Oct. 24, 1967 C. J. DUDZIK ETAL 3,348,368

METHOD AND APPARATUS FOR PROCESSING GLASS YARN

Filed July 23, 1964 2 Sheets-Sheet 1

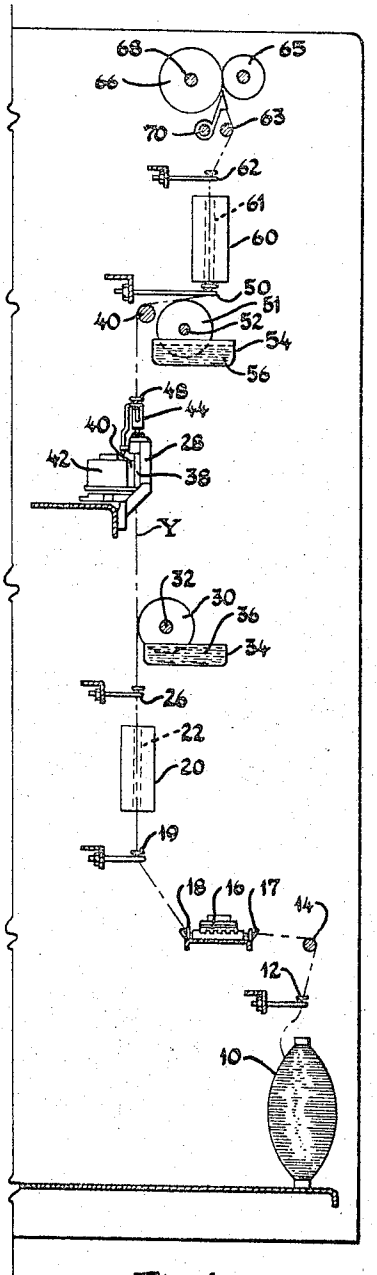

Fig. 1

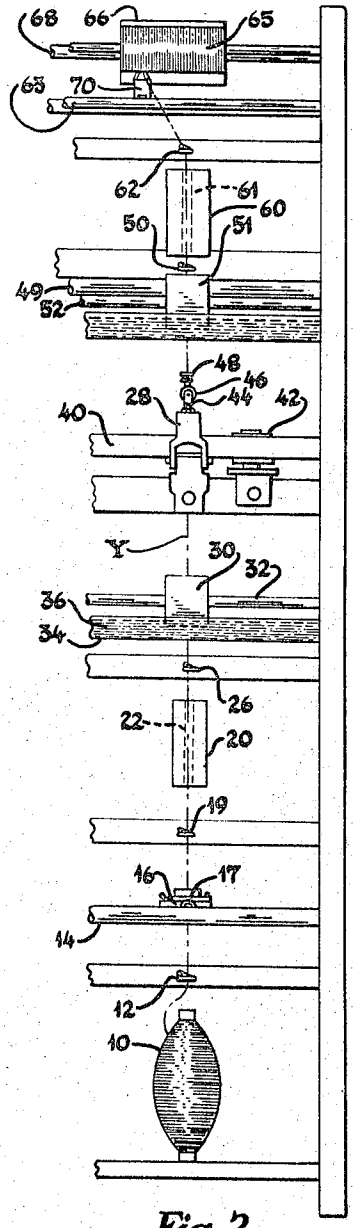

Fig. 2

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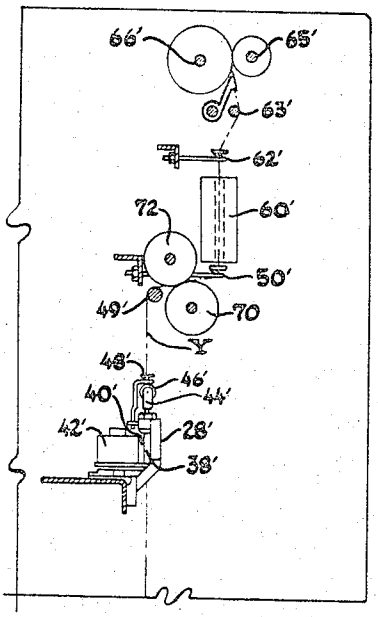

Fig. 3

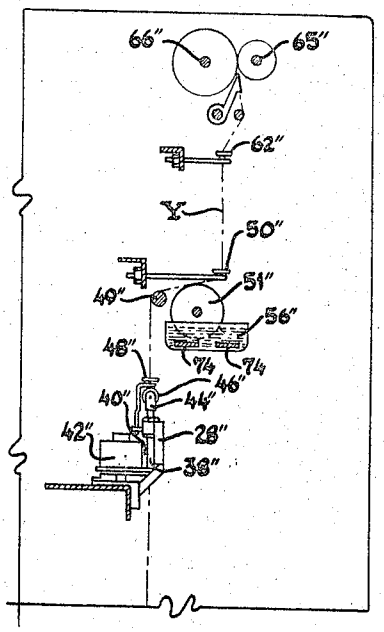

Fig. 4

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METHOD AND APPARATUS FOR PROCESSING GLASS YARN

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11 Claims. (Cl. 57—35)

ABSTRACT OF THE DISCLOSURE

A method and apparatus for producing permanently crimped, fluffed, or wavy glass yarn is described. The method comprises continuously drawing the glass yarn from a suitable supply, twisting the yarn drawn from said supply, passing the yarn at a selected linear speed through a heat zone to heat the yarn to a temperature sufficient to set the yarn in the twisted formation, applying lubricant to the yarn after heating thereof, cooling the yarn under uniform tension to stabilize the yarn after passage through the heat zone, untwisting the yarn and collecting the processed yarn. The disclosed method optionally includes applying a fixing agent to the twisted yarn. The resultant yarn is permanently crimped and has relatively high flexibility and structural strength.

The present invention relates to the manufacture of glass yarn and relates, more particularly, to high speed continuous processing of glass yarn to impart crimp and/or torque therein in order that the yarn may be made into an article exhibiting permanent crimped, wavy or fluffed characteristics.

In United States Patent 2,803,108 to N. J. Stoddard et al., issued Aug. 20, 1957 there are disclosed and claimed methods of processing polyamide and other thermoplastic textile yarns. These methods contemplate, broadly, passing yarn through a heated zone to heat the yarn to a prescribed temperature, cooling the yarn to stabilize the same after passage through the heated zone, and winding up the processed yarn. It is within the scope of the cited patent to twist the yarn during processing to impart certain physical characteristics thereto such as that which may generally be called "stretch." Broadly stated, the yarn which displays these characteristics may be thought of as exhibiting a number of crimps and/or "pigtails" when the yarn strand is relaxed, i.e., when little or no tension is present in the yarn. The crimps are simply undulations or wavy formations in the yarn. The pigtails are actually sections of the individual yarn filaments comprising the yarn strand which are looped and twisted about themselves. Obviously, the pigtails so formed will have one or more loops or cross-over points therein where a filament has spiraled or twisted about itself. When the processed yarn is placed under higher tension the loops in the filaments uncoil to permit the yarn strand to extend and when the higher tension is relieved the crimps and pigtails reform to contract the length of the yarn. This process is continuously reversible if the yarn has been permanently set in accordance with the methods of the cited patent.

Prior to the present invention it has been impractical from a commercial standpoint to process filament glass yarn in the manner just recited for processing polyamide yarn. While it is true that glass yarn under proper conditions of correlated temperature and tension can be false twisted in order to impart stretch characteristics thereto, it has been found that, with prior art methods these stretch characteristics in the yarn were both difficult to achieve and retain. It has been discovered that glass yarn which was processed by the prior art methods lost virtually all its

strength and recovery characteristics due to its being bent and abraded as occurs when the yarn is passed through a false twist spindle, or when the false twisted glass yarn is streched and relaxed. This is largely due to the poor abrasion characteristics of the individual filaments of the glass yarn after the yarn has been heated. That is to say, when filament glass is manufactured it is provided normally with a finish, such as a lubricant, which forms a protective coating providing the filaments with increased abrasion resistance. When this yarn is subsequently passed through a heat zone to reform the yarn, as contemplated by the present invention, the finish is burned off or its abrasion resistance is reduced. Thus, the yarn is thereafter responsive to abrasion as adjacent sections of the filaments rub on each other as the yarn is bent about a small radius so that the yarn cracks or fractures thereby destroying the continuity of the crimps and pigtails which, as explained, actually account for the stretch characteristics of the yarn. To consider further the condition of the yarn passing through the false twist spindle it will, of course, be appreciated that the individual filaments comprising the glass yarn strand are subjected to considerable rubbing on one another or, in other words, "interfiber friction" takes place as the yarn is wrapped around the twist trapping member of the spindle. In the absence of lubrication, these filaments abrade and subsequently fracture. Similarly, when the glass yarn which has been false twisted is alternately stretched and relaxed the pigtails uncoil and recoil thereby subjecting them to interfiber friction and considerable abrading at the cross-over points of the pigtails, all of which leads to fracturing of the filaments if the yarn is unlubricated.

With the foregoing in mind it has been found that in practice with the present invention it is possible to process filament glass yarn in a continuous process where the glass yarn which is subsequently formed into fabrics or other articles exhibits permanent qualities of stretch. Briefly, the present invention is directed to methods and apparatus for processing glass yarn wherein the yarn is continuously drawn from a source of supply, the yarn is twisted whereafter it is passed through a heat zone at a selected linear speed under uniform tension to heat the yarn and set it in its twisted formation, the yarn is then cooled and lubricated prior to entering the false twist spindle. After being untwisted it is collected and the torsional forces in the yarn are controlled. The torsional forces may be controlled by applying a soluble stiffening agent to the yarn prior to collecting the yarn, or by heating the yarn a second time under uniform tension conditions. The processed yarn may be subsequently formed into a fabric with the torsional forces in the yarn controlled. If a stiffening material has been used it can subsequently be washed out. The weave or formation of the fabric or article formed therefrom will thereupon serve to restrict the coiling or pigtailing of the filaments of the yarn to the end that a fabric exhibiting permanent stretch characteristics is obtained.

Therefore, one object of the present invention is to provide a method for manufacturing glass yarn having torque stretch characteristics of a permanent nature.

A further object of the present invention is to provide methods for processing glass yarn which has permanent stretch characteristics, which said process is a continuous one step operation.

Yet, an additional object of the present invention is to provide a method for processing filament glass yarn with torque stretch characteristics wherein the yarn is lubricated and sized to form a yarn which may be woven into a fabric under the conditions of latent stretch, and the fabric may be treated thereafter to develop the stretch characteristics of the glass yarn.

Still another object of the present invention is to provide a method for manufacturing glass yarn wherein the yarn is heated, twisted, cooled, untwisted and then reheated a second time under correlated conditions of temperature, tension, and yarn speed to control the degree of filament looping to achieve desired yarn characteristics.

An additional object of the present invention is to provide apparatus for continuously processing glass yarn wherein the yarn is heated, twisted, lubricated, and collected under uniform tension to produce yarn having crimped, fluffed or wavy characteristics.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the processes involving the several steps and the relation and the order of one or more of such steps with respect to each of the others which are exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be made to the following detailed description taken in connection with the accompanying drawing wherein:

FIG. 1 is a diagrammatic side sectional view of a multistation apparatus adapted to practice the present invention;

FIG. 2 is a diagrammatic front elevational view of the apparatus of FIG. 1; and

FIGS. 3 and 4 are fragmentary views similar to FIG. 1 showing modifications within the scope of the present invention.

With reference to the drawing, a preferred apparatus for carrying out the present invention comprises a multistation machine, each station including a false twist spindle, a separate yarn supply, a wind up means, a first heat zone for heating the glass yarn to a plastic state while the yarn is in a twisted condition, a lubricating station for applying a lubricant to the yarn while the yarn is in its twisted condition, a sizing station for applying a size to the yarn after the yarn has been untwisted, a second heat zone for setting the size prior to winding up of the processed yarn and a tension device for maintaining the yarn in a tensioned condition during its passing through said first heat zone, lubricating station, false twist spindle, sizing station, and second heat zone. The take up is coordinated by conventional drive means, not shown, to correlate the linear speed of travel of the glass yarn with the rotational speed of the false twist spindle to insert the desired false twist into the yarn. The temperatures of the heat zones are likewise correlated to the linear speed of travel and count of the yarn to supply sufficient heat thereto whereby in the first heat zone the glass yarn is transformed to a plastic state to effect the proper yarn setting in the twisted formation. The second heat zone is similarly correlated in order to properly heat the yarn with the size thereon in order that the size may be fixed or dried prior to take-up of the yarn.

With attention now to the drawing there is illustrated one processing station. It will be understood that in the preferred apparatus a plurality of similar stations would be arranged in side by side relationship along a common frame, all of the stations being operated from a single source of driving power. It will be further understood since all of these stations would be similar in construction it will suffice to describe but one of the stations in the following description. In the present instance the glass yarn is supplied from a supply package **10** mounted at the base of the machine for over-end delivery through a pigtail guide **12** and over a guide rod **14** to tension means **16**. Tension means **16** may be of the interdigitated finger type presenting a tortuous course to the yarn Y. A pair of pigtail yarn guides **17** and **18** are disposed on opposite sides of tension **16** in order to guide the yarn in a straight line path through this tension means. The yarn Y is directed from pigtail guide **18** upwardly through a further

pigtail guide **19** positioned in vertical alignment with and spaced below a heater **20**. Pigtail guide **19** serves to facilitate movement of the yarn into an appropriate tube **22** of heater **20**. Heater **20** may be any conventional type such as the electrically controlled type disclosed and claimed in U.S. Patent 2,864,931 to N. J. Stoddard, et al., entitled "Heating Device for Use in Processing Textile Yarns," issued Dec. 16, 1958 and operated by conventional means not shown herein to accurately regulate the amount of heat imparted to the yarn during its travel therethrough. While it is not the intention of the present invention to limit the method to a specific type of heating it should be noted, in practice with the instant invention, that it is desirable for the heater to be of the radiant type so that the strand of yarn Y is not in direct contact with any element of the heater. Rather, as illustrated, the yarn is conducted axially through the heated tube **22** forming a radiant yarn heating zone centrally through the heater **20**. Preferably tube **22** is approximately 27 inches long and is capable of being heated in the order of 700–2500° F. by heater **20**.

From the heater **20** the yarn passes upwardly through a centering guide **26** to a false twist spindle **28**, said spindle **28** being spaced sufficiently from the heater to provide a cooling zone for the yarn therebetween. The guide **19** cooperates with guide **26** to direct the yarn axially through tube **22** while keeping the yarn from running against the wall of the tube. Centering guide **26** also centers or positions the yarn for entrance into the central bore of false twist spindle **28** of the type, for example, disclosed and claimed in U.S. Patent 2,829,487 to N. J. Stoddard, et al. entitled "Yarn Spindle," issued Apr. 8, 1958. As the yarn moves in its path from heater **20** to spindle **28** the yarn is caused to run against a lubricant applying roll **30** mounted for rotation on a shaft **32** which is driven by a suitable power source, not herein shown. As shown in FIGS. 1 and 2 the roller has its lower section immersed in a trough **34** holding a lubricating bath **36** of suitable material. Thus, prior to entering the false twist spindle **28**, the yarn has a lubricant applied to the surface thereof.

The false twist spindle **28** is of the high speed belt-driven type and operates in the well-known manner to impart a high degree of twist to the yarn Y. The twist imparted to the yarn by the false twist spindle **28** extends in the yarn from the spindle **28** downwardly through heater **20** to tension **16** which performs the additional function of preventing the twist in the yarn from extending beyond said tension **16**. Thus, it will be seen that the yarn, as it is guided against roller **30**, is in a twisted condition. Moreover, it will be appreciated that as the yarn extends through tube **22** of heater **20** it is also in a twisted state. Advantageously, spindle **28** includes a spindle blade **38** having a central bore or aperture therethrough, said blade being in driving contact with an elongated belt **40**. An idler pulley **42** which is one of a series of such pulleys along the apparatus, serves to track the driving belt. The driving belt **40** is operated from a power source not herein shown. The upper end of spindle blade **38** is formed as an enlarged spindle head **44** which is centrally apertured in coaxial alignment with the aperture through the main spindle blade to accommodate the yarn axially therethrough. A twist trapping device spans the opening across the center of spindle head **44** and, in operation, the yarn is wrapped around this twist trapping device in order that yarn may be suitably twisted.

As the yarn emerges upwardly from twist trapping device **46** it is guided through a guide **48** which centers the yarn over device **46**. The yarn passes from device **46** to guide bar **49** and then through a pigtail guide **50** and in doing so the yarn is caused to contact a further roller **51**. Said roller **51** is mounted on a power driven shaft **52** whereby, as said shaft **52** is rotated, the roller **51** is caused to rotate at a predetermined surface speed

related to the linear speed of the yarn. It will be appreciated that roller **51** may also serve as a furnishing device. As seen in FIGS. 1 and 2 roller **51** is partially submerged in a trough **54** containing a bath **56** of a sizing agent.

Thus, as the yarn Y passes around roller **51** which is immersed in the bath **56** the yarn takes on size from the bath. It will be apparent that vertical adjustment of bar **49** and guide **50** relative to the axis of shaft **52** will also control the degree of contact of the yarn with roller **51** and, thereby control the amount of pick-up of size by the yarn.

There is disposed upwardly of said sizing station a further heater **60** having a centrally positioned elongated tube **61** therein which is located to receive the yarn axially therethrough upon its passage through guide **50**. Heater **60** is preferably about 27 inches long and is capable of being heated to a temperature to fix or dry the size on the yarn strand. Heater **60** may be of any suitable type but, preferably is a radiant heater such as that fully disclosed in the earlier cited Patent 2,864,931. By this construction the heater is not contaminated with the sizing agent, that is to say, the sizing agent is not deposited on the radiant heater. Thus the operating efficiency of the apparatus is maintained to a higher degree by the use of a radiant heater. From heater **60** the yarn is directed through a guide **62** to a take-up means. Said take-up means is constituted as a pair of rolls **65** and **66**. Roll **66** is powered through shaft **68** upon which this roll is mounted and, in turn, roll **65** is driven by frictional contact with roll **66**. A traverse **70** is arranged to receive the yarn directed thereto from guide **62** and over guide bar **63** in order to deposit the yarn in a level wind on roll **65**. It will be appreciated that the yarn is under a uniform predetermined tension at all times between its passage from tension **16** to take-up **65**, the level of tension between any two contact points being, of course, dependent upon the conditions of the contact points, sizing material, yarn count, lubricant, etc. Moreover, by virtue of the take-up arrangement the yarn is taken up at a predetermined rate correlated with the tension condition in the strand as it is processed through the apparatus described.

Referring now more particularly to the lubricating material employed in lubricating bath **36** in practicing the present invention, this is desirably a high molecular weight polyalkylene glycol such as is sold commercially under the trade name Ucon Lubricant 50–HB–55 manufactured and sold by Union Carbide Chemical Company, South Charleston, W. Va.

The particular sizing agent employed in bath **56** may be of any well known kind. Factors such as cohesiveness of a particular sizing agent to a particular glass yarn, cost, and the end use to which the processed glass yarn will be put will, obviously enter into selection. With respect to the last mentioned factor and by way of example, yarns which are to be knit would require a size having good inherent lubricity characteristics so that the yarn would flow smoothly in the knitting machine. Examples of suitable sizing agents for selected conditions are sodium alginate, polyvinyl alcohol and paraffin wax.

In accordance with the present embodiment of the invention glass yarn Y is drawn over the end of supply package **10** and drawn through the apparatus at a preselected linear speed to be finally wound onto take-up roll **65**. In the course of its movement the glass yarn is engaged by tension means **16** which serves to maintain the yarn Y under a pre-established tension in the heat zone. By virtue of this arrangement twist which is inserted into the yarn by spindle **28** runs back through heater **20** and is arrested at tension means **16**. The actual number of turns of twist in the glass yarn between spindle **28** and tension means **16** is, of course, controlled by the speed of rotation of said spindle **28** and the linear speed of the yarn through the spindle **28**. Further, it will be clear that after the yarn is heated in its twisted state in the zone of heater **20** the yarn is cooled in the cooling zone between heater **20** and twist trapping device **46** to thereby set the twist in the glass yarn. Moreover, this yarn is lubricated in the cooling zone by roller **30** prior to passing around twist trapping device **46**. This lubrication of the yarn is advantageous in facilitating the movement of the glass yarn around the twist trapping device **46** and upwardly through guide **48**. Due to the fact that the yarn is wrapped about twist trapping device **46** on a small radius of curvature (twist trapping devices commonly employed in apparatus as exemplified herein being in the order of ⅛ inch diameter) and further, in the light of the fact that the glass yarn may rub against an adjoining wrap of yarn on the twist trapping device thereby increasing the frictional drag of the yarn by resisting its movement, the yarn has been observed to break frequently in the area of twist trapping device **46** and guide **48** in the absence of such lubrication. This lubricant also lubricates the individual filaments during the untwisting process and thereby reduces the abrasive action of filaments on each other during the untwisting step of the operation.

Upon emergence from the twist trapping device **46** the yarn is untwisted, this untwisting occurring by virtue of the operation of false twist spindle **28** in a manner well known in the art. After the yarn has been untwisted it is sized by contact with roll **51**. It will be appreciated that the glass yarn, after being untwisted, is maintained under tension sufficient to prevent the afore-mentioned pigtails forming in the yarn. In the course of the movement of the yarn Y against roll **51** and through heater **60** the yarn is sized, the size fixed or dried and thus the yarn is prevented from looping. Consequently, as it is wound onto take-up roll **65** the yarn is in a substantially straight configuration, possessing only latent forces. Thereafter, the yarn from take-up roll **65** may be readily woven or knitted into a fabric after which the size is removed by washing in water or other suitable solvents or by being vaporized off in a heated zone at a suitable temperature to release or activate the latent forces in the yarn to thereby provide a product having highly desirable permanent stretch characteristics.

In fabric form the yarn either does not assume the looped or pigtail configuration because of fabric type and geometry or the loops that are developed in the yarn are never fully extended, thus barring the undesirable fracturing characteristics of the looped or pigtailed glass yarn described earlier.

The following are typical examples of the production of glass yarn processed by the method of the present invention:

Example I

To produce a stretch glass yarn having high stretch and recovery characteristics for use in upholstery materials and the like, glass yarn of the type identified as type 150/1/0 manufactured and sold by Owens-Corning Fiberglas Corporation, Ashton, R.I., and having 1 turn Z twist per inch was processed by being drawn off the supply package **10** at 533 inches per minute. The yarn was S twisted 37 turns per inch by spindle **28** being operated at a speed of 19,700 r.p.m. and while thus being twisted the yarn was passed through heater **20** under a tension of 7 grams. The heater **20** was heated to a temperature of 1100° F., the heater being 27 inches long. Ucon Lubricant 50–HB–55 was applied to the yarn by roll **30**. A 0.5% solution of sodium alignate was applied to the yarn by roller **51** and the sized yarn was dried by heater **60** which was set at a temperature of 800° F. as the yarn was passed therethrough. The length of heater **60** was 27 inches. The glass yarn processed in accordance with the foregoing possessed about 400% stretch in yarn form and about 100% in fabric form.

Example II

A stretch yarn having stretch and recovery characteristics of a lower percentage than that of the foregoing example may be desired for curtains and like articles. In keeping with this objective and as a typical example thereof type 150/1/0 glass yarn, of the same kind set forth in the previous example, having 1 turn Z twist was processed by being drawn off supply package **10** at 533 inches per minute. The yarn was S twisted 37 turns per inch by spindle **28** being operated at 19,700 r.p.m. and while thus being twisted the yarn was passed through heater **20** under a tension of 7 grams. The heater was 27 inches long and was heated to a temperature of 1100° F. Ucon Lubricant 50–HB–55 was applied to the yarn by roll **30**. No sizing agent was applied to the yarn. The twisted yarn was passed through heater **60**, which was heated to 800° F. The length of the heater was 27 inches. The glass yarn produced in accordance with the foregoing procedure had about 100% stretch in yarn form and about 25% stretch in fabric form.

Thus, it will be appreciated from the foregoing that the present invention provides a method for producing stretch glass yarn having torsional forces in the yarn, which said yarn can be readily made into an article. The article exhibits permanent stretch wavy or fluffed characteristics. Moreover, the present invention provides a method for producing stretch glass yarn wherein the degree of stretch or liveliness in the yarn may be controlled as a part of the overall process, which said stretch is uniform and permanent.

While a selected embodiment of the present invention has been herein illustrated and described, it should be apparent that many variations are possible within the scope of the present invention. For example, under certain conditions it may be desirable to provide positive feeding of the glass yarn to the take-up. This may be required, for example, when a high degree of control of the stretch in the yarn is required as in Example II or where the density characteristics of the yarn package are to be controlled. With such objectives in mind there is shown in FIG. 3 a modified form of the present invention. It will be appreciated, in connection with FIG. 3, that the elements below false twist spindle **28'** will be identical with those shown in FIGS. 1 and 2. Moreover, it is to be understood in the modification of FIG. 3 false twist spindle **28'** operates in the same manner as false twist spindle **28** of the embodiment of FIGS. 1 and 2. Thus, spindle **28'** includes a blade **38'** driven by an endless belt **40'** against the blade by a guide pulley **42'**. The spindle **28'** includes an enlarged head portion **44'** supporting a twist trapping device **46'**, and an upper guide **48'**. The yarn Y' is false twisted by spindle **28'** in the same manner as described in connection with the earlier embodiment whereafter the yarn is directed over guide bar **49'**, through guide eyes **50'** and **62'** and heater **60'**, over bar **63'** to be taken up on take-up **64'** driven by frictional engagement with drive roll **65'**. All of the foregoing elements are the same in construction and operate in the same manner as their counterparts in the embodiment of FIGS. 1 and 2. In the modification of FIG. 3 the sizing roll and trough are omitted and a pair of positively driven nip rolls or feed rolls **70'**, **72'** are provided between bar **49'** and guide **50'** to nip the yarn therebetween and advance it at a controlled rate through heater **60'**. Thus, the tension in the glass yarn passing through heater **60'** is correlated with the heat applied to the yarn thereat so that the desired degree of relaxation in the torsional forces in the yarn is achieved. A high accurate and precise control for the yarn is, therefore, provided to control the physical characteristics of the yarn taken up on roll **65'**. Obviously, the stretch imparted to the processed yarn will be a function of the degree of relaxation given the yarn as it passes through heater **60'** and the temperature to which the yarn is heated at heater **60'**.

Another modification within the scope of the invention is achieved with the structure of FIG. 4. Here again, the view is fragmentary and it should be understood that the arrangement of parts below false twist spindle **28''** is the same as that as shown in FIGS. 1 and 2. Moreover, false twist spindle **28''** includes blade **38''** operated by belt **40''** which is guided by pulley **42''**. False twist spindle **28''** includes a head **44''** carrying a twist trapping device **46''** so that the false twist spindle operates in the same manner as that of the spindle of FIGS. 1 and 2. The yarn Y'' is guided from spindle **28''** over bar **49''**, through guides **50''** and **62''** to be taken up on roll **65''** driven by frictional engagement with drive roll **66''**. It is to be understood that all of the components just recited operate in the same manner as the corresponding structures in the first described embodiment. In FIG. 4 it will be seen that a trough **54''** is provided between bar **49''** and guide **50''**. Said trough **54''** is provided with a series of heating elements **74** arranged to heat a bath **56''** of sizing agent having a melting point higher than ambient, such as parafin wax. A roll **51''** is partially submerged in the bath and is rotated on drive shaft **52''**. The yarn Y'' is fed against the roll to have the sizing agent applied thereto. It will be observed that the heater for dying the size have been omitted in this modification and the space between guides **50''** and **62''** constitutes a cooling zone whereby the size is hardened on the glass yarn prior to take up on roll **65''**. The sizing agent, of course, functions the same as described earlier with reference to FIGS. 1 and 2 to control the coiling and crimping of the yarn as the yarn is taken up. It will be apparent that this modification of the invention admits of certain additional economies in operation by avoiding the necessity for heat drying of the size.

Since certain changes may be made in the above method and apparatuses without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative only, and not in a limiting sense.

What is claimed is:

1. The method of producing glass yarn having permanently crimped, fluffed or wavy characteristics which comprises, continuously drawing the glass yarn from a source of supply, twisting the yarn drawn from said supply, passing the yarn at a selected linear speed through a heat zone to heat the yarn to a temperature to yarn-set the same in the twisted formation, providing uniform tension on the yarn in said heated zone, applying a lubricant to the yarn after heating thereof, cooling the yarn under uniform tension to stabilize the same after passage through said heat zone, untwisting the yarn, and collecting the processed yarn.

2. The method of producing glass yarn having permanently crimped, fluffed or wavy characteristics which comprises, continuously drawing the glass yarn from a source of supply, twisting the yarn drawn from said supply, passing the yarn at a selected linear speed through a heat zone to heat the yarn to a temperature to yarn-set the same in the twisted formation, providing uniform tension on the yarn in said heat zone, applying a lubricant to the yarn after heating thereof, cooling the yarn under uniform tension to stabilize the same after passage through said heat zone, untwisting the yarn, collecting the processed yarn, and fixing a stiffening agent on said yarn prior to collecting of the same while maintaining the yarn under prescribed tension to preclude substantially any coiling in the processed yarn.

3. The method of producing glass yarn having permanently crimped, fluffed or wavy characteristics which comprises, continuously drawing the glass yarn from a source of supply, twisting the yarn drawn from said supply, passing the yarn at a selected linear speed through a heat zone to heat the yarn to a temperature to yarn-set the same in the twisted formation, providing uniform

tension on the yarn in said heat zone, applying a lubricant to the yarn after heating thereof, cooling the yarn under uniform tension to stabilize the same after passage through said heat zone, untwisting the yarn, applying a stiffening agent to said yarn, heating said yarn to dry the stiffening agent thereon while maintaining the yarn under prescribed tension to preclude substantially any coiling in the processed yarn, and finally collecting the processed yarn.

4. The method of producing glass yarn having permanently crimped, fluffed or wavy characteristics which comprises, continuously drawing the glass yarn from a source of supply, twisting the yarn drawn from said supply, passing the yarn at a selected linear speed through a heat zone to heat the yarn to a temperature to yarn-set the same in the twisted formation, providing uniform tension on the yarn in said heat zone, applying a lubricant to the yarn after heating thereof, cooling the yarn under uniform tension to stabilize the same after passage through said heat zone, untwisting the yarn, applying a stiffening agent to said yarn, passing said yarn through a cooling zone to set said stiffening agent thereon while maintaining the yarn under prescribed tension to preclude substantially any coiling in the processed yarn, and finally collecting the processed yarn.

5. The method of producing glass yarn having permanently crimped, fluffed or wavy characteristics which comprises, continuously drawing the glass yarn from a source of supply, twisting the yarn drawn from said supply, passing the yarn at a selected linear speed through a heat zone to heat the yarn to a temperature to yarn-set the same in the twisted formation, providing uniform tension on the yarn in said heat zone, applying a lubricant to the yarn after heating thereof, untwisting the yarn, relaxing the strand in a controlled manner to preclude substantially any coiling in the processed yarn, setting said yarn in said relaxed condition, and finally collecting the processed yarn.

6. Apparatus for processing glass yarn comprising, a support for a supply of yarn, a heating device defining a thermally isolated heat zone for passage of yarn therethrough to heat the yarn, a false twist device including a twist trapping member to impart twist in the yarn before passage thereof through said heat zone and to untwist the yarn thereafter, means for applying a lubricant to said yarn after passage of the yarn through said heat zone and prior to engagement of the yarn with said twist trapping member, take up means for collecting the processed yarn, and tension means operable to maintain the yarn at a uniform tension during passage thereof through said heating device and to said take-up means.

7. Apparatus as set forth in claim 6 wherein said lubricating means includes a trough for holding said lubricant, and a rotatable roller disposed to deliver said lubricant to said yarn during passage of the yarn to said twist trapping member.

8. Apparatus for processing glass yarn comprising, a support for a supply of yarn, a heating device defining a thermally isolated heat zone for passage of yarn therethrough to heat the yarn, a false twist device including a twist trapping member to impart twist in the yarn before passage thereof through said heat zone and to untwist the yarn thereafter, means for applying a lubricant to said yarn after passage of the yarn through said heated zone and prior to engagement of the yarn with said twist trapping member, take up means for collecting the processed yarn, means for controlling the torsional forces in the twisted yarn to preclude substantially any coiling in the processed yarn, and tension means operable to maintain the yarn at a uniform tension during passage thereof through said heating device.

9. Apparatus as set forth in claim 8 wherein said controlling means includes a receptacle for containing a supply of a stiffening agent, a delivery member for depositing said agent on the surface of said yarn, and a second heating device for drying said stiffening agent on said yarn.

10. Apparatus as set forth in claim 8 wherein said controlling means includes a container for accommodating a supply of stiffening agent, heating means for maintaining said stiffening agent in a liquid state in said container, and a delivery member for depositing said agent on the surface of said yarn, said container being spaced apart from said take-up means to thereby define a cooling zone through which the yarn is passed to said take-up means to thereby dry said stiffening agent on said yarn.

11. Apparatus as set forth in claim 8 wherein said controlling means includes a pair of yarn engaging rolls positioned to advance said yarn from said false twist device to said take-up means at a pre-selected speed, said yarn engaging rolls being spaced apart from said take-up means, said speed of advancement of the yarn by said yarn engaging rolls being greater than the speed at which the yarn is taken up by said take-up means, to thereby achieve controlled relaxation of said yarn, and a second heating device disposed between said yarn engaging rolls and said take-up means to uniformly heat the yarn to a pre-selected temperature sufficient to set said yarn in said relaxed condition.

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