

[54] TEXTURING YARNS BY FALSE TWISTING

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[51] Int. Cl. D02g 1/02

[58] Field of Search 57/34 HS, 157 TS,
57/34 AT, 157 MS, 140 R

[56] References Cited
UNITED STATES PATENTS

3,166,881	1/1965	Servage.....	57/34
3,379,003	4/1968	Kanbar.....	57/157 TS
3,422,616	1/1969	Felix	57/157
3,543,505	12/1970	Stutz	57/157 TS
2,463,620	3/1949	Heberlein.....	57/157 TS X

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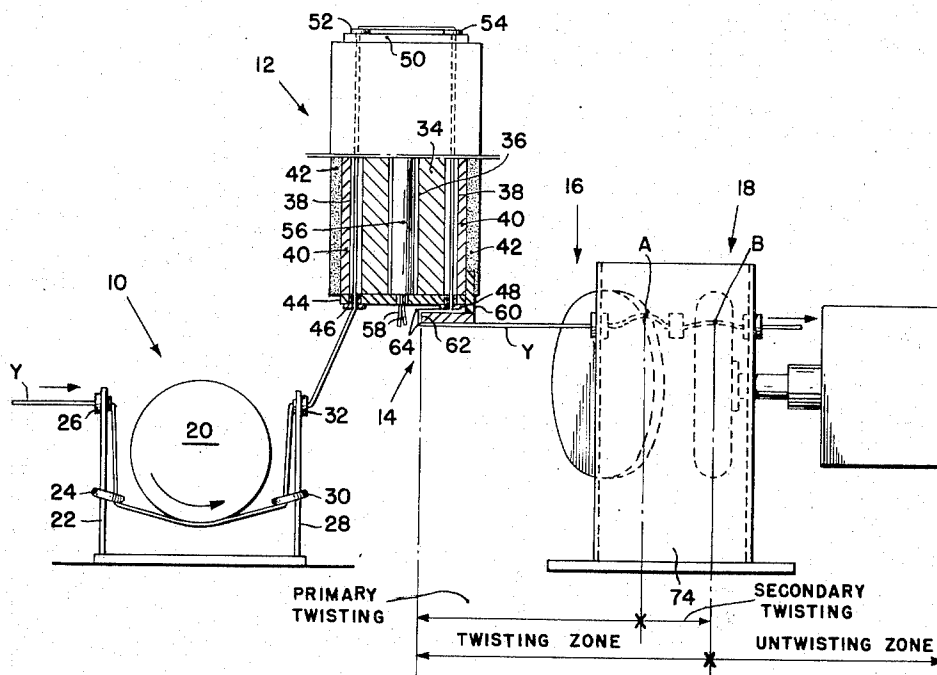
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[57] ABSTRACT

Untextured yarn is drawn from a producer's package, threaded through apparatus comprising a tension leveling device, an electric heater and a false twist device and, having been textured thereby, is wound on yarn take-up means. Close to the yarn exit from the heater is a twist stop device which effectively restricts twisting of the yarn to the downstream side thereof, and close to the downstream side of the false twist device is a check device which effectively restricts to the downstream side thereof the tendency of the yarn to relax due to untwisting thereof.

10 Claims, 6 Drawing Figures



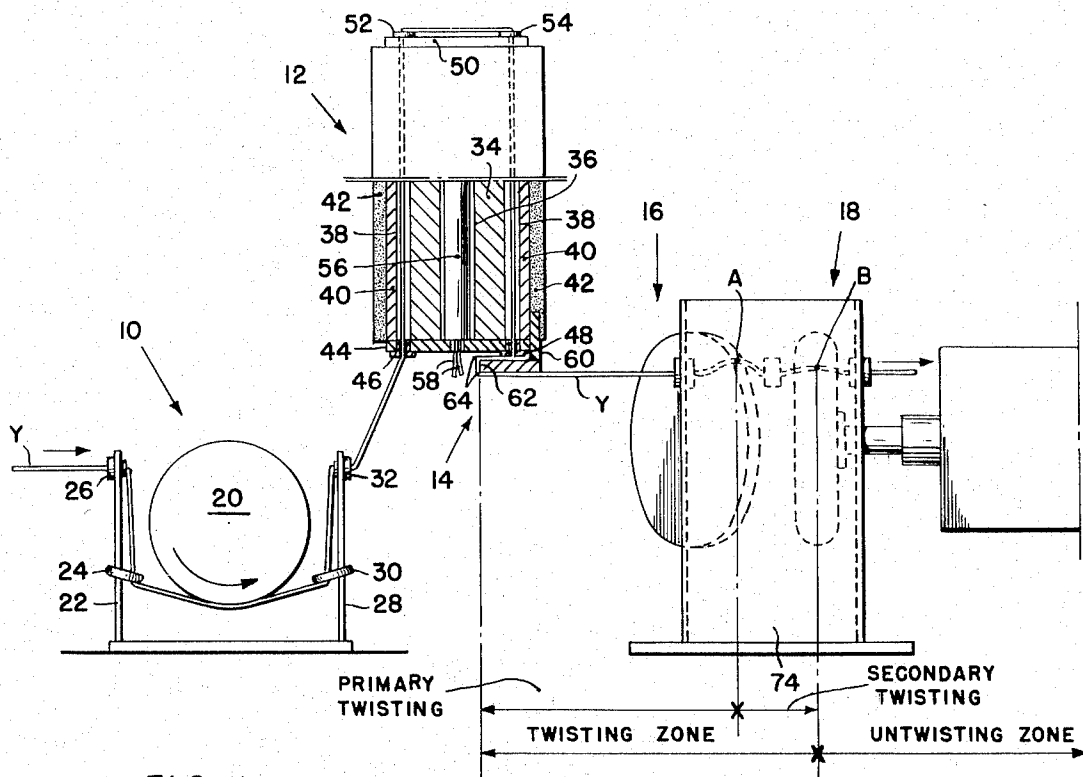


FIG. 1.

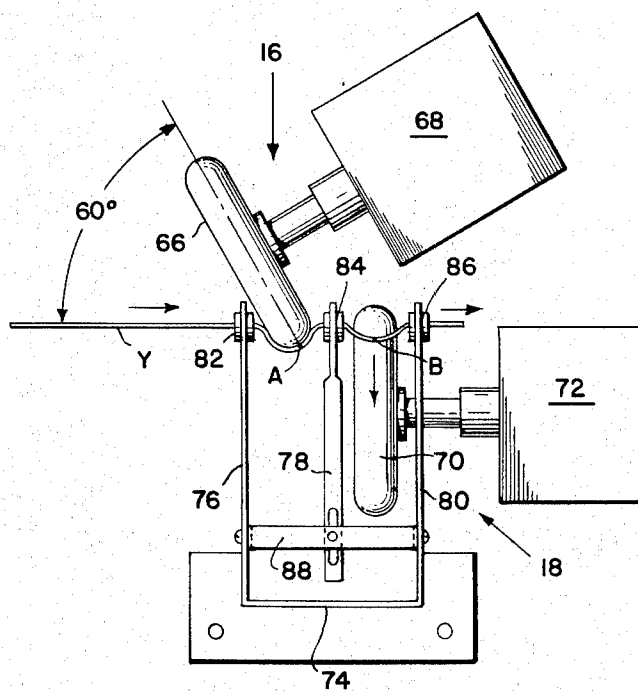
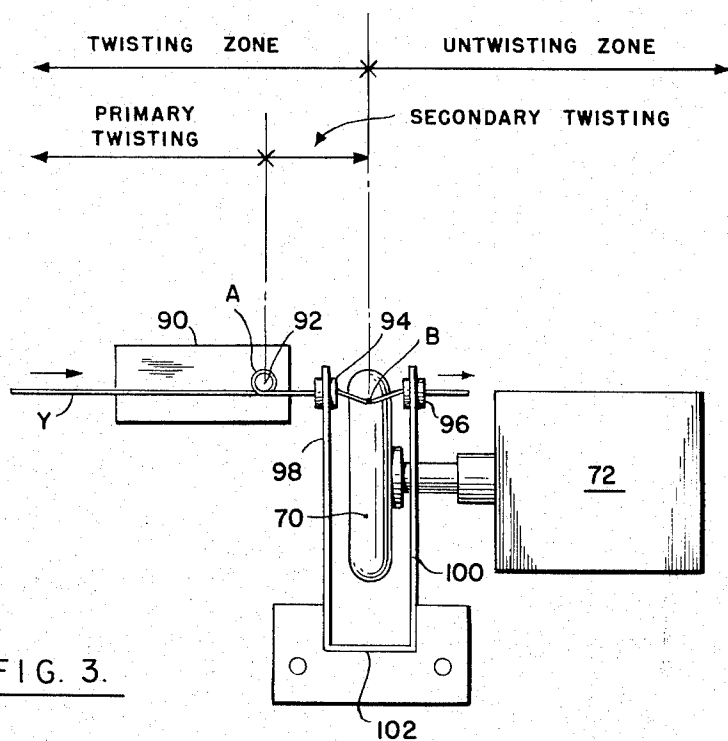


FIG. 2.

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A	DuPont	21-3-141	
B			
C	Monsanto	21-3-480	
D	Rehm + Haas	21-3-	
E	Turbo Duo	21-4	
F	Spurgeon	21-3	66 200TPI
G	Spurgeon	18-4	66 400TPI
H	Spurgeon	20-3	6 360TPI
	Spurgeon	15-3	66 400TPI

FIG. 4.

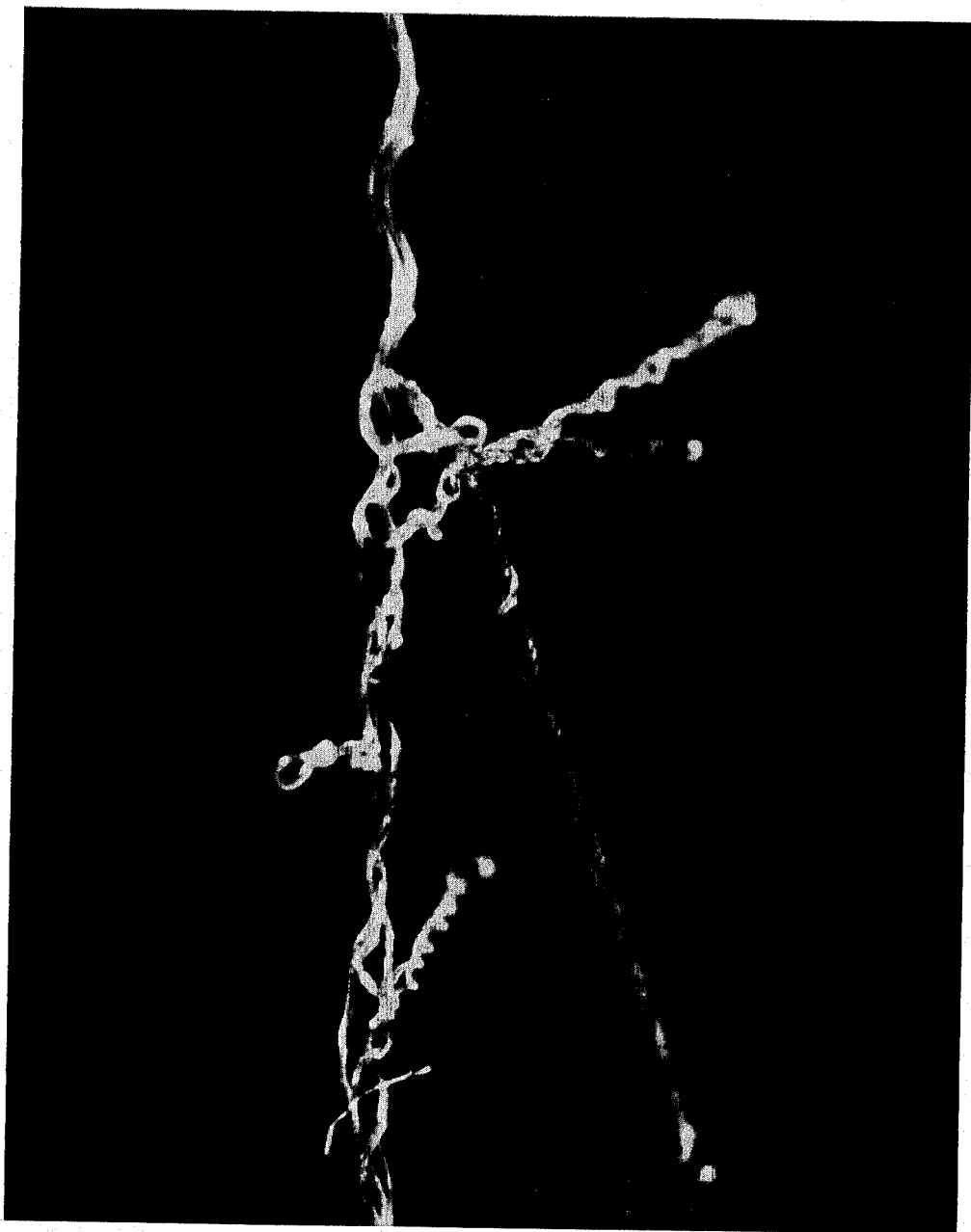


FIG. 5.

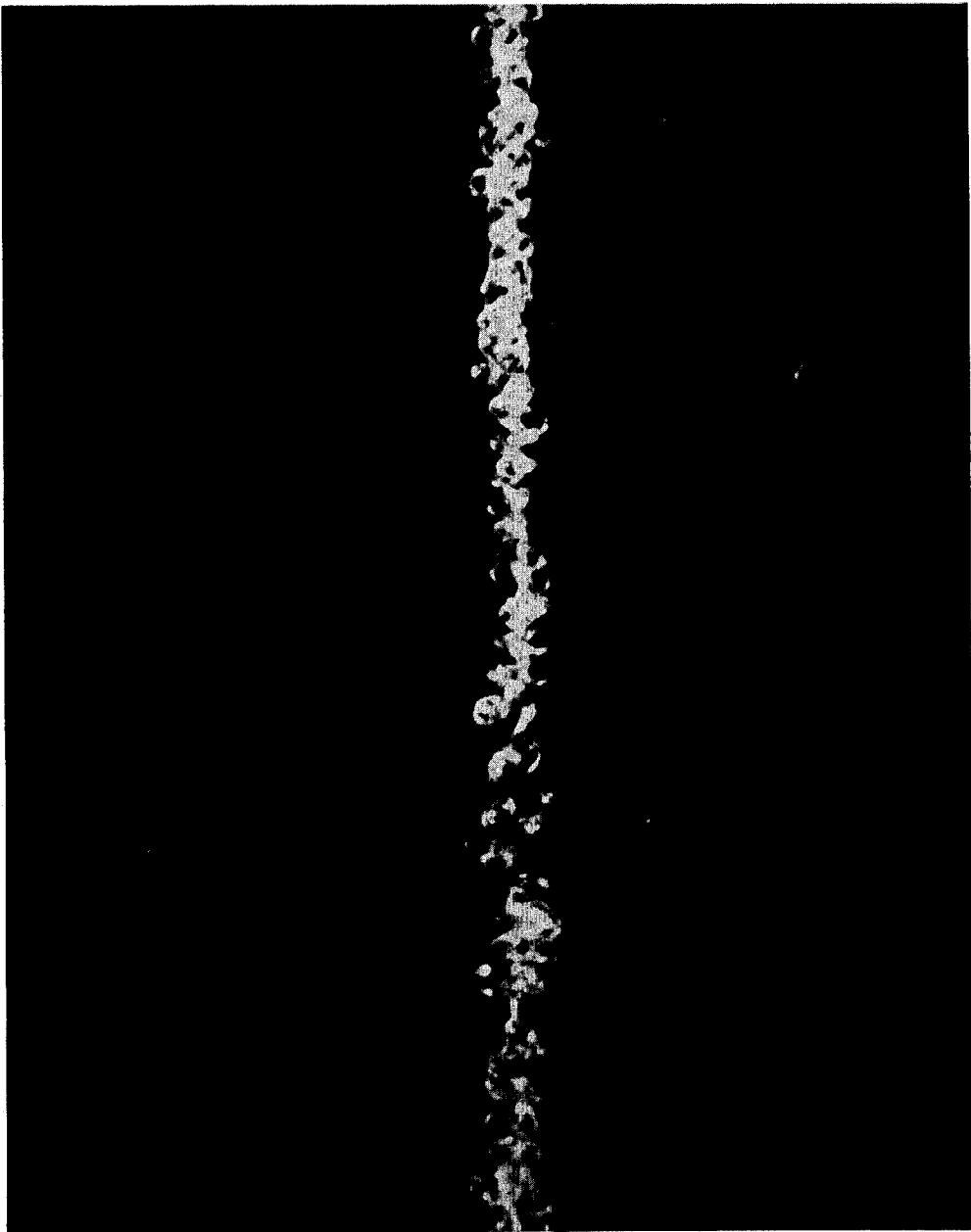


FIG. 6.

TEXTURING YARNS BY FALSE TWISTING

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the texturing of yarn by false twisting.

2. Description of the Prior Art

Yarn textured as taught by my pending application for U. S. Letters Patent, Ser. No. 36,975, filed May 13, 1970 now U.S. Pat. No. 3,626,682, is not entirely satisfactory because it is not twisted throughout its entire length with the greatest degree of uniformity. The reason is that the yarn is twisted on the upstream side of the false twist device and untwisted on the downstream side of the false twist device. Incident to untwisting, the yarn is elongated and relaxed, and this elongation and relaxation reaches upstream past the false twist device into the twisted yarn segment, thereby affecting the tension in the twisted yarn segment. Since the degree of elongation and relaxation varies, it follows that the effect on the tension in the twisted yarn segment varies. The result is that the yarn is not twisted to the desired degree of uniformity throughout its entire length. This lack of uniformity makes the textured yarn hispidulous, i.e., replete with spike or bristle-like formations which are clearly visible to the naked eye, and gives fabrics made thereof a comparatively rough hand and appearance. The lack of uniformity results in glaring thick and thin spots in the courses of the fabric. When false twist textured yarn is used to knit ladies' stockings, the fabric is literally covered with the protruding spike or bristle-like formations. These formations are not flattering to the wearer. In addition, they cause discomforting skin itching. Furthermore, such fabrics tend to have a comparatively short useful life because the formations extend above the surface of the fabric and are prone to catch and pull out the thread so caught, or the thread so caught may break and cause a runner.

SUMMARY OF THE INVENTION

A principal object of the present invention is to provide a method of texturing continuous multifilament thermoplastic yarn by false twisting wherein both the upstream reach of the twist and upstream reach of the tendency of the yarn to relax due to untwisting thereof are stopped or checked at locations fixed in the yarn path.

Another object of the present invention is to provide such method of texturing yarn characterized by control of the yarn in a manner effective for maintaining the twisted yarn segment constant in length.

Still another object of the present invention is to provide such a method of texturing yarn characterized by uniformity of twisting such that when relaxed the textured yarn will not become hispidulous, i.e., will not become replete with spike or bristle-like formations.

Another object of the present invention is to provide a false twisted continuous multifilament thermoplastic yarn completely free of spike or bristle-like formations from which there may be made a fabric having a suede-like hand and correspondingly attractive appearance.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevation diagrammatically showing apparatus which may be used to practice the method of the invention;

FIG. 2 is a plan view showing the false twist and check devices of FIG. 1;

FIG. 3 is similar to FIG. 2 but a conventional false twist spindle is shown instead of the false twist device in FIG. 2;

FIG. 4 is a photograph showing two sets of continuous multifilament thermoplastic yarns textured by false twisting and clearly illustrating the difference between commercially available false twisted yarns and yarns textured by the method of the present invention;

FIG. 5 is a photographic enlargement of a commercially available continuous multifilament thermoplastic yarn textured by false twisting; and

FIG. 6 is a photographic enlargement of a continuous multifilament thermoplastic yarn textured by false twisting in accordance with the method of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring particularly to FIGS. 1 and 2, the apparatus shown includes a tension leveling device 10, an electric heater 12, a twist stop device 14, a false twist device 16, and a check device 18.

The tension leveling device 10 includes a roller 20. To the left of the roller 20 is a standard 22 embraced by a ring 24 and provided with an eyelet 26 at the head thereof, and to the right of the roller 20 is a second standard 28 embraced by a ring 30 and provided with an eyelet 32 at the head thereof. Reference may be had to my U. S. 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 FIG. 1, the heater 12 comprises a main body 34 with a longitudinally extending central opening 36 and two longitudinally extending grooves 38 respectively disposed on oppositely facing sides thereof. The groove 38 on each side of the main body 34 is covered by a plate 40, and extending about the main body 34 and the plates 40 is a jacket 42 of insulating material. At the bottom of the heater is a plate 44 which carries an eyelet 46 on the inlet side thereof aligned with the associated groove 38 and an eyelet 48 on the outlet side thereof aligned with the associated groove 38. At the top of the heater is a plate 50 which carries an eyelet 52 on the inlet side thereof aligned with the associated groove 38 and an eyelet 54 on the outlet side thereof aligned with the associated groove 38. The central opening 36 accommodates a heating coil 56 energized by means of wire leads 58 connected to a suitable source of electric current (not shown).

Adjustably fixed to the base of the heater and depending therefrom is a plate 60 to which is affixed the twist stop device 14. The device 14 is in the form of a plate, which may be of any desired thickness. However, the longitudinally extending marginal portion 62 thereof preferably is provided with square edges, designated 64.

Referring particularly to FIGS. 1 and 2, the false twist device 16 comprises a rubber rimmed friction disc 66 approximately four inches in diameter mounted upon the shaft of an electric motor 68. The disc 66 may be disposed normal to the line of movement of the yarn, but preferably it is disposed at an angle of approximately 60° relative thereto, as shown in FIG. 2.

Again referring particularly to FIGS. 1 and 2, the check device 18 comprises a rubber rimmed friction

disc 70, similar to the disc 66, mounted upon the shaft of an electric motor 72. The disc 70 is disposed normal to the line of movement of the yarn.

For holding the yarn to the rim of the discs 66 and 70 an upright frame, generally designated 74, is provided. The frame mounts three horizontally extending laterally spaced parallel arms 76, 78 and 80 respectively carrying eyelets 82, 84 and 86. The arms 76 and 80 are fixed in position while the arm 78 is suitably mounted upon a bracket 88 for being positionally adjusted as required relative to the arms 76 and 80.

An end of untextured multifilament yarn, designated Y, is drawn from a yarn package (not shown) and threaded through the eyelet 26, passed downwardly along the standard 22 and threaded through the ring 24. Then it is passed under the roller 20 in contact therewith, threaded through the ring 30, passed upwardly along the standard 28 and threaded through the eyelet 32. Next, the yarn end is looped through the heater 12, being passed upwardly through the eyelet 46, the groove 38 and the eyelet 52 on the inlet side of the heater, then downwardly through the eyelet 54, groove 38 and eyelet 48 on the outlet side of the heater. When the yarn end issues from the eyelet 48, it is turned sharply to one side and trained along the upper surface of the stop plate 14, about the edges 64 thereof, fully in contact therewith, and along the undersurface of the stop plate 14 toward the false twist device 16. It will be noted that the portion of the yarn path extending about the stop plate 14 is substantially in the form of a square loop. At the false twist device, the yarn end is passed through the eyelets 82, 84 and 86, which are positioned to bring the yarn end into contact with the rim of the friction disc 66 of the false twist device and the rim of the friction disc 70 of the check device, as shown. From the eyelet 86, the yarn end goes to a yarn take-up means, which may be in the form of a conventional ring and traveler array (not shown).

The roller 20 turns in yarn advancing direction at a speed which exceeds the linear speed of the yarn end. Tension in the yarn is induced by resistance to movement of the yarn over the edges 64 of the stop plate 14. The yarn between the tension leveling device 10 and the yarn take-up means will be predetermined in length for a desired yarn tension. When said length increases, the rings 24 and 30 are lowered, removing some of the yarn from engagement with the roller 20 and increasing slippage between the roller 20 and the yarn end. Thus the amount of yarn passing under the roller 20 is reduced and the yarn between the tension leveling device and the yarn take-up means is restored to its initial length. When said length decreases, the rings 24 and 30 are raised, causing a greater length of yarn to engage the roller 20 and decreasing slippage between the roller 20 and the yarn end. Thus the amount of yarn passing under the roller 20 is increased and the length of yarn between the tension leveling device and the yarn take-up means is restored to its initial length.

In view of the foregoing, it will be appreciated that insofar as the tension leveling device 10, the heater 12 and the twist stop device 14 are concerned, the apparatus is similar in construction and operation to that disclosed in my pending application, Ser. No. 36,975, filed May 13, 1970, to which reference may be had for further details of construction and principles of operation. Critical differences in the manner of operation of the apparatus as a whole resulting from elimination of the

false twist and tension reducing devices of my pending application and introduction of the false twist device 16 and check device 18 will now be pointed out.

Referring particularly to FIGS. 1 and 2, as noted hereinabove, the yarn end Y is trained over the rims of the friction discs 66 and 70. The discs turn in the same direction at the same rate, making 3,450 r.p.m. As a consequence, the yarn end is twisted about its central axis, as will be understood by those skilled in the art. The twist extends upstream to the stop device or plate 14. 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 stop plate 14 is to function for the purpose intended, i.e., for restricting the twist in the yarn end to the downstream side of the plate 14, yarn tension must be such that the yarn end is drawn firmly about the plate 14. Any significant drop in yarn tension would render the plate 14 ineffective and cause the twist to extend or reach upstream into the heater 12. The tension leveler 10, exercising tight control over yarn tension, effectively functions to prevent any such occurrence by maintaining yarn tension uniform. Restriction of the twist zone to the downstream side of the plate 14 is advantageous because the yarn should be heated and thereby stress-relieved before being subjected to twisting. Stress-relieving the yarn end before attempting to twist it contributes significantly to uniformity of the twist in the finished product.

Referring particularly to FIG. 2, in the absence of friction disc 70, the terminal at which twisting ends and untwisting begins, designated A, is on the crest of the rim of friction disc 66, which applies the primary twist effort. I have found that relaxation and elongation of the yarn due to untwisting thereof tends to reach upstream past the rim of friction disc 66, affecting tension in the twisted yarn segment. The degree of relaxation and elongation varies, as a consequence of which the degree to which tension in the twisted yarn segment is affected varies. This contributes significantly to lack of uniformity of the twist in the finished product. The function of the check device, i.e., the friction disc 70, is to keep relaxation and elongation of the yarn due to untwisting thereof from reaching upstream into the twisted yarn segment.

The tendency for the yarn to untwist begins at point A, on the crest of the rim of the friction disc 66. However, the yarn segment between the friction discs 66 and 70 cannot untwist because the tendency to do so is cancelled out by the action of friction disc 70, which applies a secondary twist effort that operates to immediately put the twist back in again. The yarn segment downstream from the friction discs 70 not only has a tendency to untwist, but it does in fact do so, thereby being somewhat elongated and relaxed. This tendency for the yarn to elongate and relax in response to untwisting tends to reach upstream past the point B, on the crest of the rim of the friction disc 70, but it is prevented from doing so by twisting of the yarn segment extending between the friction discs 66 and 70 as aforesaid, and also by the friction generated by linear movement of the yarn over the rim of the friction disc 70 in contact therewith. It will be appreciated that not only is the terminal at which twisting ends and untwisting begins fixed in the yarn path at point B, but, in addition, since the upstream reach of the twisted yarn segment is fixed in the yarn path at the twist stop device or plate 14 and the upstream reach of the tendency of the yarn

to relax due to untwisting thereof is fixed in the yarn path at point B, the length of the twisted yarn segment is maintained uniform.

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 at which it is processed, which is 500 yards per minute. The following table gives examples of highly twisted yarn produced by the method of this invention:

Denier	No. of Filaments	Type	Length of heater inches	Temp. of heater °F.	No. of twists per inch
15	3	6	28	350	440
20	3	6	"	350	350
15	3	6'6	"	410	350
18	4	6'6	"	410	300
21	3	6'6	"	430	250
150	34	Poly-ester	84	430	150

Referring particularly to FIG. 4, the four topmost yarns, designated A, B, C and D, are producer's textured yarns. In each case the manufacturer is identified and the denier and number of filaments are noted. The four lowermost yarns, designated E, F, G and H, are Spurgeon yarns, textured by the method of the present invention. In each case the denier and number of filaments are noted. With regard to the producer's textured yarns, which are examples of the best false twisted yarns on the market today, it will be noted that they are hispidulous, i.e., replete with spike or bristle-like formations. On the other hand, with regard to the yarns textured by the method of the present invention, spikes or bristle-like formations are conspicuous by their absence. The spike or bristle-like formations characteristic of the producer's textured yarns are caused by lack of uniformity in the twisting process. The failure to stress-relieve the yarn before twisting it contributes substantially to lack of uniformity. But a principal reason for the lack of uniformity is failure to prevent the tendency of the yarn to untwist from reaching upstream and affecting the tension in the twisted yarn segment.

Referring particularly to the enlarged photograph denoted FIG. 5, the spike and bristle-like formations characteristic of DuPont 21-Denier, 3-Filament nylon yarn is clearly illustrated, and referring particularly to the enlarged photograph denoted FIG. 6, the characteristic absence of such spike or bristle-like formations in Spurgeon 21-Denier, 3-Filament nylon yarn is clearly illustrated.

It will be appreciated that a yarn textured in accordance with the method of the present invention makes a fabric which has an unusually fine, suede-like hand and a correspondingly attractive appearance. In addition, such a fabric is stretchable and has elastic properties equal to and in most cases exceeding those of other fabrics made of known producer's textured false twist yarn.

Now referring particularly to FIG. 3, which shows a conventional false twist spindle, generally designated 90, substituted for the false twist friction disc 66 of

FIG. 1, the yarn end Y from the twist stop plate 14 extends into the false twist spindle 90, is trained about the pin 92 and continues through the spindle to and through eyelets 94 and 96 respectively carried by arms 98 and 100 extending from an upright bracket or frame 102. The eyelets 94 and 96 hold the yarn end Y to the rim of the friction disc 70.

It will be appreciated that with this modified form of the apparatus, the primary twisting effort is applied to the yarn end Y by means of the false twist spindle 90, while the secondary twisting effort is applied by the friction disc 70. It will be understood that the twisted yarn segment extends from the twist stop plate 14 downstream to the point B. In view of the detailed description of the method of this invention as practiced by use of the apparatus described above and shown in FIG. 1, it would seem superfluous to go into further detail in describing the method of the invention as practiced by use of this modified form of the apparatus.

Having thus described my invention, what I desire to claim and secure by Letters Patent is:

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

- drawing such a yarn from a source thereof successively through heating, twisting and untwisting zones to yarn take-up means,
- elevating the temperature of the yarn as it passes through the heating zone sufficiently to plasticize but insufficiently to melt the yarn whereby to stress-relieve the same,
- applying a primary twisting effort to the yarn thereby to twist the stress-relieved yarn in one direction as it passes through the twisting zone,
- turning the twisted yarn in the opposite direction as it passes through the untwisting zone whereby to cancel out or remove the twist and relieve the tension induced by said twisting effort,
- effectively stopping the twist at a non-floating terminal positionally fixed in the yarn path at a first point the location of which is such that none of the twist reaches upstream into the heating zone,
- checking the upstream reach of the tendency of the yarn to relax due to untwisting thereof at a non-floating terminal positionally fixed in the yarn path at a second point the location of which is a predetermined fixed distance from the first point aforesaid,
- restraining said yarn to induce predetermined tension therein when a predetermined length of said yarn extends from said yarn take-up means to a location upstream from the upstream one of said terminals, and
- compensating for variations in the length of the yarn extending from said yarn take-up means to said location whereby to maintain the same uniform.

2. The method according to claim 1 wherein stopping the upstream reach of the twist is effected by drawing the yarn 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.

3. The method according to claim 2 wherein the yarn is constantly maintained in such firm engagement with the pair of edges over which it is drawn that the latter

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effectively limit the twist induced in the yarn to the downstream side of said edges.

4. The method according to claim 3 wherein the portion of the heating zone in which the yarn is stress-relieved is in that portion of the yarn path immediately upstream from the pair of edges over which the yarn is drawn.

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

6. The method according to claim 1 wherein checking the upstream reach of the tendency of the yarn to relax due to untwisting thereof is effected by applying a secondary twisting effort in the same direction in which the primary twisting effort is applied by frictionally clutching the yarn at a location closely adjacent and on the downstream side of the location at which the primary twisting effort is applied.

7. The method according to claim 6 wherein frictional clutching of the yarn is effective to restrict yarn movement in the upstream direction sufficiently to ef-

fectively limit relaxation of the yarn due to untwisting thereof to the downstream side of the location at which the yarn is frictionally clutched and the secondary twist is applied.

8. The method according to claim 7 wherein the yarn is frictionally clutched at two separate close spaced locations and primary and secondary twisting efforts are applied thereto, and the twisted segment of yarn includes the short length of yarn which extends between said locations.

9. The method according to claim 7 wherein the primary twisting effort is applied by means of a conventional false twist spindle, a friction disc frictionally clutches the yarn to resist movement thereof in the upstream direction, and the twisted segment of yarn includes the short length of yarn from the friction disc upstream to the pin of the conventional false twist spindle.

10. A continuous multifilament thermoplastic false twist stretch yarn textured in accordance with the method of claim 1.

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