Dec. 14, 1971 R. C. SPURGEON 3,626,682

METHOD OF AND APPARATUS FOR PROCESSING YARN

Filed May 13, 1970 2 Sheets-Sheet 1

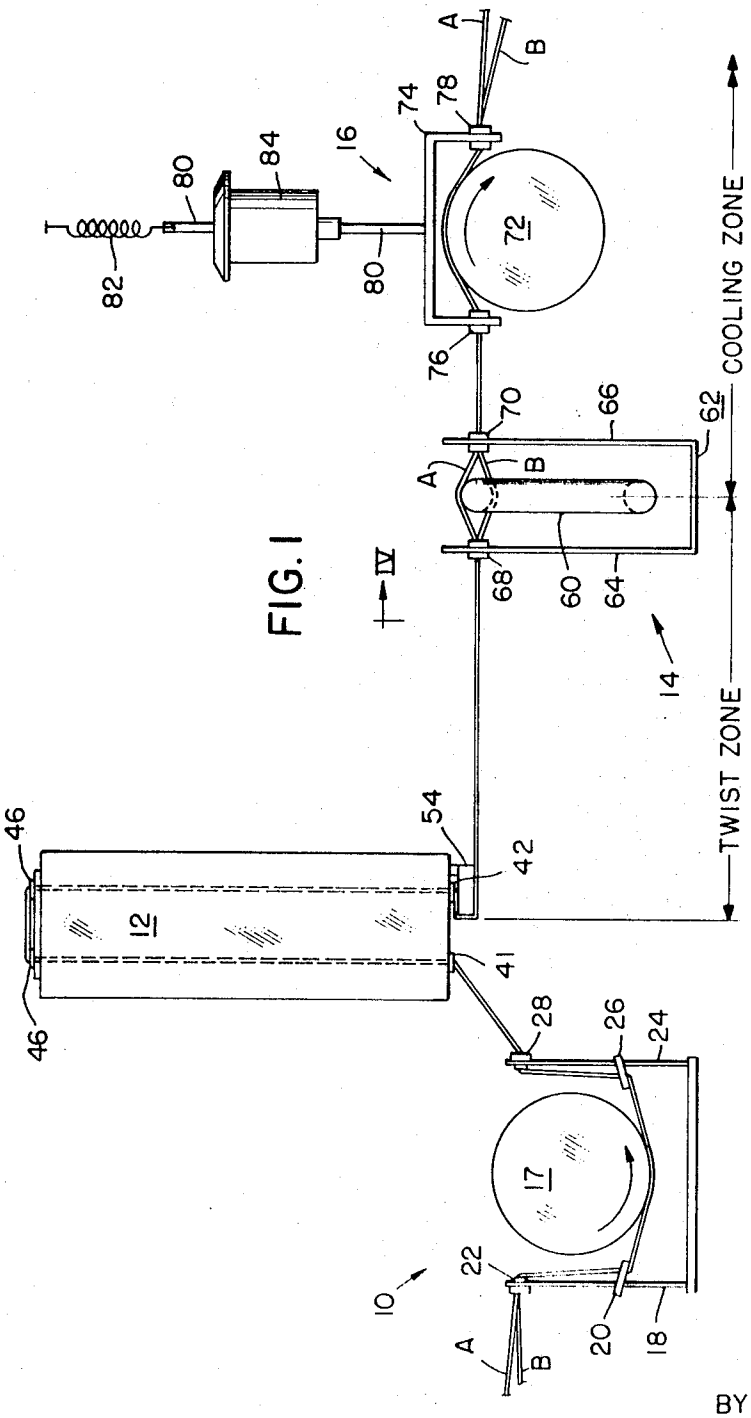


FIG. 1

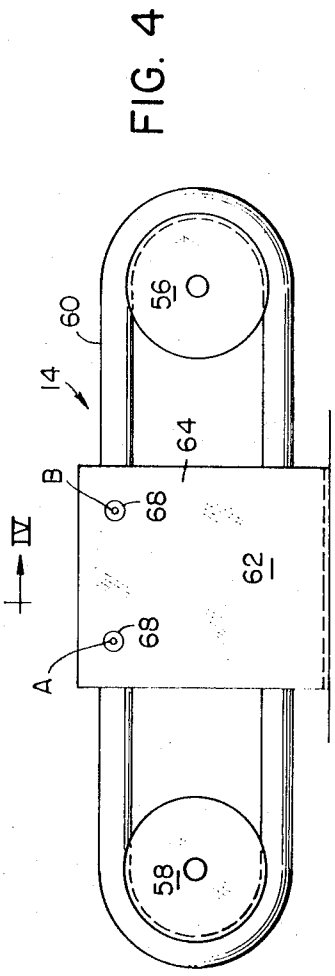


FIG. 4

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FIG. 2

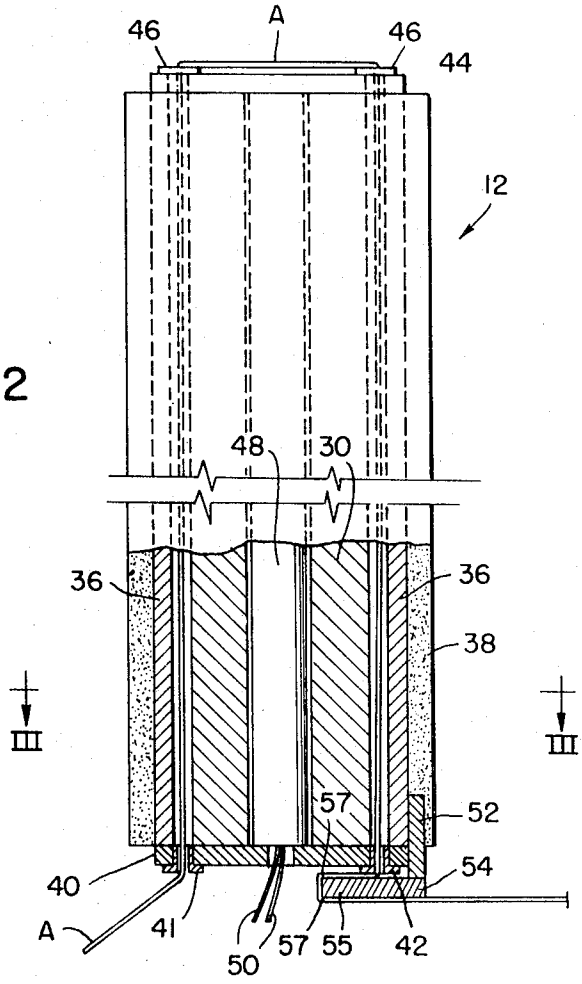
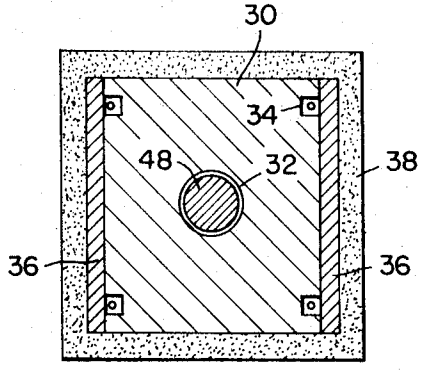


FIG. 3



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3,626,682

METHOD OF AND APPARATUS FOR PROCESSING YARN

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Int. Cl. D02g 1/02, 3/00; D01h 7/92
U.S. Cl. 57—77.3 9 Claims

ABSTRACT OF THE DISCLOSURE

Yarn from a package thereof is threaded through apparatus comprising a tension leveling device, electric heater, false twist device, and tension reducing device and then fed directly to a circular knitting machine or other utility. Close to the heater and interposed between the same and the false twist device is means which effectively coacts with the tension leveling device to restrict twisting of the yarn to the downstream side of the heater.

BACKGROUND OF THE INVENTION

(1) Field of he invention

This invention relates to the texturing of yarn by false twisting.

(2) Description of the prior art

In the texturing of yarn by heating the yarn to a temperature sufficient to plasticize it and subjecting the same to twisting by means of a false twist device, it is conventional to heat the yarn to a selected high temperature in one zone and then cool it in a separate and distinct zone before passing it through the false twist device. As a consequence, the combined lengths of the several zones makes it impractical to adapt the apparatus for texturing the yarns and immediately feeding them directly to a circular knitting machine or other utility.

SUMMARY

A principal object of this invention is to provide apparatus for texturing yarn by false twisting and characterized by an arrangement whereby the yarn is heated to a selected high temperature and thereafter twisted before it is cooled to any significant degree, which makes it possible to pass yarn through the apparatus and immediately thereafter feed the textured yarn directly to a circular knitting machine or other utility.

Another object of this invention is to provide such apparatus effective for restricting the twist zone in its entirely to the downstream side of the heater, as a consequence of which the yarn is in an untwisted condition when it passes through the heater.

Still another object of this invention is to provide such apparatus for processing yarn at the required high rate and for producing therein an unusually high number of twists per unit of yarn length for yarn processed at such a rate.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevation diagrammatically showing apparatus constructed in accordance with the invention;

FIG. 2 is an enlarged longitudinal section through the heater shown in FIG. 1;

FIG. 3 is a section on line III—III in FIG. 2; and

FIG. 4 is an elevation on line IV—IV in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The following description is directed to the specific embodiment of the invention disclosed in the drawings. It is not addressed to the scope of the invention, which may be practiced in a variety of forms.

Referring to FIG. 1, the apparatus shown includes a tension leveling device **10**, an electric heater **12**, a false twist device **14** and a tension reducing device **16**.

The tension leveling device **10** includes a roller **17**. To the left of the roller **17** is a set of two laterally spaced standards **18** each embraced by a ring **20** and each provided with an eyelet **22** at the head thereof, and to the right of the roller **16** is a second set of two laterally spaced standards **24** each embraced by a ring **26** and each provided with an eyelet **28** at the head thereof. Reference may be had to my Pat. No. 3,323,753, issued June 6, 1967, for the essential features of the tension leveling device and for the principles of its operation.

Referring particularly to FIGS. 2 and 3, the heater **12** comprises a main body **30** with a longitudinally extending central opening **32** and two sets of two laterally spaced grooves **34** each respectively disposed on oppositely facing sides thereof. The grooves **34** on each side of the main body **30** are covered by a plate **36**, and extending about the main body **30** and the plate **36** is a jacket **38** of ininsulating material. At the bottom of the heater is a plate **40** which carries a set of two eyelets **41** on the inlet side thereof each aligned with one of the grooves **34**, and a set of two eyelets **42** on the outlet side thereof each aligned with one of the grooves **34**. At the top of the heater is a plate **44** which carries a set of four eyelets **46**, each aligned with one of the grooves **34**. The central opening **32** accommodates a heating coil **48** energized by means of wire leads **50** connected to a suitable source of electric current (not shown).

Adjustably fixed to the base of the heater and depending therefrom is a plate **52** to which is affixed a twist limiting stop plate **54**. The plate **54** may be of any desired thickness. However, the longitudinally extending marginal portion **55** thereof preferably is provided with square edges, designated **57**.

Referring particularly to FIGS. 1 and 4, the false twist device **14** comprises a pulley **56**, a pulley **58** and a friction belt **60** arranged in such manner that through the belt **60** pulley **56** drives pulley **58**. The belt **60** is circular in transverse section. The device **14** also includes a bracket **62** of U-shape in transverse section. The belt **60** is disposed between the upright arms of the bracket, respectively designated **64** and **66**. The arm **64** mounts a pair of laterally spaced eyelets **68**, and the arm **66** mounts a pair of laterally spaced eyelets **70** respectively aligned with the eyelets **68**.

The tension reducing device **16** includes a roller **72** underlying a member **74** of inverted U-shape and mounting a pair of laterally spaced eyelets **76** and a pair of laterally spaced eyelets **78** respectively aligned with the eyelets **76**. The member **74** is carried by a rod **80** suspended from a tension spring **82** and extending through the coil of a stationarily mounted solenoid **84**. The tension reducing device **16** basically is the same as that disclosed in my Pat. No. 3,377,672, issued Apr. 16, 1968, to which reference may be had for a fuller description of its construction and operation.

Two ends of untwisted monofilament or multifilament yarn, respectively designated A and B, are drawn from yarn packages (not shown) and threaded through the apparatus. The yarn ends are threaded through the eyelets **22**, passed downwardly along the standards **18** and threaded through the rings **20**. Then they are passed under the roller **17** in contact therewith, threaded through the rings **26**, passed upwardly along the standards **24** and threaded through the eyelets **28**. Next the yarn ends are looped through the heater **12**, being passed upwardly through the eyelets **41**, the grooves **34** and the eyelets **46** on the inlet side of the heater, then downwardly through the eyelets **46**, grooves **34** and eyelets

42 on the outlet side of the heater. When the yarn ends issue from the eyelets 42, they are turned sharply to one side and trained along the upper surface of the plate 54, about the edges 57, fully in contact therewith, and along the undersurface of the plate 54 to the false twist device 14. It will be noted that the portion of the yarn path extending about the plate 54 is substantially in the form of a square loop. At the false twist device, the yarns are threaded respectively through the eyelet 68. Then yarn A is passed over the upper run of the belt 60 in contact therewith, and the yarn B is passed under the upper run of the belt 60 in contact therewith. Next, the yarns are threaded respectively through the eyelets 70 and extended to the tension reducing device 16. At the tension reducing device, the yarns are threaded respectively through the eyelets 76, passed over the roller 72 in contact therewith and then threaded respectively through the eyelets 78, from whence they extend directly to a circular knitting machine or other utility (not shown).

The roller 17 turns in yarn advancing direction at a speed which exceeds the linear speed of the yarn ends. Tension in the yarn is induced by resistance to movement of the yarn over the edges 57 of the plate 54. The yarn between the tension leveling device 10 and the utility will be predetermined in length for a desired yarn tension. With respect to each individual yarn A and B, when said length increases, the rings 20 and 26 are lowered, removing some of the yarn from engagement with the roller 17 and increasing slippage between the roller 17 and the yarn. Thus the amount of yarn passing under the roller 17 is reduced and the yarn between the tension leveling device and the utility is restored to its initial length. When said length decreases, the rings 20 and 26 are raised, causing a greater length of yarn to engage the roller 17 and decreasing slippage between the roller 17 and the yarn. Thus the amount of yarn passing under the roller 17 is increased and the length of yarn between the tension leveling device and the utility is restored to its initial length.

The yarn tension on the downstream side of the plate 54 may be too high for the utility to which the yarn is being fed. Therefore, for best results, it should be reduced just before the yarn reaches the utility. To this end, the roller 72 turns in yarn advancing direction at a speed in excess of the linear speed of the yarn. If it is not desired to reduce the tension, the solenoid 84 is deenergized, whereupon the spring 82 raises the rod 80 and member 74 to a position for holding the yarn out of contact with the roller 72.

In view of the foregoing, it will be appreciated that, except for the use of the false twist device 14 interposed between the heater 12 and tension reducing device 16, the apparatus as a whole basically is the same as that disclosed in my Pat. No. 3,377,672, issued Apr. 16, 1968, to which reference may be had generally for details of construction and principles of operation. Critical differences in the manner of operation of the apparatus, resulting from substitution of the twist limiting stop plate 54 for the sharp edged blade of my said patent, and from interposition of the false twist device 14 between the plate 54 and the tension reducing device 16, will now be pointed out.

Referring particularly to FIGS. 1 and 4, as noted hereinabove, the yarns A and B are trained respectively over and under the upper run of the belt 60, as a consequence of which the yarns are twisted in opposite directions, each about its central axis, as will be understood by those skilled in the art. The twist in the yarn extends upstream from the false twist device 14 to the plate 54. The twist zone may be of any selected short length, but preferably is in the order of seven inches long. It will be evident that if the plate 54 is to function for the purpose intended, i.e., for restricting the twist in the yarn to the downstream side of the plate 54, the

tension in the yarn must be such that the yarn is drawn firmly about the plate 54. Any significant drop in yarn tension would render the plate 54 ineffective and cause the twist in the yarn to extend up into the heater 12. Then tension leveler 10, exercising tight control over yarn tension, effectively functions to prevent any such occurrence by maintaining the yarn tension uniform. Restriction of the twist zone to the downstream side of the plate 54 is advantageous because, for the production of false twisted yarn superior in quality, the yarn should be passed through the heater before being subjected to twisting.

As pointed out hereinabove, the twist zone is very short—in the order of seven inches long. As a consequence, no significant cooling of the yarn occurs in the twist zone, and the yarn is twisted before it has a chance to cool off. This makes it possible to effectively twist the yarn to an uncommonly high degree, considering the rate of processing—200 to 250 yards per minute for yarn processed and fed directly to a circular hosiery knitting machine, and a good deal higher when the utility is capable of taking up the yarn at a higher rate. Such yarn may be made into a fabric which has unusual stretchability and smoothness. The following table gives examples of highly twisted nylon yarns produced by the method and apparatus of this invention:

Type yarn		Rate of yarn movement, y.p.m.	Effective length of heater, inches	Temp. of heater-degrees F.	No. of twists per inch
Denier	No. of filaments				
15	1	225	28	360	80
15	3	225	28	400	110-120
21	3	225	28	410	88
40	13	225	28	440	68

As indicated hereinbefore, yarn processed by the apparatus and method of this invention has unusual stretchability. The results of tests made to illustrate this stretchability are given in the following table, wherein yarn made by the apparatus and method of this invention is indicated "Spurgeon" yarn. Skeins of yarn processed by selected producers and each carrying a weight of 3¼ grams on the lower end thereof were suspended in water at a temperature of 140° F. and the resulting shrinkage noted. Then the same thing was done using comparable yarns processed by the apparatus and method of this invention.

Produced by	Denier/ filaments	Length of skein in inches		Shrinkage in inches
		Initial	Final	
Chemstraud	15-3	27	12	15
Spurgeon	15-3	27	4	23
Sanquoit	21-3	27	6	21
Spurgeon	21-3	26	3	24
Enka	15-1	27	18	9
Spurgeon	15-1	27	7½	19½

As indicated hereinabove, the effective cooling zone is on the downstream side of the false twist device. This makes it possible to arrange the apparatus in a manner sufficiently compact to permit mounting the same in relation to a circular knitting machine or other utility so that the textured yarn may be fed directly to the utility.

What is claimed is:

1. In a method of false twisting a continuous thermoplastic yarn, the steps comprising

(A) drawing continuous filament thermoplastic yarn from a source thereof to a utility across a pair of edges, the yarn approaching the first of said edges, withdrawing from said first edge and approaching the second of said edges, and withdrawing from said second edge moving along a portion of the yarn path substantially in the shape of a square loop,

(B) restraining said yarn to hold it against said edges and to induce predetermined tension in said yarn when a predetermined length of said yarn extends

from said utility to a location upstream of said edges,

(C) compensating for variations in the length of the yarn extending from said utility to said location whereby to maintain the same uniform,

(D) heating the yarn in the portion of the yarn path upstream from said edges to a temperature sufficient to plasticize but insufficient to melt said yarn, and

(E) frictionally clutching said yarn at a point intermediate the second of said edges and said utility and thereby turning said yarn about its axis whereby to twist in one direction the portion thereof extending upstream from said point to the second of said edges, and whereby to turn in the opposite direction the portion thereof extending downstream from said point to said utility.

2. The method according to claim **1** wherein the yarn is constantly maintained in such firm engagement with the pair of edges over which it is drawn that the latter effectively limit the twist induced in the yarn to the downstream side of said edges.

3. The method according to claim **2** wherein the yarn heated is in that portion of the yarn path immediately upstream from the pair of edges over which the yarn is drawn.

4. The method according to claim **1** wherein the heating and twisting zones are separate but adjacent to each other, and the twisting zone is of such short length that the yarn is not cooled to any significant degree while passing therethrough.

5. The combination comprising

(A) a source of yarn,

(B) a utility operable at least periodically for continiuously drawing yarn from said source,

(C) a member provided with a pair of edges,

(D) means for training said yarn over said edges for movement thereof along a portion of the yarn path in the shape or a substantially square loop,

(E) tension leveling means between said yarn source and edged member, said edged member being responsive to a predetermined yarn length between said tension leveling means and utility for developing

resistance to movement of said yarn over said edged member whereby to induce a predetermined tension in the yarn on the downstream side of said edged member, said tension leveling means being operative for maintaining the length of yarn between said tension leveling means and utility uniform,

(F) a heater interposed between said tension leveling device and edged member and operable for heating the yarn to a temperature sufficient to plasticize but insufficient to melt said yarn, and

(G) means interposed between said edged member and utility for frictionally gripping the yarn and twisting the same.

6. The combination according to claim **5** wherein the edges about which the yarn is trained are those of a substantially thick plate member.

7. The combination according to claim **6** wherein the edged plate member is stationarily mounted close adjacent the point at which the yarn issues from the heater.

8. The combination according to claim **7** wherein the edged plate extends across an opening in the heater through which the yarn issues, and the edges over which the yarn is drawn are disposed a substantial distance to one side of said opening.

9. The combination according to claim **5** wherein the yarn gripping and twisting means is spaced from but disposed close to the edges about which the yarn is trained.

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DONALD E. WATKINS, Primary Examiner

U.S. Cl. X.R.

57—106, 157 TS

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,626,682 Dated December 14, 1971

Inventor(s) RICHARD C. SPURGEON

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, lines 49 and 50, "entirely" should read --entirety--.

Column 2, line 20, delete completely "in-".

Column 4, line 5, change "Then" to --The--; Column 4, line 53, that portion of the table under the heading Length of skein in inches, sub-heading Initial, change the numeral "26" to --27--.

Column 5, line 37, change "or" to --of--.

Signed and sealed this 16th day of May 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

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