United States Patent [19]

Eskridge et al.

[11] **3,832,759**

[45] **Sept. 3, 1974**

[54] **PROCESS AND APPARATUS FOR TEXTURIZING YARN**

[75] Inventors: **Brewster B. Eskridge; Roger H. Fink,** both of Asheville; **Boyce M. Lyon,** Candler, all of N.C.

[73] Assignee: **Akzona Incorporated,** Asheville, N.C.

[22] Filed: **Mar. 23, 1972**

[21] Appl. No.: **237,295**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 33,785, May 1, 1970, abandoned.

[52] **U.S. Cl.** **28/1.3,** 28/1.6, 28/72.11, 28/72.14

[51] **Int. Cl.** **D02g 1/20,** D02g 1/12

[58] **Field of Search** 28/1.3, 72.11, 1.7, 72.1, 28/72.12, 1.6, 72.14

[56] **References Cited**

UNITED STATES PATENTS

2,854,728	10/1958	Rainard et al.	28/1.6
3,289,265	12/1966	Hedges et al.	28/1.7
3,343,240	9/1967	Parmeggiani et al.	28/1.3
3,345,719	10/1967	Schatz et al.	28/1.7
3,417,445	12/1968	Gemeinhardt et al.	28/72.11 X
3,457,610	7/1969	Williams et al.	28/72.12
3,461,521	8/1969	Eskridge et al.	28/72.11
3,480,709	11/1969	Jacob et al.	28/72.1 X
3,482,294	12/1969	Joly	28/1.6
3,501,819	3/1970	Satterwhite	28/1.3
3,530,660	9/1970	Kirchner, Jr. et al.	28/1.3 (XR)
3,576,058	4/1971	Berg et al.	28/1.3
3,594,878	7/1971	Porter	28/1.3
3,616,503	11/1971	Mattingly	28/1.7 X
3,663,352	5/1972	Self et al.	28/72.1 X

FOREIGN PATENTS OR APPLICATIONS

763,156	7/1967	Canada	28/72.11
4,015,860	7/1965	Japan	28/72.11

Primary Examiner—Robert R. Mackey

Attorney, Agent, or Firm—Craig & Antonelli

[57] **ABSTRACT**

Continuous thermoplastic multifilament yarn is texturized by aspirating such yarn into a pneumatic jet with dry gas followed by passing said yarn through said jet into a crimping tube having exhaust ports, and then passing said yarn into an accumulator chamber with steam being supplied thereto to produce bulked yarn which can then be passed to a take-up package; annealing and air tangling after-treatment, prior to take-up, are optional. Yarn so processed travels at a comparatively high and increased rate of speed to thus achieve a more effective processing system. A conventional mechanical stuffer box can be incorporated between said accumulator chamber and the take-up package to further increase bulking prior to annealing and air tangling which are optional, depending on the feeder yarn and/or the desired bulk level. The feeder yarn to be processed may also be pretreated to have a latent crimp which is developed and stabilized during the texturizing process.

17 Claims, 3 Drawing Figures

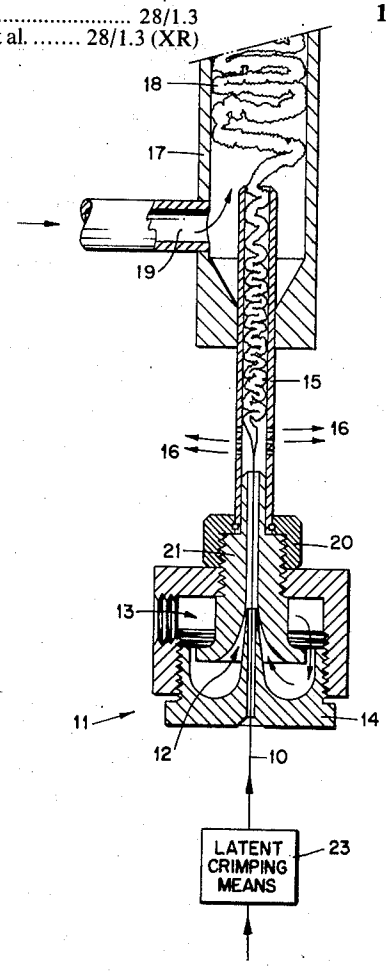
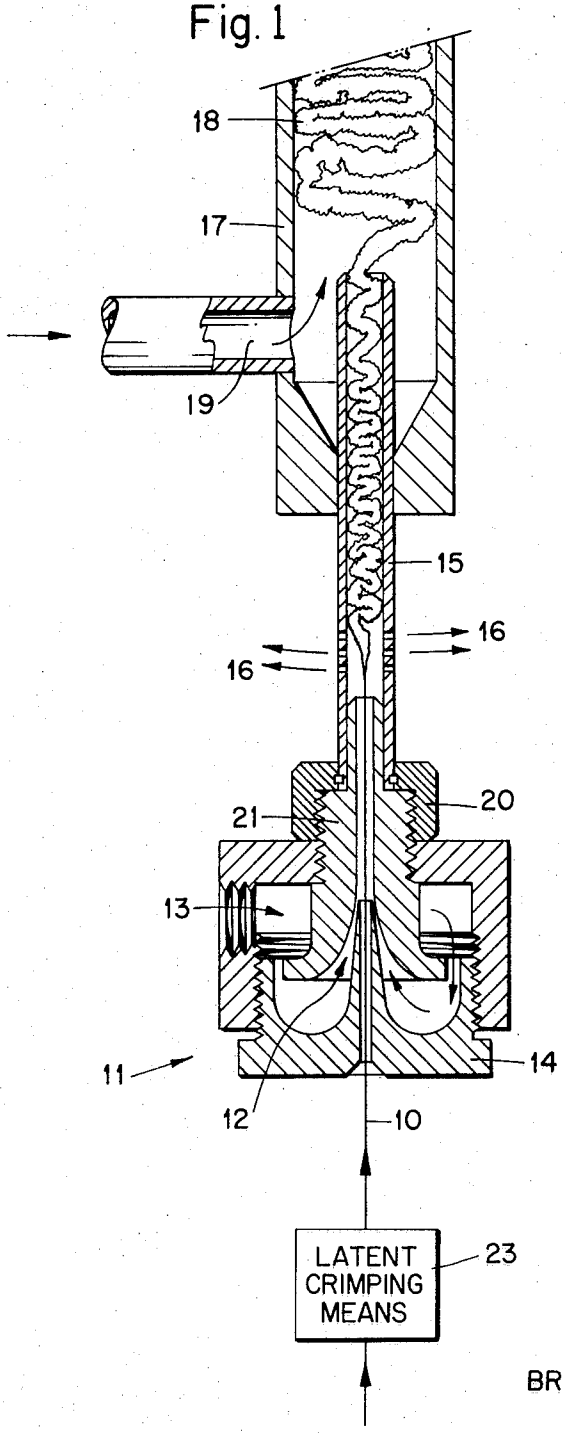


Fig. 1



INVENTORS
BREWSTER B. ESKRIDGE
ROGER M. FINK
BOYCE M. LYON

Fig 2

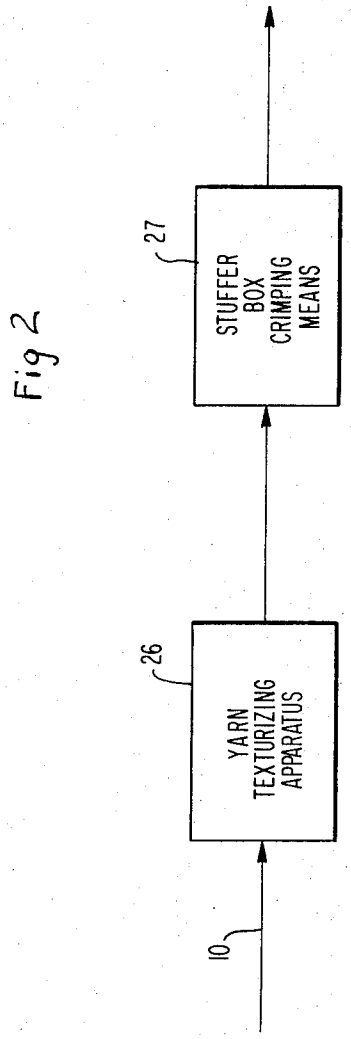
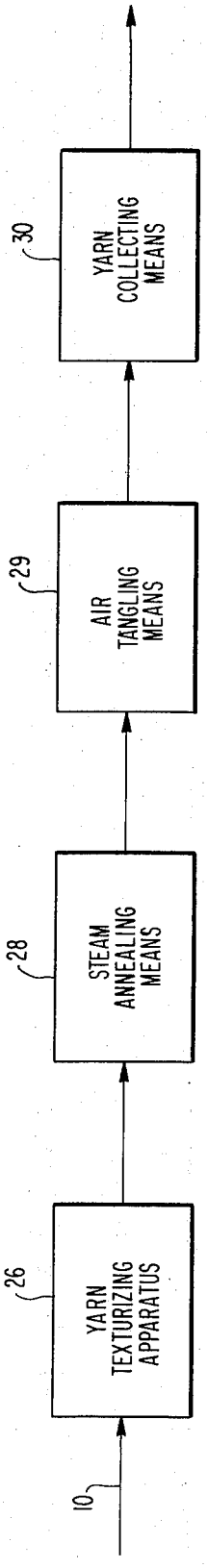

10
26
YARN TEXTURIZING APPARATUS
27
STUFFER BOX CRIMPING MEANS

Fig 3.


10
26
YARN TEXTURIZING APPARATUS
28
STEAM ANNEALING MEANS
29
AIR TANGLING MEANS
30
YARN COLLECTING MEANS

PROCESS AND APPARATUS FOR TEXTURIZING YARN

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of application Ser. No. 33,785, filed on May 1, 1970 and now abandoned.

BACKGROUND OF THE INVENTION

This invention is directed to the continuous treatment of filaments, fibers, yarns or larger bundles of thermoplastic filaments, such as tow and the like, hereinafter referred to generically as yarn, and is directed to the apparatus utilized to effect this treatment and the product resulting from the use of said apparatus.

More specifically, this invention is directed to a process of producing bulked voluminous yarn having a high degree of uniformity, improved bulk stability, even dyeing characteristics, soft pleasant "hand", and desired covering power when made into textile fabrics, floor coverings, and the like.

Running lengths of feeder yarn textured by this system reflect a high degree of bulk retention and bulk stability when knitted, tufted or woven into fabrics. Improved pattern definition characteristics are maintained after knitting or tufting and are maintained through harsh finishing operations.

The yarn which can be texturized in the practice of the present invention includes any thermoplastic material made of nylon, polyester, acrylonitrile, polyolefins, i.e., polypropylene, etc.; polyvinyl chloride; polyphenylene oxides; or, copolymers of these synthetics regardless of denier, length, structure or composition. It is preferred, for purposes of this invention, that plural continuous yarn be used which consists entirely of a synthetic organic polymeric material such as nylon, polyester, and the like. Composite filaments of, for example, nylon and polyester, can also be utilized in the practice of this invention.

Bulky or voluminous yarn is made in a variety of ways. For the most part, known methods comprise: (1) forwarding initially straight twisted or zero twist feeder or source yarn to a stuffer box wherein the yarn overlaps and becomes folded upon compression; and (2) subjecting the source yarn to the action of fluids or gases under pressure as in an air jet wherein yarn products are obtained with individual filaments having loops, convolutions, curls, whorls, or the like.

The well-known stuffer box crimping procedure utilizes a system wherein relatively straight feeder yarn is forced into an enclosed chamber by a pair of driven rolls and accumulates therein by pressure developed by its passage through the chamber. The feeder yarn accordingly forms "plugs" or "wads" in the box and a repeating crimp is imparted to individual filaments thereof by this accumulation. The crimp usually recurs in a somewhat regular fashion. To obtain improved warmth-giving bulk, heated fluids also are often utilized to soften, moisten, and/or heat set the yarn while in a relaxed condition in the box.

In producing yarns of increased bulk pneumatically, i.e., wherein processes and apparatus are utilized that subject an initially straight twisted or untwisted (zero twist) source yarn to the action of a turbulent fluid, the individual filaments of the yarn are looped, curled, or

convoluted. The individual strands are in effect entangled to form a bulky, wool-like yarn product wherein each of a multiplicity of filaments, when in a relaxed condition, have a plurality of convolutions along a selected length. The convolutions are usually offset and out of phase with each other.

U.S. Pat. No. 3,296,677 discloses a process for crimping yarn wherein said yarn is passed through a particular type stuffer box supplied with a high velocity heated fluid and is in contact with said fluid, the exit end of the zone being connected to a divergent passageway in which the fluid expands to open the yarn to a diameter substantially greater than the diameter of the yarn as initially fed to said jet. The resulting open mass of separated yarn filaments is then fed to a conventional stuffer box crimper wherein it is brought into contact with a heated fluid which is exhausted through ports in said chamber and with the crimped filaments at the discharge end of said crimping chamber.

U.S. Pat. Nos. 3,373,470, 3,409,956, and 3,482,294 relate to a process and apparatus for stuffer box crimping in which a heated fluid (steam) conveys the yarn into the stuffer box and sets the yarn crimp in the chamber.

It should therefore be readily apparent that attempts toward development of yarn having an increased warmth-giving bulk, covering effectiveness, and, in general, qualities that are more like wool, embrace numerous methods and apparatus. And while most, if not all, lead in some manner to an improved product in regard to such qualities, they still reflect serious drawbacks such as streakiness and flashes, non-uniform crimping and, therefore, are not completely satisfactory to the industry for all applications where textured yarns can be utilized.

One significant problem long associated with textured synthetic yarns produced using stuffer box crimpers that has continually plagued the textile industry is their uneven or irregular dyeing characteristics. It has been observed that the affinity of such yarns for various dyes is very sensitive to change, changes not only embracing certain variations of conditions in polymer formation and spinning, but also changes in conditions which impart a different crimped or bulked configuration, or for that matter, a mere difference in the degree of crimp to the yarn. This sensitivity varies markedly with even the slightest variation in the processing conditions of either the polymer or the yarn and directly causes visible off-color sections, such as deeper or lighter dyed streaks, to occur throughout a fabric product. Since such fabrics are generally unacceptable on a commercial basis, yarn producers are faced with costly claims of the textile fabric manufacturers for all such irregularities believed caused by such yarns.

Manufacturers of textured yarns have made various attempts, including greater control of the source yarn production systems, i.e., control of polymer molecular weight, exact control of temperatures used during spinning and drawing, tensions used during drawing and winding, etc., in an effort to solve the uneven dyeing characteristics and yet obtain yarns that can be evenly crimped or bulked and retain a measure of bulk retention when in fabric form. In this direction, attention has been focused on manufacture and subsequent utilization of filaments having a plurality of different cross sections in texturizing operations. This second proce-

dure serves, in effect, to "hide" dyeing inconsistencies when the yarn is woven into fabric.

While the necessity of bulk stability and bulk retention has not been frequently stated to be a problem in the literature, it remains an important aesthetic quality long sought by producers of synthetic yarns in order to provide a salable product more favorably comparable to wool when in fabric form. A definite need therefore exists for a synthetic yarn which retains a level of bulk and height of pile along with acceptable dye-evenness characteristics when manufactured into floor coverings, knit goods, or fabrics, and subjected to numerous batch or continuous hot and/or aqueous aftertreatments such as dyeing, steaming, washing, and the like. Heretofore no one texturing procedure has been found totally satisfactory.

A primary object of the present invention is to provide a system that has technical simplicity and economy of operation. Also, the process of this invention produces exceptionally bulky yarns having a low percent of contraction; these yarns can be made into fabrics having good dyeability, covering power, a wool-like appearance and hand, notwithstanding their excellent stability under conditions of extreme compression and tensile stress. Moreover, an excellent degree of bulk can be achieved in fabric which avoids uncertainties in regard to the amount of shrinkage to be expected during subsequent harsh aftertreatments. The yarn is sufficiently strong and uniform to be handled easily by all textile machinery, including weaving, knitting and tufting machines, without sacrifice of bulk characteristics and fabric pattern definition.

Textured yarn produced according to the present invention has acceptable bulk, wool-like appearance, and hand when in fabric form. In addition, such textured yarn has acceptable crimp and dimensional stability with a distinct uniformity of bulk, bulk retention, and color shade or tone when dyed in fabric form.

BROAD DESCRIPTION OF THE INVENTION

Feeder or source yarn is fed to an aspirator jet by air and passed into a crimping tube with exhaust ports, followed by passing the yarn from said crimping tube into an accumulator box of a substantially larger dimension than said tube to effect annealing and further bulk setting with steam, preferably saturated steam. Bulked yarn from the accumulator box can then be optionally processed through a steam annealing jet and air tangled for additional bulk control prior to being processed to a take-up package. U.S. Pat. No. 3,461,521 discloses specific (optional) annealing and air tangling means that can be utilized. Air tangling is optional; for example, by supplying sufficient twist to the feeder yarn, air tangling can be eliminated from the process.

The denier range of the feeder yarn can be from 500 to 4,000 denier. A denier of from 1,000 to 3,000 is preferred for processing. In addition, the feeder yarn can have zero twist or be twisted and should reflect the proper moisture content derived from a selected oil and/or emulsion finish. Controlled bulking is achieved and the feeder yarn can be processed at a rate greater than 750 yards per minute, or even in excess of 1,000 yards per minute.

In accordance with this invention the gas, preferably air, used to feed the yarn into the crimping tube must be a relatively dry gas in order to avoid wetting of the yarn in the crimping tube. Use of a gas such as wet saturated steam which condenses in the crimping tube wets the yarn and causes the yarn to adhere to the inner wall of the crimping tube. Consequently, the wet yarn packs or jams in the crimping tube, thereby causing stoppage of the texturizing process. Generally, the gas, suitable for the purpose of this invention, is air taken from the atmosphere at ambient conditions and then compressed to a pressure of about 80–100 psig. The compressed air is then fed to the aspirator jet at ambient temperature. Also, it will be recognized that superheated steam having sufficient superheat to remain dry in the crimping tube may also be employed to feed the yarn through the aspirator jet, i.e., 80 to 90 psig., the steam having a minimum temperature of about 165° C. and a maximum temperature below the melting point of the polymer being processed. For example, 210° C. would be the maximum temperature for nylon 6 and generally, processing of nylon 6 would be with 90 psig. steam at 200° C. Because of the cost and availability, use of compressed air is much preferred.

Advantageously, it has been found that the apparatus and process of this invention are especially suitable for developing and stabilizing any latent crimp in the feeder or source yarn. The latent crimp may be introduced into the feeder yarn by various conventional procedures. For example, a feed yarn may be produced by (*a*) spinning and drawtwisting in separate steps or by (*b*) spin-drawwinding in a single step, followed by (1) asymmetrical cooling, (2) asymmetrical heating, (3) gear crimp or (4) other known techniques for introducing a latent crimp into the drawn yarn.

In accordance with this aspect of the invention the feeder yarn with the latent crimp is fed to the aspirator jet with a cool or ambient compressed air (which is dry) under tension and then heated by the steam in one end of the crimping tube and in the accumulator chamber while under substantially no tension. This causes development of the latent crimp. Consequently, the resulting yarn exhibits a particularly uniform crimp and bulkiness.

PREFERRED EMBODIMENT

Nylon (drawn) feeder yarn is pulled into a jet aspirator at a rate of about 850 yards per minute by means of compressed ambient air under a sufficient pressure, i.e., about 85 psig. to force the yarn into a pneumatic crimping tube to form a yarn wad or plug; this yarn then empties into an accumulator chamber wherein it is treated with saturated steam for a sufficient time to set the crimps and then drawn out of said accumulator chamber at about **720** yards per minute by means of, e.g., an optional air jet; the bulked yarn can also be passed through a steam annealing jet after the yarn exits from the accumulator chamber. The bulk level of the yarn above produced is 15–22 percent with acceptable shrinkage and crimps per inch characterizations. Carpets prepared from this yarn reflect acceptable tuftability and pattern definitions with a minimum of streaks and flashes.

In using the process of this invention, a textured yarn having specific crimp characteristics for subsequent operations is produced. The yarn from the accumulator can, as a more specific embodiment, be fed to a second crimping means, e.g., a mechanical stuffer box crimper consisting of an elongated yarn confining stuffing box or chamber for the purpose of increasing the number

of crimps along a selected length in the presence of steam.

It is an object of this invention to increase the degree of permanency in regard to amplitude and frequency of the crimp imparted; the yarn thus textured is subjected in the accumulator not only to moist, crimp setting steam in the manner described above, but it can be further subjected to a separate and optional annealing treatment utilizing moist steam at a temperature of at least 100° C. While under sufficient tension to prevent linear and amplitude contraction (plural dimensional shrinkage) of the yarn, this can also be followed by optional air tangling. Tension in excess of that required to prevent yarn contraction should not be used since the previously imparted crimp conceivably could be removed should it be too great.

In addition to the foregoing objects and advantages, the invention will be more fully understood when considered in conjunction with the accompanying drawings wherein:

FIG. **1** is a sectional view of a preferred embodiment of the apparatus for manufacturing the textured yarn according to this invention;

FIG. **2** is a schematic block diagram showing the apparatus for continuously texturizing yarn followed by a conventional stuffer box crimping means; and

FIG. **3** is a schematic block diagram showing the apparatus for continuously texturizing yarn of FIG. **1** followed by a steam annealing means, an air tangling means and a yarn collecting means.

Referring to FIG. **1**, nylon yarn **10** is drawn into an aspirator generally indicated at **11** through a feeder yarn inlet by a venturi cup **12.** Air for the venturi **12** is supplied through an air inlet **13** in the jet housing **14.** The feeder yarn is propelled by the air through the venturi cup orifice into the crimping tube **15.** As the yarn **10** backs up in the crimping tube, it starts closing the air exhaust ports **16.** As the exhaust ports are closed, the pressure behind the backed up yarn increases until an equilibrium point is reached where the pressure behind the backed up yarn is equal to the force required to move the backed up yarn up and out of the crimping tube into an accumulator chamber **17** where it is steam treated, and the random folds **18** heat set by steam introduced therein through steam inlet **19.** Crimper tube **15** is retained in a rigid position by means of nut **20** screwed onto the upper portion **21** of housing **14.**

It will be understood that one particularly advantageous aspect of this invention is that the apparatus is self-regulating with respect to the yarn passing through the crimping tube **15** and into and out of the accumulator chamber **17.** When the yarn is not drawn out of the accumulator chamber by the take-off apparatus the yarn builds up in the accumulator chamber thereby causing the pressure in the chamber and in the end of the tube to increase. Consequently, the pressure of the air is insufficient to push the yarn out of the tube and air passes out through the exhaust ports **16** so that no more yarn is introduced into the crimping tube. When the take-off apparatus again removes yarn from the accumulator chamber the aspirator jet is then sufficient to push yarn from the crimping tube **15.**

In this preferred embodiment, the feeder yarn is fed into the aspirator jet at a rate of about 1,000 yards per minute, the bulked yarn take-up being at a rate of about 720 yards per minute.

If it is desired to increase bulkiness, a conventional mechanical stuffer box can be incorporated into the preceding system between the accumulator chamber and an optional steam annealing jet; the latter represents a more specific embodiment of applicants' broader invention which produces a fully acceptable yarn, depending on the characterization of the drawn feeder yarn, the length of the crimping tube with exhaust ports and accumulator chamber dimensions, without the use of a conventional mechanical stuffer box after the bulking effected in the crimping tube and accumulator chamber.

Thermoplastic filaments which can be utilized in the practice of this invention, such as nylon and polyester yarn, can be those in which the polymer melt has had incorporated therein, prior to spinning, various additives such as colorants, delustrants, flame retardants, antistats, bacteriostats, and dye-enhancing additives. The selected additives, and the amounts thereof utilized, are readily determined by one skilled in the art. The process of the present invention effectively operates with a feeder yarn take-off package tension of up to about 60 grams. It is to be understood however, that higher feeder yarn tension can be effectively utilized with routine modification.

In the practice of the present invention, the take-up rate for the bulked yarn is at a rate of about 15–20 percent slower than that rate fed into the pneumatic jet because of the shrinkage and bulk development imparted to said yarn. The feeder yarn channel guide dimension is determined to achieve minimum air loss but must be of sufficient dimension to allow yarn defects to pass through. The diameter of the jet exit channel into the crimping tube controls the speed of the yarn and the dimension of said crimping tube should be held to a minimum to achieve maximum bulking. The length of the crimping tube is not critical but it should be sufficient to provide the necessary crimp. The diameter of the tube should be substantially smaller than that of the accumulator chamber. The accumulator chamber has a diameter that is generally at least about two times, and usually from about two to about three times larger than the crimping tube. Moreover, the exhaust ports of the crimping tube should be small enough so that the yarn does not escape therethrough.

The steam introduced into the accumulator chamber is introduced at atmospheric or higher pressure at the point of introduction into said chamber and will normally be so introduced at a temperature of 100°–103° C.; wet saturated steam at a pressure of from about 2–15 psig. is preferred. It will be understood that the steam pressure within the accumulator is a function of the operating speed. In general, the maximum steam pressure in the accumulator is that pressure above which the yarn will not be packed in the accumulator and will be blown out. For example, the maximum steam pressure in the accumulator is about 7 psig. for processing a high denier yarn such as carpet yarn at 720 yards per minute.

The length of the accumulator chamber can be varied and the diameter thereof is not critical. The particular diameter of the accumulator chamber must, however, be related to the bulk of yarn and the retention time of yarn in said chamber. Also, desired diameter must be larger than the diameter of the crimping tube.

The position of outlet **22** of the crimping tube within the accumulator chamber provides several advantages to the apparatus and process of this invention. As shown in the drawing, the crimping tube extends into the accumulator chamber. Generally about 1/8 to about 1/3 of the tube is within the chamber. Moreover, the outlet **22** is positioned above the steam inlet **19** so that steam introduced into accumulator chamber **17** will flow cocurrently with the air exiting from the outlet of the crimping tube. Also, in the position shown, the steam will not flow directly into the outlet or flow across the outlet to disrupt the passage of the yarn and air from the crimping tube.

Advantageously, the steam entering into the chamber also heats the upper end of the crimping tube **15** so that crimping of the yarn within the tube is assured even when unheated air is used to convey the yarn through the tube.

The source of the drawn feeder yarn fed to the pneumatic jet can vary; if said feeder yarn is taken from a take-up package it is preferred to introduce the yarn at a rate of 1,000 yards per minute; an introductory rate of 500 to 1,000 yards per minute from a take-off package can be utilized. If the feeder yarn is introduced from a drawtwister or a spin draw winder, higher introductory feed rates can be effectively utilized up to, for example, 2,000 to 2,500 yards per minute, as there is no source tension problem.

Filaments, strands, or yarn textured according to this invention thus can be further characterized by having substantially reduced residual internal stress and strain, associated with a reduced degree of bulk contraction and an undiminished degree of crimp amplitude and frequency and individual filament or yarn properties.

A voluminous textured yarn is produced composed of a plurality of substantially continuous individual filaments permanently fixed by their internal molecular structure in a persistent serrated or sawtooth-like configuration and individual curvilinear bends at random intervals along a selected length thereof. Therefore, the term "textured" is used for the purpose of this invention to indicate the fact that lengths of yarn selected at random include filaments having, in combination, a serrated or sawtooth-like configuration and curvilinear bends which are offset and out of phase with each other. The flow of the moist steam in the optional annealing step which can be utilized after crimping enhances the amplitude and frequency of the serrated or sawtooth crimp in the yarn; it also induces and preserves numerous evenly distributed curvilinear bends which occur throughout a selected length thereof.

The textured yarn obtained is serrated (sawtooth configuration) and rather arch-like, in the nature of deep waves in contradistinction to having serrations combined with complete ring-like loops. The filaments retain their texture (crimp and bulk), covering power, and pattern definition when knitted, tufted or woven into fabrics. The yarn, fabrics, etc., are smooth, soft and pliable. Moreover, the fabrics are more appealing and warm to the touch than those which utilize textured yarns produced by conventional processes. Textile fabrics including floor coverings, such as rugs and carpets, closely resemble wool both in appearance and voluminosity, and these properties are retained through long periods of use.

As heretofore described, it is particularly advantageous to use a feeder yarn which has a latent crimp. The yarn is under tension only until it is taken up by the air jet and is then heated under no tension in the accumulator chamber. Conventional means **23** for applying a latent crimp to the feeder yarn prior to being drawn into the aspirator jet are schematically illustrated in the drawing.

With this particular aspect of the invention it is much more difficult to pull the crimp out of the asymmetrically heated yarn such as a polyester, than a normally crimped yarn. Moreover, it has been found that the latent crimp developed in the accumulator chamber tends to even out those portions of the yarn which may escape the mechanical crimp applied to the crimping tube. This effect substantially improves the overall uniformity in the crimp of the resultant yarn product by hiding flat spots produced during crimping.

The following specific example further illustrates the development of a latent crimp in a synthetic yarn in accordance with this invention.

A nylon yarn having a trilobal cross-section obtained from a spin-drawwinder apparatus is asymmetrically heated in a conventional manner with a hot plate and then bulked in an apparatus of the type shown in the drawing employing an air pressure of 85 psig. and saturated steam at 9 psig. The resulting yarn product shows a wet bulk of 20 percent and a dry bulk of 5 percent, 10 crimps per inch and an elongation at break, approximately 67 percent greater than before bulking. A controlled yarn bulked in the same apparatus without asymmetrical heating exhibits comparable properties except the crimp is less uniform and substantially less difficult to remove by pulling on the yarn.

In FIG. **2** there is illustrated the arrangement wherein textured yarn from the accumulator in the yarn texturizing apparatus **26** is fed to a second crimping means, i.e., stuffer box means **27** to increase the number of crimps along a selected length of the yarn.

Another embodiment of the apparatus of the invention is shown in FIG. **3** wherein the bulk yarn taken from the accumulator of the yarn texturizing apparatus **26** is then processed through a steam annealing means **28** and subsequently through an air tangling means **29** for additional bulk control prior to being processed by yarn collecting means **30.**

What is claimed is:

1. Apparatus for continuously texturizing yarn comprising a pneumatic aspirator having an internally disposed passage for the introduction of a gas and a yarn to be pneumatically conveyed, a venturi portion in said passage and a gas inlet means for supplying a gas under pressure into said venturi portion to thereby create a suction motivating force to convey the yarn through the passage of said aspirator, a narrow crimping tube secured at the aspirator for receiving said yarn, exhaust ports in the tube through which at least part of the gas is removed, a yarn accumulator chamber surrounding a portion of the exit end of the tube, the chamber being adapted to contain a compacted yarn mass therein, and steam inlet means for introducing saturated steam into said chamber and adjacent to the exit end portion of said tube, whereby the portion of the tube surrounded by said chamber is heated by steam.

2. The apparatus of claim **1,** including stuffer box crimping means arranged after said accumulator chamber wherein the compacted yarn is recrimped in said stuffer box means.

3. The apparatus of claim 1, including a steam annealing means, an air tangling means, and a yarn collecting means wherein the compacted yarn is further treated by said steam annealing means and by said air tangling means prior to winding on said yarn collecting means.

4. The apparatus of claim 1, wherein the steam inlet means is positioned to introduce steam below the exit end of said crimping tube.

5. The apparatus of claim 1, wherein the accumulator chamber has a diameter that is at least two times larger than the diameter of the crimping tube.

6. A continuous process for texturizing synthetic polymeric yarn which comprises drawing a yarn into an aspirator zone with a dry gas, pneumatically conveying the yarn through the aspirator zone, pneumatically forcing the yarn into a narrow elongated crimping zone while exhausting part of the gas laterally from said crimping zone, supplying heat to at least a part of said crimping zone, forming a sawtooth crimp within said yarn in said crimping zone as a result of the back pressure created in said crimping zone and the supply of heat, passing the yarn to an accumulator zone that has a diameter at least twice that of said crimping zone to induce curvilinear bends along a length of the yarn, setting the crimp and the bends in the accumulator zone by exposing the yarn to wet saturated steam within said zone, and withdrawing the yarn from said accumulator zone.

7. The process of claim 6, wherein the gas is air compressed to 80–100 psig and at ambient temperature.

8. The process of claim 6, wherein the saturated steam is at a temperature of about 100° C. and a pressure of from about 2 to about 15 psig.

9. The process of claim 6, wherein said accumulator zone surrounds the outlet end of said crimping zone and said yarn is heated by said steam in said outlet end before entering said accumulator zone.

10. The process of claim 6, wherein the texturized yarn is further treated by steam annealing and by air tangling prior to winding into a yarn package.

11. A continuous process for texturizing synthetic polymeric yarn which comprises drawing a yarn into an aspirator zone with a dry gas, pneumatically conveying the yarn through the aspirator zone, pneumatically forcing the yarn into a narrow elongated crimping zone while exhausting part of the gas laterally from said crimping zone, the outlet end of said crimping zone being surrounded by an accumulator zone, supplying wet saturated steam to said accumulator zone, heating the yarn by said steam in the outlet end of said crimping zone, forming a crimp within said yarn in said crimping zone as a result of the back pressure created in said crimping zone and the heat of said steam, passing the yarn to said accumulator zone, setting the crimp in the accumulator zone by exposing the yarn to said wet saturated steam within said zone, and withdrawing the yarn from said accumulator zone.

12. A continuous process for developing and stabilizing a latent crimp in synthetic polymeric yarn which comprises applying a latent crimp to a synthetic yarn, drawing the yarn into an aspirator zone by dry cool air, conveying the yarn through the aspirator zone, pneumatically forcing the yarn into a narrow elongated crimping zone, supplying heat to at least a portion of said crimping zone, forming a sawtooth crimp within said yarn in said crimping zone, pneumatically pushing the yarn from said crimping zone under substantially no tension into an accumulator zone that has a diameter at least twice that of said crimping zone to induce curvilinear bends along a length of said yarn, and developing the latent crimp and setting the sawtooth crimp and the bends in said accumulator zone by exposing the yarn to wet saturated steam, and thereafter withdrawing the crimped yarn from said accumulator zone.

13. The process of claim 12, wherein the air is compressed to 80–100 psig and at ambient temperature.

14. The process of claim 12, wherein the saturated steam is at a temperature of about 100° C. at a pressure of from about 2 to 15 psig.

15. The process of claim 12, wherein the latent crimp is applied to said yarn by asymmetrically heating a drawn yarn under tension.

16. The process of claim 12, wherein the latent crimp is applied to said yarn by asymmetrically cooling a drawn yarn under tension.

17. The process of claim 12, wherein said accumulator zone surrounds the outlet end of said crimping zone and said yarn is heated by said steam in said outlet end before entering said accumulator zone.

* * * * *