

Nov. 19, 1968

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TEXTILE STRAND TREATMENT

3,411,282

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2 Sheets-Sheet 1

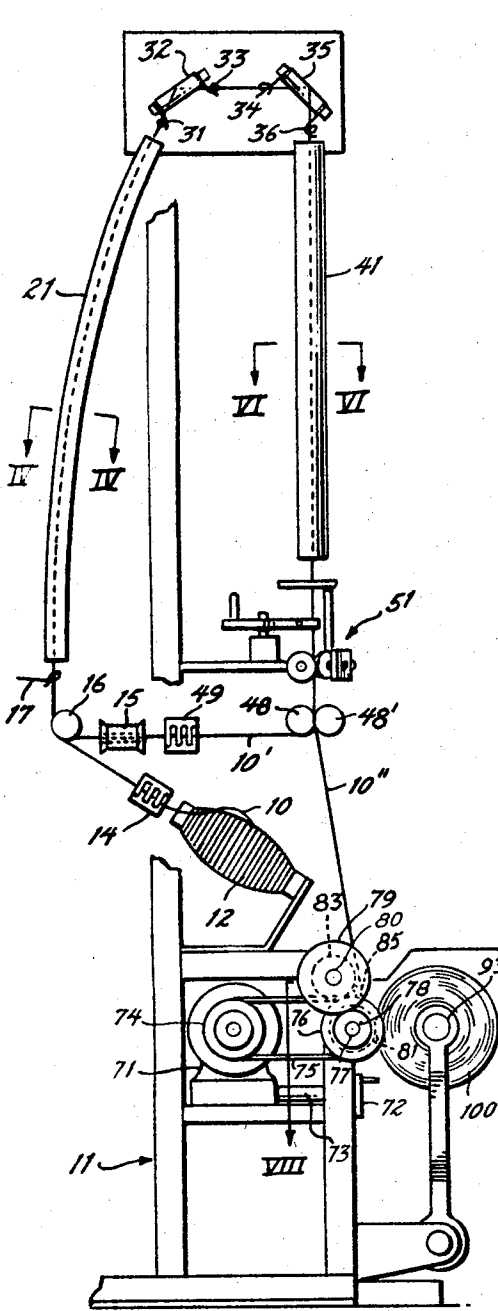


Fig. 1.

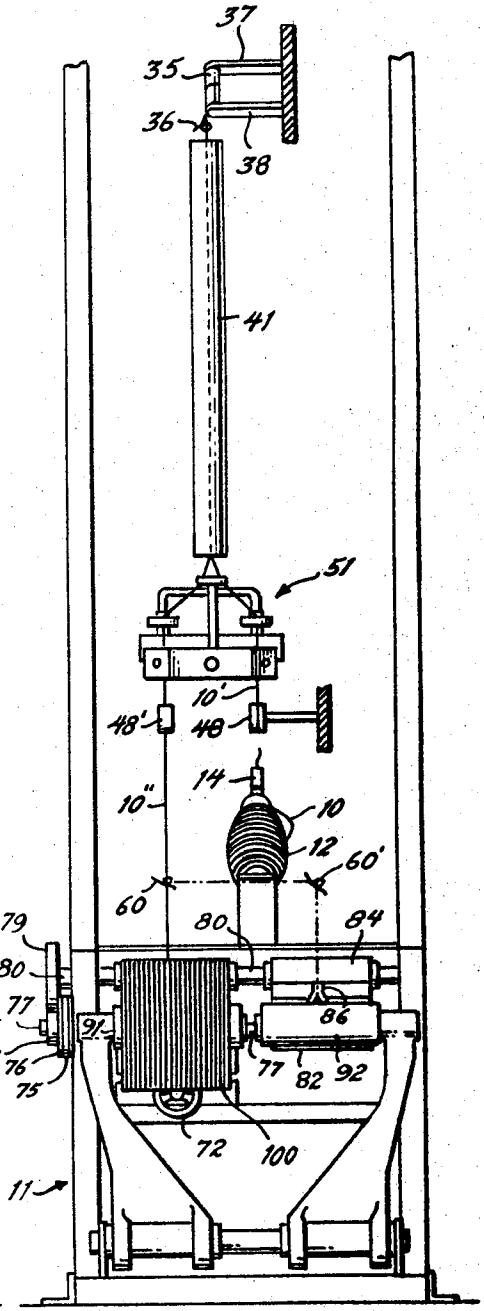


Fig. 2.

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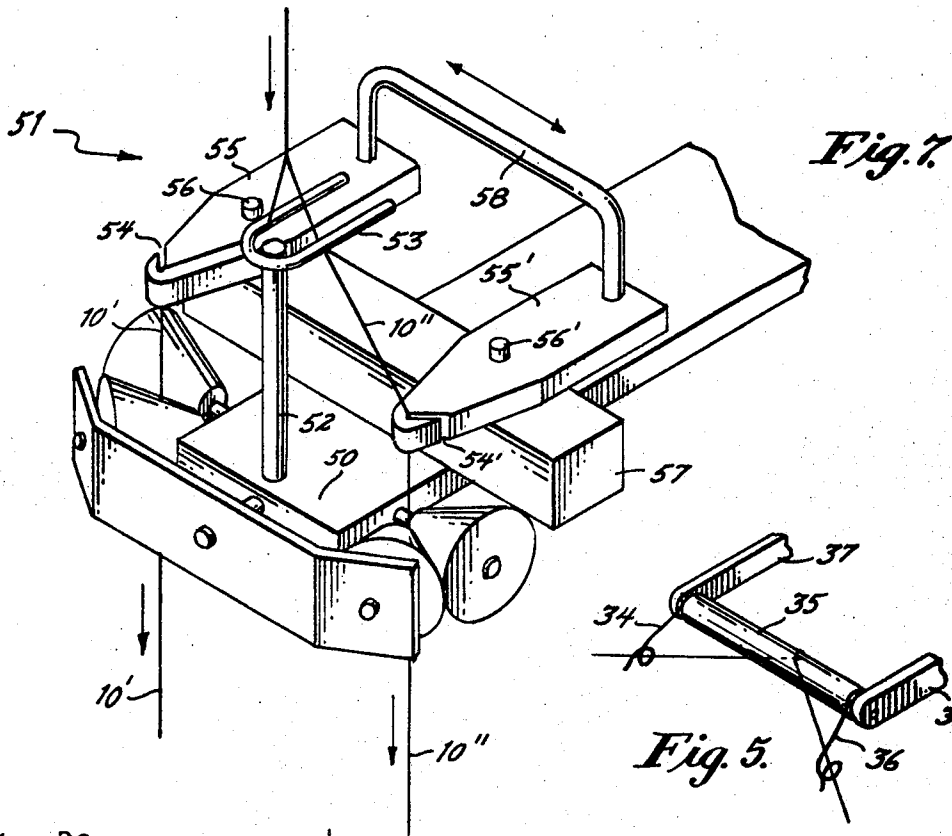


Fig. 7.

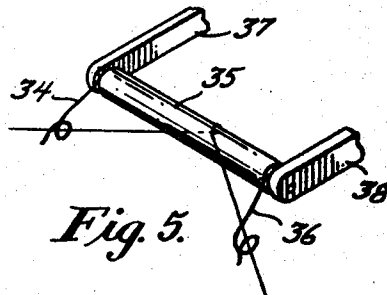


Fig. 5.

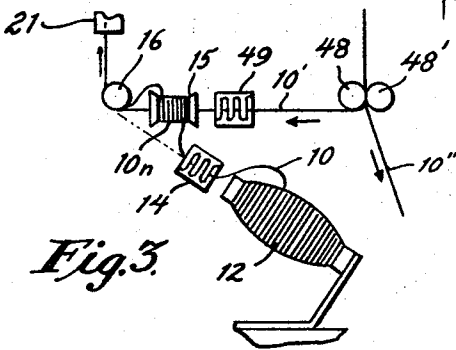


Fig. 3.

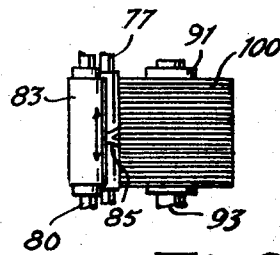


Fig. 8.

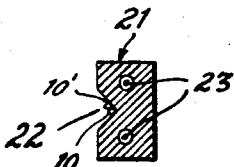


Fig. 4.

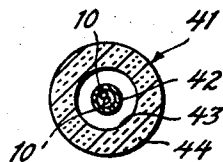


Fig. 6.

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**TEXTILE STRAND TREATMENT**

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16 Claims. (Cl. 57-34)

**ABSTRACT OF THE DISCLOSURE**

A textile strand is bulked by being formed into a loop configuration, with a plurality of lengths of the strand adjoining one another, twisting the adjoining strand lengths about one another, heating and optionally then cooling the strand lengths while so twisted, and separating them.

This invention relates to treatment of textile strands, especially thermoplastic multifilament strands to impart increased bulk thereto. The treatment preferably is performed in continuous manner upon appropriate apparatus, with the strand running continuously from a source of supply through a loop configuration in a plurality of passes and with the leading portion that has been through the loop the maximum number of times being wound up therefrom.

In conventional methods of bulking or crimping textile strands by twisting (or false-twisting) and heating them, various devices with moving parts are employed to introduce the desired twist, and one such device is required for each strand to be so treated, resulting in a complex and expensive arrangement. While it has been suggested that a plurality of strands be twisted about themselves, the degree of success therewith has been slight, whether because of physical non-uniformities between respective strands or otherwise.

A primary object of the present invention is provision of a simple, inexpensive method of bulking textile strands wherein a plurality of lengths of the same strand are treated simultaneously.

Another object is utilization of the same strand to impart the desired twist to its plurality of lengths being treated.

A further object is provision of apparatus useful accordingly.

Other objects of this invention, together with means and methods for attaining the various objects, will be apparent from the following description and accompanying drawings of a preferred embodiment, which is presented by way of example for persons having ordinary skill in the art to learn the invention.

FIG. 1 is a side elevation, partly cut away to improve the showing, of apparatus useful in practicing the present invention;

FIG. 2 is a front elevation of the apparatus of FIG. 1, with portions thereof omitted in the interest of clarity;

FIG. 3 is a side elevation, on an enlarged scale, of components of the apparatus of the foregoing views;

FIG. 4 is an enlarged sectional plan of one of the elements previously shown, taken at IV—IV in FIG. 1;

FIG. 5 is a perspective view, also enlarged, of another of the elements, shown in FIGS. 1 and 2;

FIG. 6 is an enlarged sectional plan of yet another of the elements previously shown, taken at VI—VI in FIG. 1;

FIG. 7 is a perspective view, greatly enlarged, of a subassembly shown in FIGS. 1 and 2; and

FIG. 8 is a plan of other elements shown in the same views, taken at VIII—VIII in FIG. 1.

In general, the objects of the present invention are accomplished, in a process for treating textile strands where-

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in a textile strand is twisted and is heated while twisted, by forming the strand into a loop configuration wherein one length thereof adjoins another length thereof, twisting the adjacent lengths about one another, heating the twisted adjacent lengths in the loop configuration, and separating the respective lengths from one another.

More particularly, the invention provides a process wherein the twisted adjacent strand lengths in the loop configuration are cooled following the heating thereof.

Apparatus for practicing such a process comprises means for supporting a textile strand in loop configuration, with a plurality of strand lengths adjoining and twisted about one another, means for heating the strand in a portion of the loop configuration, and means for forwarding the strand through the loop configuration.

FIGS. 1 and 2 show, in side and front elevation, respectively, apparatus for practicing this invention, comprising frame 11 composed of a base and uprights, with cross pieces of appropriate intervals, the frame being cut away in large part to show the components supported thereby. Supply package 12 is removably supported on a flange of the frame, and strand 10 therefrom is shown passing through gate tensioner 14 and past (but not about) twist spool 15, which has a longitudinal bore (indicated in broken lines) therethrough. From the twist spool the strand passes about roller guide 16, through pigtail guide 17, and over curved heater 21. The strand rides in longitudinal channel 22 in the heater, which itself has a generally rectangular cross-section, as shown in sectional plan view in FIG. 4. Internal electrical resistance heating element 23 occupies a pair of suitable longitudinal bores in the heater block.

After passing upward over the heater the strand passes through pigtail guides 31, 33, 34, and 36 in succession, and over guide bars 32 and 35 located, respectively, between the first and second pairs of such guides. The latter guide bar and pair of pigtail guides, together with supported arms 37 and 38, are shown in perspective in FIG. 5. Then the strand passes downward through cooler 41, which itself is in tubular form and jacketed as shown in sectional plan view in FIG. 6. Inner tube 42, by which the strand is enclosed, as in this view, is surrounded by jacket 43 which itself is surrounded by layer of insulation 44. No attempt is made to represent the cooling fluid between the inner tube and the jacket. After passing through the inner tube of the cooler the strand (now denoted as 10' to indicate that it has completed a single pass about the looplike treating path) passes through separator 51, which is shown in more detail in FIG. 7, and about roller guide 48, through gate tensioner 49, and then through the bore in twist spool 15 and around the loop again, where it encounters the heater, the cooler, and the separator in like succession.

After its second pass about the loop, the strand (now denoted as 10'' to indicate completion of its second pass) goes past roller guide 48' and through pigtail guide 60 and on downward toward the windup mechanism, which is conventional in design. Motor 71 is slidably mounted for to and fro motion on the frame, and handwheel 72 controls the motor position through a threaded shaft (not visible) inside cover tube 73. The position to which the motor is adjusted by means of the handwheel controls the tension in belt 75, which interconnects drive pulley 74 on the motor shaft and driven pulley 76 carried on axle 77 journaled on the frame. Affixed to the driven pulley is frictional drive disc 78, which is in driving contact with driven disc 79 on axle 80. Axle 77 carries a pair of package surface drive rolls 81 and 82 spaced laterally from one another, and axle 80 carries a pair of strand-traverse devices 83 and 84, with respective traverse guides 85 and 86, similarly spaced but upward and to the rear of the drive rolls.

Strand 10'' is shown passing through traverse guide 85 and onto package 91 of wound yarn driven by surface contact with drive roll 81. These windup components are shown in plan in FIG. 8 (strand 10'' being omitted in the interest of clarity). Stub shaft 93 on which package 91 is carried is mounted in swing arm 95 pivotally supported on traverse shaft 90 near the bottom of the frame. Similar swing arm 96 on the shaft carries empty package 92 on stub shaft 94 therein, the empty package being located ahead of drive roll 82 for transfer of the winding strand (by way of alternate pigtail guide 60' from similar guide 60) when package 91 is filled with wound strand 100 and must be removed. Of course, supply package 12 is removed and replaced when exhausted of untreated strand 10, the tail end of strand therefrom being tied or spliced to the leading end of the replacement package.

FIG. 7 shows, in perspective and on an enlarged scale, separator 51 by which once-treated strand 10' and twice-treated strand 10'', which issue together from cooler 41 (see FIGS. 1 and 2), are separated to go their respective ways: the former to be treated in another pass about the loop-like path, and the latter to be wound up. Support block 50 (part of frame 11) carries upstanding rod 52, which carries horizontal U-guide 53, and strands 10 and 10' separate from their common path and slide over opposing surfaces of the respective guide slots 54, 54' in the front ends of a pair of swivel guides 55, 55' mounted pivotally on pins 56, 56' in cross-piece 57 on support block 50. Tie-piece 58 joins the rear ends of the swivel guides to assure like swiveling of both together. After passing through the swivel guide slots the respective strand lengths continue downward between respective pairs of tapered nip rolls. Respective traverse rolls 61, 61' extend on lateral axes from support block 50, while similar rolls 62, 62' extend on oblique axes from supporting flange 63 affixed by bolt 64 to the support block. Rolls 61 and 62 form the nip through which strand 10' passes, while strand 10'' passes through the nip of rolls 61', 62'. These components of the separator are made of lightweight material to impede passage of the strand as little as possible while themselves being moved thereby and serving to equalize tension variations in the respective strand lengths.

FIG. 3 shows supply package 12 of untreated strand 10 and related elements at the stage of start-up, after the strand has been strung all the way about the loop-like path configuration twice and on to windup. At this stage strand 10 is wrapped (numerous turns 10<sub>n</sub>) about twist spool 15 before passing about roller guide 16 and over heater 21. Once-treated strand 10' passes through the bore of the twist spool as before, and twice-treated strand 10'' goes downward to the windup. At the initial stage of the treatment process, strand 10 is unwound from the numerous turns thereof about the twist spool, twisting it about once-treated strand 10' from the spool bore. When all 10<sub>n</sub> turns are unwound from about the twist spool, strand 10 proceeds directly from tensioner 14 to roller guide 16 along the portion of the path shown in broken lines. The twist thus imparted to the pair of strands passing over the heater is distributed fairly evenly as a distortion of once-treated strand 10' and relatively untreated strand 10, both of which are according to this invention successive lengths of the same strand twisted about one another. Bar guides 32 and (to a lesser extent) 35 act as twist stops to retain most, if not all, of the twist in the length intervals occupied by the heater.

It will be apparent that the heating of the mutually twisted strand lengths by the heater softens them and results in imparting a more or less helical configuration thereto. Cooler 41, while not essential, is greatly preferred according to this invention because prompt cooling of the treated strand is effective in precluding removal of the helical bulky or crimped configuration by

winding tension applied to the strand. Employment of two passes about the treating loop is most conducive to acquisition of a commercially acceptable degree of bulk and crimp without necessity for excessive length of treating components. Strand so treated, which may be composed of nylon or other preferably thermoplastic composition, exhibits a high degree of bulk or crimp retention as measured by conventional bulk or crimp recovery tests. In addition to these obvious product advantages the practice of this invention is advantageous because only a single strand is being treated as two lengths thereof are being treated together, eliminating the complications that have been encountered in attempts to treat two separate strands twisted about one another.

Other benefits of this invention will accrue to those undertaking to practice it in the light of the present teaching. Although a preferred embodiment of the invention has been described and illustrated it may be modified while maintaining some or all of the benefits of the invention, as by adding, combining, or subdividing parts or otherwise. The present invention itself although described and illustrated by way of example is not to be limited thereby, being defined in and by the following claims.

The claimed invention:

1. In a process for treating textile strands wherein a textile strand is twisted and is heated while twisted, the improvement comprising forming the strand into a loop configuration wherein one length thereof adjoins another length thereof in the loop configuration, twisting the adjacent lengths about one another, heating the twisted adjacent lengths in the loop configuration, and separating the respective lengths from one another.

2. The process improvement according to claim 1 wherein the strand is circulated continuously through the loop configuration.

3. The process improvement according to claim 1 wherein the twisted adjacent strand lengths in the loop configuration are cooled following the heating thereof.

4. The process improvement according to claim 1 wherein the twist is backed out upon separation of the twisted strand lengths.

5. The process improvement according to claim 1 wherein the loop is formed between a source of supply of the strand and a windup package for the strand.

6. Process for treating a thermoplastic textile strand on the run comprising forming the strand into a loop configuration wherein the strand passes through the loop configuration a plurality of times, an equal plurality of lengths of the strand adjoining one another in the loop configuration, twisting the adjacent lengths of the strand about one another, heating the adjacent twisted lengths, and separating the respective strand lengths by withdrawing one length from the loop configuration.

7. Process according to claim 6 wherein the strand is forwarded on the run through the loop configuration by winding up the strand.

8. Process according to claim 6 wherein the strand is heated and cooled successively in the loop configuration.

9. Process according to claim 8 wherein the strand is heated and cooled successively on each of its passes through the loop configuration, the adjacent lengths of the strand being twisted about one another while being so heated.

10. Process of bulking a thermoplastic multifilament strand comprising passing the strand a plurality of times through a loop configuration, there being an equal plurality of strand lengths in the loop configuration including one strand length entering the loop configuration for its first pass therethrough and one strand length leaving the loop configuration for its last pass therethrough, twisting the adjoining strand lengths about one another, and heating the adjoining twisted strand lengths.

11. Process according to claim 10 wherein the strand

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length withdrawn from the loop configuration is cooled before being withdrawn therefrom.

12. Process according to claim 10 wherein the strand length withdrawn from the loop configuration is untwisted before being withdrawn therefrom.

13. Apparatus for treating thermoplastic textile strands, comprising means for supporting a strand in loop configuration with a plurality of strand lengths adjoining and twisted about one another, means for heating the strand in a portion of the loop configuration, and means for forwarding the strand through the loop configuration.

14. Apparatus according to claim 13 including means for cooling the strand in a portion of the loop configuration.

15. Apparatus according to claim 13 including means for separating one of the plurality of the adjoining twisted strand lengths from the rest.

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16. Apparatus according to claim 15 including means for winding up the separated strand length.

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