accompanying increasing roll separation to bleed fluid away from the source at a decreasing rate and thereby strengthen the braking of the package-supporting means, the improvement wherein a mounting for the movable roll is adapted to be suspended

below a mounting for the other roll by strand wrapped about the rolls and to rise and fall in accordance with increasing and decreasing tension on the strand and to be guided in such rising and falling movement by means extending between the respective mountings, and wherein the valve means comprises a valve member attached to one of the mountings and a compartment attached to the other mounting, the compartment being supplied with fluid from the source and having a bleed opening therein and the valve member being adapted upon such movement to vary the rate of bleeding of fluid from the compartment and thereby vary the braking of the package.

2. Apparatus for strand treatment comprising means for supporting a traverse-wound package of textile strand rotatably for unreeling, means for braking rotation of the package, a plurality of rolls mounted rotatably on fixed axes paralleling the package axis, and adapted to receive the strand in a continuous path from the package, the package axis and roll axes being located at the corners of a polygon, a substantially friction-free guide at a fixed location further along in the path of the strand, and tension control means including a plurality of rolls adapted to receive the strand thereabout, one of the rolls being mounted for movement toward and away from another of the rolls in accordance with increase and decrease in tension of strand wrapped thereabout, and means responsive to such roll movement to actuate the braking means.

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