

Aug. 26, 1969

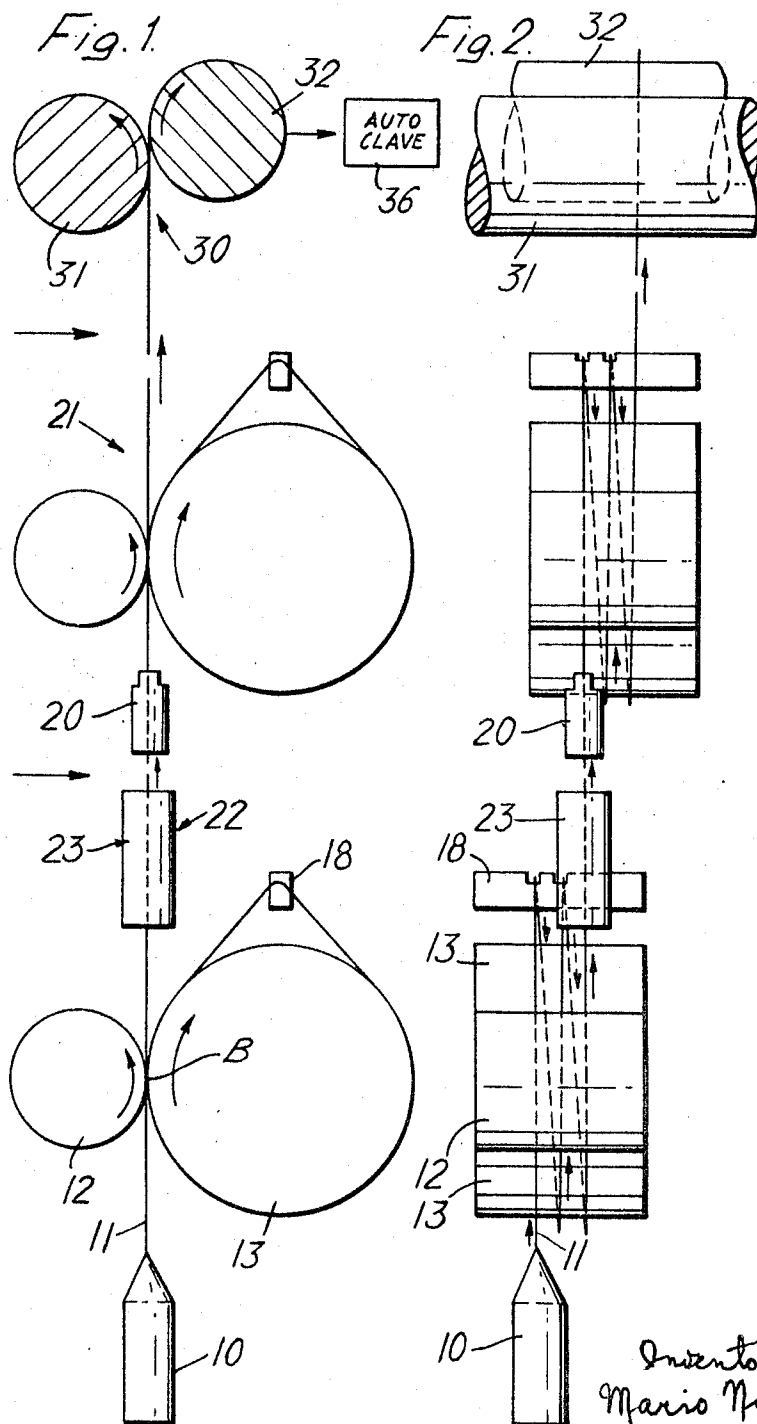
M. NAVA

3,462,933

FALSE TWIST CRIMPING APPARATUS

Original Filed Oct. 2, 1963

2 Sheets-Sheet 1



Inventor:
Mario Nava
by Michael S. Striker,
Attorney

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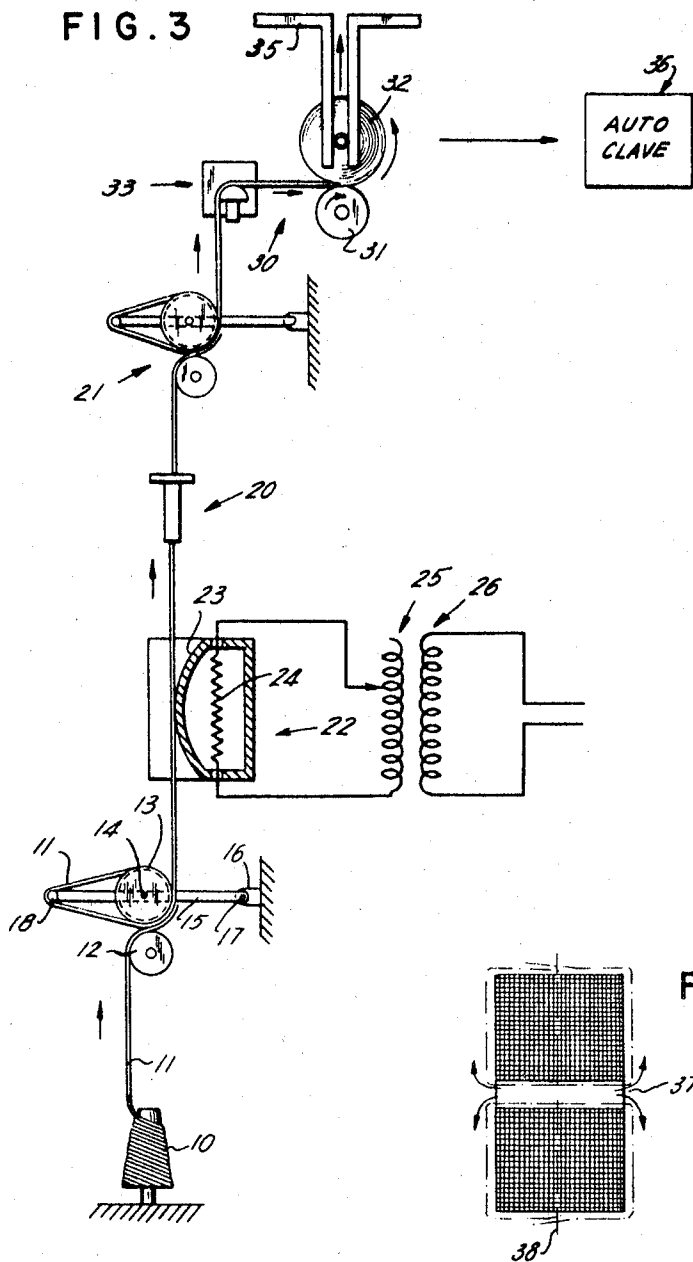
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INVENTOR
MARIO NAVA

B, *Michael S. Steen*
ATTORNEY

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FALSE TWIST CRIMPING APPARATUS

Mario Nava, Manderley, Castle Hill, Prestbury, England, assignor, by mesne assignments, to The Mecasta Corporation, Raleigh, N.C., a corporation of North Carolina

Application May 31, 1966, Ser. No. 554,209, now Patent No. 3,316,705, dated May 2, 1967, which is a continuation of application Ser. No. 313,392, Oct. 2, 1963, which is a continuation-in-part of application Ser. No. 12,536, Mar. 8, 1960. Divided and this application Mar. 27, 1967, Ser. No. 626,230

Claims priority, application Great Britain, May 13, 1958, 15,240/58

Int. Cl. D01h 13/26; D02g 3/00

U.S. Cl. 57—34

15 Claims

ABSTRACT OF THE DISCLOSURE

False twisting means false-twists a thermoplastic yarn while the same is maintained at a relatively low temperature below its melting point. This results in a partially set false twist crimped yarn having a high contractibility exceeding 50%. Delivery means is operatively associated with the false twisting means for delivering the yarn from the same at a predetermined speed. Collecting means is operatively associated with the delivery means for collecting the thus delivered yarn on a take-up package, but at a speed less than the predetermined delivery speed so that the tension of the yarn is reduced while, however, the yarn is still maintained under substantial tension when it reaches the take-up package. Finally, setting means is provided for treating the thus wound-up yarn with a setting fluid for a given period of time so as to complete the setting of the yarn, thus obtaining a relaxed false twist crimped yarn which has only a low contractibility of substantially less than 50%, has substantial dimensional stability and is substantially of the non-torque type while being almost as highly bulked as fully twist crimped yarn.

Cross-references to related applications

This application is a division of my copending application Ser. No. 554,209, filed May 31, 1966, now U.S. Patent No. 3,316,705, which, in turn, is a continuation of application Ser. No. 313,392, filed Oct. 2, 1963, now abandoned, which, in turn, is a continuation-in-part of application Ser. No. 12,536, filed Mar. 8, 1960, now abandoned, which, in turn, is a continuation-in-part of application Ser. No. 812,744, filed May 12, 1959, now abandoned, and application Ser. No. 782,536, filed Dec. 23, 1968, now abandoned.

Background of the invention

The present invention relates to an arrangement for producing artificial yarns. More particularly, the invention relates to an arrangement for producing an artificial yarn which is only contractile to the extent of less than 50% and which is almost as highly bulked as fully twist crimped yarn.

It is known to manufacture bulked yarn by twisting the yarn and setting the twist therein, as, for example, by heating the yarn and untwisting the same. In this manner the individual yarns which originally are substantially straight become crimped and thus the yarn is bulked. These yarns are highly contractile, for example, to the extent of 200–350%. In other words, when the yarn is held straight but not stretched to such an extent that it will break, and then released, the yarn will contract in length from 200–350%. Yarn of this type is extremely useful in the making of articles such as stretch socks or

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other stretch garments, but such yarns have uneven shrinkage properties and do not have dimensional stability when knitted or woven so that it becomes necessary to further treat these yarns, thus incurring undesirable inconvenience and expenses. In other words, in order to render such yarns suitable for warp knitting and also for weaving, the yarns must undergo the long and rather expensive processes of stapling, drafting and spinning.

The disadvantages outlined above could be overcome by providing a yarn which, while almost as highly bulked as a fully twist crimped yarn, is nevertheless contractile to an extent substantially less than 50%, and which is preferably contractile to an extent of only 10–20%. However no arrangement capable of producing such a yarn has become known heretofore.

Summary of the invention

The present invention overcomes the above-outlined disadvantages of the prior art, and makes it possible to manufacture a yarn having the desired properties, by providing an arrangement capable of manufacturing such a yarn and not heretofore known in the art.

More particularly, the present invention provides an arrangement for the production of a yarn which, while almost as highly bulked as a fully twist crimped yarn, nevertheless is contractile to an extent substantially less than 50%.

Furthermore, the novel arrangement in accordance with the present invention makes possible the production of a yarn of the type outlined above in a rapid and inexpensive manner from any thermoplastic yarn, even such thermoplastic yarns as in the past have presented difficulties in working.

Furthermore, the novel arrangement in accordance with the present invention is also particularly suitable for handling a soft-yarn package in order to subject the same to the influence of a setting fluid.

The novel arrangement is also easily regulatable so that it can be adapted to the treatment of any thermoplastic yarn, and is not limited to the treatment of any particular type of such yarn.

Furthermore, the arrangement in accordance with the present invention also includes an extremely simple and efficient structure for applying heat to the yarn during the treatment of the latter.

In accordance with these and other features of my invention I provide an arrangement for producing a yarn which is only contractile to the extent of substantially less than 50% and which is almost as highly bulked as fully twist crimped yarn. My novel arrangement comprises false twisting means for false twisting a thermoplastic yarn and for only partially setting the yarn for maintaining the same during the false twisting at a relatively low temperature below the melting point of the thermoplastic yarn so as to obtain a partially set false twist crimped yarn which has a high contractibility exceeding 50%. Furthermore, my novel arrangement comprises delivering means which is operatively associated with the false twisting means, and such delivering means delivers the partially set false twist crimped yarn from the false twisting means at a predetermined speed. Collecting means are provided which are operatively associated with the delivering means for collecting the partially set false twist crimped yarn, which is delivered from the false twisting means at the aforementioned predetermined speed, and for collecting this yarn on a take-up package at a speed which is less than this predetermined delivery speed, whereby the tension of the thus-collected yarn is reduced while the yarn is, however, still retained at substantial tension when it reaches the take-up package so that it is wound up onto the latter still under substantial tension. Finally, my novel arrangement includes setting means

for treating the yarn which is thusly wound onto the take-up package, and this setting means includes means for subjecting the yarn for a given period of time to the influence of a setting fluid so as to complete the setting of the partially tensioned, partially set false twist crimped yarn. With this arrangement I obtain a relaxed false twist-crimped yarn which has only a low contractibility of substantially less than 50%, which has substantial dimensional stability, and which is substantially of the non-torque type while being almost as highly bulked as fully twist crimped yarn.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be better understood from the following description of specific embodiments when read in connection with the accompanying drawings.

Brief description of the drawing

FIG. 1 is a diagrammatic illustration of an arrangement in accordance with the present invention;

FIG. 2 is a view of FIG. 1 as seen in the direction of the arrow in FIG. 1;

FIG. 3 is a further illustration of the arrangement shown in FIGS. 1 and 2, as described in greater detail; and

FIG. 4 is a diagrammatic illustration of the manner in which a soft yarn package produced with the apparatus shown in FIG. 1 is enveloped in a cheesecloth covering prior to introduction of such package into an autoclave.

Description of the preferred embodiments

Referring now to the drawing, and more particularly to FIGS. 1-3, it will be seen that the yarn which is to be treated is derived from a supply package 10 which is supported in a conventional manner. Thus, the yarn can be drawn upwardly from the supply package 10 and it will be understood that this yarn may be any thermoplastic yarn as it is received ready for false twisting. Thus, for example, the yarn which is identified with reference numeral 11 may be nylon of 60 denier or it may be 60 denier Terylene, the latter being the trade name for the fiber forming synthetic linear polymeric condensation product of terephthalic acid and ethylene glycol, and the yarn is of the continuous multifilament type.

The thermoplastic yarn 11 is drawn upwardly from the supply package 10 by a feed roll means including a lower driven roll 12 and an upper rubber-covered roll 13 which latter simply rests with its own weight on the driven roll 12 as seen in FIG. 3. The roll 12 is driven by any suitable motor through any suitable gearing or the like, and it is not believed to illustrate this driving means since it is entirely conventional. Driving of the roll 12 is so adjusted as to produce a desired speed of movement of the yarn 11 along the path which is illustrated in FIG. 1. The roll 13 is supported, as clearly evident from FIG. 3, for turning movement by a shaft 14 which extends between and is fixedly carried by a pair of arms 15 which latter are parallel to each other and only one of which is shown in the drawing. These arms 15 are pivotally supported by a bracket 16 carried by the stationary framework 17 which is only diagrammatically illustrated in the drawing.

The arms 15 extend beyond the shaft 14 and are interconnected at their ends distant from the brackets 16 by a spacer bar 18 which is fixed to the arms 15 and which is formed with a plurality of notches so that the yarn 11 may be wound a desired number of times around the roll 13 with each loop of the yarn passing around the spacer bar 18 and the several loops respectively being located in the notches of this bar. This assures that the several loops cannot become fouled, and the yarn which passes into the nip between the rolls 12 and 13 and is then wound

a desired number of times around the roll 13 in the manner described above thereupon passes upwardly to the false twisting means 20. This latter is in the form of any conventional false twist spindle driven in a purely conventional manner and it is not believed necessary to describe this in more detail since it will be readily evident to those of ordinary skill in the art.

The yarn 11 is received above the false twisting means 20 by a forwarding roll means 21 whose construction is identical with that of the feed roll means described below and the yarn is again wound in the same way, after passing to the nip between the rolls of the forwarding roll means 21, a desired number of times around the upper rubber-covered roll so as to provide a desired number of flukes which are also prevented from fouling by a spacer bar, just as described above relative to the feed roll means. The forwarding rolls advance the yarn onto a take-up package in a manner which will be described subsequently.

During the false twist crimping of the yarn, the tension thereof is regulated by providing a speed of the yarn at the forwarding roll means 21 which has a predetermined ratio with respect to the speed given to the yarn by the feed roll means. Preferably, this tension is controlled in such a way that the yarn is allowed to contract by approximately 3% during the twisting thereof, the permitted contraction being determined by the kind of yarn which is utilized.

The twist is only partially set in the yarn by applying a relatively low temperature thereto, and for this purpose a heating means 22 is provided which includes a curved heating surface 23. This curved heating surface 23 has been found to be of considerable advantage since it very uniformly heats the yarn as the latter moves rapidly past the surface 23 which is illustrated in FIG. 3 as being heated by a heating coil 24. In practice it has been found that the relatively low temperature applied to the yarn by the heating means 22 need not be maintained precisely. Putting this differently, it has been found that the temperature may vary considerably without producing any detrimental results in the final product. It is, however, essential to provide a relatively low temperature of approximately 50° less than the melting temperature of the yarn. The temperature applied to the yarn by the heating means 22 may, for example, be 60° less than the melting temperature of the yarn.

FIG. 3 illustrates that the temperature can be controlled by connecting the heating coil 24 to the secondary winding of a step transformer 25 having a series of taps, any one of which may be selectively used for regulating the temperature of the heating means 22. The secondary winding 25 cooperates with the primary winding 26 which is supplied with current from the main.

The partially set yarn, forwarded by the delivery or forwarding roll means 21, is received by a package-forming arrangement 30 which includes a driven lower roll 31. The package 32 which is being formed in this manner rests on the driven roll 31 and the yarn is collected onto the package 32 whose diameter of course increases during the collecting of the yarn. The yarn is distributed along the take-up package 32 by a conventional traverse mechanism 33 which will be well known to those conversant with this art. The yarn of the take-up package 32 is wound onto a tubular core capable of moving vertically, this core being guided by the vertical guides 35 of the framework which is diagrammatically illustrated in FIG. 3.

In accordance with the present invention the speed at which the yarn is taken up onto the take-up package 32 is substantially less than the speed of the yarn at the delivery or forwarding roll means 21. However, the speed at which the yarn is taken up onto the take-up package 32 is not so much less that there is no tension at all in the yarn reaching the take-up package. Rather, the speed of the yarn at the take-up package, which speed is con-

trolled by the speed of rotation of the roll 31, is on the order of 10-30° less than the speed of the yarn at the forwarding or delivery roll means 21. This assures that the package 32 is quite soft. In accordance with the invention it is preferred to control the yarn by the degree of overfeed rather than by any tensioning device. In other words, while the yarn is under tension when reaching the take-up package, the tension is not of a very high order which would make it feasible to control the speed of movement of the yarn to the take-up package by a suitable tensioning device. By providing an overfeed of the yarn traveling to the take-up package it is possible to very precisely control the degree to which the yarn is tensioned as it reaches the take-up package without relying on any particular tensioning devices which could only provide a greater tension than is actually desired. Thus, reference is made herein to the degree of overfeed, namely an overfeed which will provide at the take-up package a speed of travel of the yarn which is on the order of 10-30% less than the speed of the yarn at the forwarding or delivery roll means 21, because in the actual performance of the operations the controls are carried out precisely in this way rather than by maintaining a particular tension in the yarn.

This soft package of partially set yarn thus obtained is removed from the framework 35 and is introduced into an autoclave 36 for final setting. After the autoclave is evacuated, it is filled with steam so that the soft yarn package is influenced by the setting fluid, and the steam is applied at a pressure of 2-3 atmospheres for a period of half an hour. Thereafter, the yarn remains in an atmosphere of at least 50% humidity at room temperature for a period of twenty-four hours.

In accordance with the invention, the yarn package 32 is enveloped in a length of cheesecloth 37 as shown in FIG. 4, before the package is placed into the autoclave. To accomplish this, the length of cheesecloth 37 which may be of approximately rectangular configuration, is inserted through the hollow center of the soft yarn package, and then the ends of the cheesecloth 37 are drawn around the package into an overlying relation, as indicated diagrammatically in FIG. 4, whereupon a string 38 is tied around the thus-enveloped package, and in this manner the soft packages are extremely easy to handle and at the same time the cheesecloth does not in any way detract from the accessibility of the yarn to the setting fluid in the autoclave.

Yarn produced with the above-described arrangement in accordance with the present invention is almost as highly bulked as a fully twist crimped yarn and at the same time it is contractile to an extent of less than 50%, and in actual operating experience it has been found to be contractile to an extent on the order of 10-20%. As indicated earlier, the yarn which is wound onto the take-up package is still under a substantial tension. The filaments of the yarn, when wound onto the take-up package, have a partially spiral or undulator formation and these filaments remain separate from one another without tending to twist on themselves or to "pigtail" so that the yarn is set in this latter condition. Thus, the final yarn has such filaments when the tension on the yarn is relaxed and the yarn is in a stabilized or yarnset condition, and in addition it is substantially free from torque. The significance of the yarn produced in this manner is immediately evident when one considers that the yarn has considerable dimensional stability without sacrificing in any way the highly bulked characteristics which are desirable. Thus, the yarn produced by the arrangement according to the present invention can immediately be used for knitting or weaving and all of the undesirable further processing required for conventional bulked yarn to give it dimensional stability is completely avoided. Furthermore, yarn produced by the arrangement according to the present invention is substantially "non-torque," which means that it need not be doubled with an oppositely

twisted yarn in order to provide counterbalancing of the torques, and thus the yarn produced with the arrangement of the present invention can be a simple single yarn, a feature which also represents a great advantage over the known state of the art.

The partial setting provided by the heating means 22 is rendered just that, namely "partial," by the fact that the crimp induced by the false twister is not permanently set in the yarn with the heating means 22. In other words, if the yarn is straightened and permitted to contract a few times when influenced only by the heating means 22, it will be found that the yarn will simply lose its crimp after a relatively small number of extensions, whereas, if the crimp were permanently set, any number of extensions of the yarn could be carried out without eliminating the crimping.

In utilizing Terylene of 75 denier with an arrangement according to the present invention, a soft lively yarn was produced when feeding the yarn at a speed of 12-18 meters per minute through the false twister so as to produce a crimp of 55-80 turns per inch. The heating means 22 was utilized for applying a temperature of 100-140° C. to the yarn, and in the autoclave the yarn was subjected for 15-45 minutes to steam at 20-30 pounds per square inch pressure.

Utilizing nylon yarn in the arrangement according to the present invention, the temperature applied by the heating means 22 was as low as 70° C., but never more than 120° C. When using a high speed machine, the feeding speed for Terylene may be as high as 80 meters per minute, and in this case the temperature applied by the heating means 22 may be as high as 215° C. The temperature applied to the yarn by the heating means 22 is such that for the particular yarn speed which is used the thermoplastic filaments become sufficiently hot so as to be rendered plastic, which is to say readily deformable by relatively small forces. This is so because, as outlined earlier, the crimp need only be temporarily or partially set by the heating means 22 since the actual setting takes place in the autoclave 36.

The advance which the arrangement hereindisclosed represents in the state of this art is evident to those who are skilled in this art. It becomes particularly clear when a yarn produced according to the invention is compared with a known false twist crimped bulked yarn. Such comparisons have been made, and after knitting both such yarns into fabric these fabrics have been compared. In both cases the bulked yarn was two fold 150 denier, and on comparison it was found that the fabric made from a yarn produced with an arrangement according to the present invention weighed 6.9 ounces per square yard while that made conventionally weighed 8.6 ounces per square yard, but at the same time the covering power and bulky feel of the yarn of the invention was identical with that of the conventional yarn.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of arrangements differing from the types described above.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. An arrangement for producing a yarn which is only contractile to the extent of substantially less than 50% and which is almost as highly bulked as fully twist crimped yarn, said arrangement comprising, in combination, false twisting means for false twisting a thermoplastic yarn and twist setting means for only partially setting the yarn by maintaining the same during said false twisting at a relatively low temperature below the melting point of said thermoplastic yarn so as to obtain a partially set false twist crimped yarn which has a high contractibility exceeding 50%; delivering means operatively associated with said false twisting means for delivering said partially set false twist crimped yarn having high contractibility from said false twisting means at a

predetermined first speed; collecting means associated with said delivering means and operative for collecting said partially set false twist crimped yarn having high contractibility on a take-up package at second speed which is less than said predetermined first speed of delivery so that the tension of said partially set twist crimped yarn having high contractibility is reduced, but which second speed is still great enough to retain substantial tension in said thus only partially tensioned partially set false twist crimped yarn having high contractibility when the same reaches said take-up package, so that said partially tensioned partially set false twist crimped yarn of high contractibility is wound up on said take-up package still under substantial tension; and additional setting means for treating said partially tensioned partially set false twist crimped yarn having high contractibility wound up under said substantial tension on said take-up package, for a given period of time with a setting fluid so as to complete the setting of said partially tensioned partially set false twist crimped yarn, thus obtaining a relaxed false twist crimped yarn which has only a low contractibility of substantially less than 50%, has substantial dimensional stability and is substantially of the non-torque type while being almost as highly bulked as fully twist crimped yarn.

2. An arrangement as defined in claim 1, wherein said delivering means includes means for controlling said predetermined first speed.

3. An arrangement as defined in claim 1; and further comprising yarn supply means arranged below said false twisting means for supplying yarn to the latter in upward direction.

4. An arrangement as defined in claim 1, wherein said twist setting means comprise heating means for heating said yarn to an elevated temperature below the melting point thereof.

5. An arrangement as defined in claim 4, wherein said heating means are arranged for heating said yarn to between 100° and 140° centigrade.

6. An arrangement as defined in claim 4, wherein said heating means are arranged for heating said yarn to an elevated temperature ranging up to 215° centigrade.

7. An arrangement as defined in claim 1, wherein said additional setting means include an autoclave, evacuating means for reducing the pressure in said autoclave, and setting fluid supply means for introducing setting fluid into said autoclave.

8. An arrangement as defined in claim 1, wherein said

delivering means includes means for controlling said predetermined first speed within such a range that such predetermined second speed is substantially greater than the second speed at which said yarn is collected on said take-up package, so as to thereby obtain a soft take-up package.

9. An arrangement as defined in claim 8, wherein said means for controlling said predetermined speed enables varying of the latter within such a range that the second speed at which said yarn is collected on said take-up package is between 10% and 30% lower than said predetermined first speed.

10. An arrangement as defined in claim 1, wherein said additional setting means include means for maintaining said take-up package at a predetermined pressure during said given period of time.

11. An arrangement as defined in claim 1, wherein said additional setting means comprise evacuable chamber means arranged to accommodate said take-up package.

12. An arrangement as defined in claim 11, wherein said additional setting means further comprise means for increasing pressure within said chamber means to a range between 2 and 3 atmospheres.

13. An arrangement as defined in claim 1, wherein said collecting means comprises winding means for winding said yarn on said take-up package in such manner that the filaments of said yarn remain separate from each other and without tending to twist on themselves.

14. An arrangement as defined in claim 1, wherein said false twisting means is arranged for false twisting said yarn at a rate of advancement ranging between 12 and 18 meters per minute.

15. An arrangement as defined in claim 1, wherein said false twisting means is arranged for false twisting said yarn at a rate of advancement ranging up to 80 meters per minute.

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JOHN PETRAKES, Primary Examiner
U.S. Cl. X.R.

57—157

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,462,933 Dated August 26, 1969

Inventor(s) Mario Nava

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

Claim 8, line 4, -- first -- is substituted for "second".

SIGNED AND
SEALED
FEB 24 1970

(SEAL)

Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents