

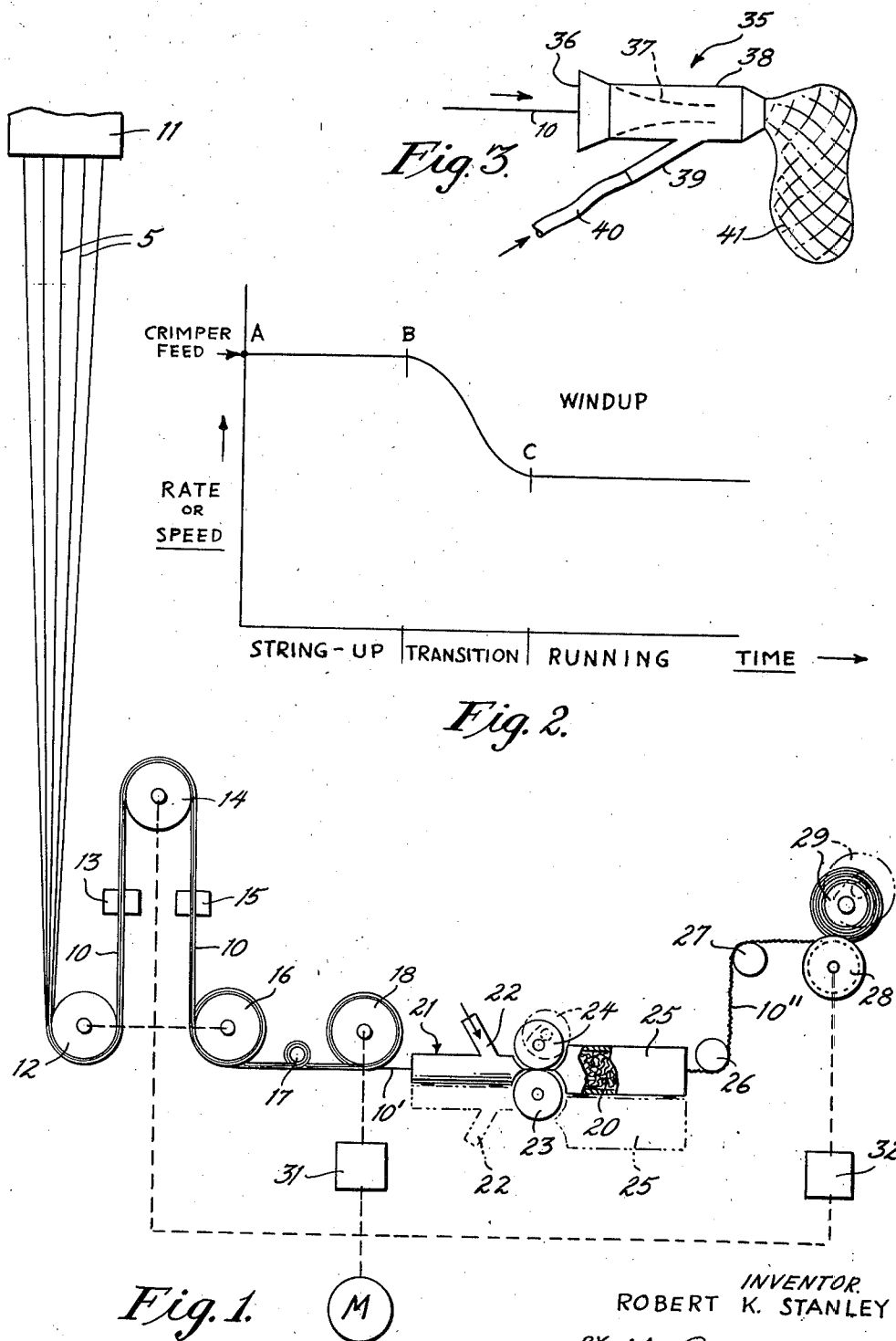
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STRAND TREATMENT

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STRAND TREATMENT

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7 Claims

ABSTRACT OF THE DISCLOSURE

Textile strands are strung up and treated in a continuous drawing and crimping process. When the process is started up the initial rate of withdrawal of the strand from the crimping zone equals the rate of feed thereinto, followed by reduction in withdrawal rate and in corresponding windup rate to a fixed, lower operating rate.

This invention relates to processing or treatment of textile strands, concerning especially the production of crimped strands of synthetic organic polymeric materials, most of which are suitable therefor.

A primary object of the present invention is provision of a continuous process for drawing and crimping textile strands.

Another object is improvement in strand string-up during start-up of a combined drawing and crimping process.

A further object is continuous extrusion, drawing, crimping, and windup of textile strands.

Other objects of the present invention, together with means and methods for attaining the various objects, will be apparent from the following description and the accompanying diagrams relating to a preferred embodiment thereof.

FIG. 1 is a side elevation, partly diagrammatic, of a continuous system for extruding, drawing, crimping, and winding up textile strands, according to the present invention;

FIG. 2 is a graphical representation of strand windup rate (or speed of strand windup means) as a function of time, from process start-up or strand string-up to full operation or running to produce crimped strand.

In general, the objects of this invention are accomplished in a continuous process for treating textile strands by feeding a textile strand into a drawing zone at a predetermined rate, drawing the strand therein and withdrawing it therefrom and feeding it into a crimping zone at a predetermined rate, crimping the strand in the crimping zone and withdrawing it therefrom at a predetermined rate. The invention comprehends apparatus for use therein and particularly in a continuous extrusion-drawing-crimping-windup process incorporating such steps.

FIG. 1 shows, partly schematically and partly in side elevation, extrusion head 11 from which filaments 5 are extruded to fall toward and be collected into multi-filament strand 10 by collecting roll 12 after solidification into self-supporting form. The strand makes a partial turn about that roll, then at least a partial turn about take-up godet 14 after passing in contact with oil roll 13. From the take-up godet, strand 10 passes in contact with oil roll 15 and then makes at least one and a fraction turns about input godet 16 to a drawing zone between it and draw roll 18, which rotates at a greater surface speed than that of the input godet and about which the strand makes at least a full turn. The strand is wrapped also about draw pin 17 therebetween, localizing there the actual drawing of the strand to increased length.

The drawn strand, designated as 10' to distinguish it from undrawn strand 10, passes through preheating chamber 21, which has branch 22 for cocurrent injection of steam, hot air, or other fluid, to the nip of feed rolls 23,

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24 to which is juxtaposed the entrance to stuffing chamber 25. Part of the near wall of the stuffing chamber is cut away to show strand accumulation 20 inside. From the open exit end of the stuffing chamber, crimped strand 10' (so designated to distinguish it from the strand at previous stages in its formation or treatment) passes about part of rolls 26 and 27, over helically grooved traversing drive roll 28, and winds onto package 29 rotated by surface contact with the drive roll.

Nip roll 24 and package 29 are swingably mounted to permit temporary spacing (shown in broken lines) from the respective adjacent rolls to facilitate introduction of the strand therebetween when starting up the apparatus. Both the preheating and stuffing chambers have their near walls pivotally mounted to open (also shown in broken lines) for a like reason. The strand is normally strung up through the entire system with all the rolls rotating at normal operating speed except rolls 26 and 27, which usually are idler rolls (i.e., undriven), and the traversing drive roll. That drive roll is rotated at the same speed as feed rolls 23, 24 while the strand is strung up from the extrusion head to the windup package during start-up, and then its speed is reduced gradually until it is at a predetermined fixed ratio of that of the feed rolls, thereby similarly reducing the speed of the package, which is allowed to rest on the drive roll as soon as the strand is strung up onto the package. The strand may be aspirated through preheating chamber 21 (left in the closed position) by introduction of air into branch 22 and presentation of the strand to the chamber entrance, whereupon it will be sucked thereinto and be blown out the opposite end of stuffing chamber 25.

Alternatively, the string-up can be performed with the chamber walls pivoted open (broken lines). In any event, upon completion of the string-up, the temporarily displaced feed roll is swung back into its normal operating location (shown in solid).

Motor M drives collecting roll 12, take-up godet 14, and input godet 16 at uniform speed, appropriately matched to the extrusion rate, draw roll 18 at a greater speed in accordance with the desired draw ratio (usually about 4× on nylon strands) and feed rolls 23, 24 at the speed of the draw roll, and package drive roll 28 at a lower speed as indicated. Variable-speed transmission 31 is interposed between motor M and draw roll 18, and variable-speed transmission 32 is interposed between the motor and traversing drive roll 28. Mechanical interconnections between the motor and the rolls and/or transmissions are shown in broken lines. The construction of the interconnecting linkages and of the elements so interconnected and the controls therefor (not shown) are conventional and require no further description or illustration.

FIG. 2 shows in graphical form the change in value of the strand windup rate (or windup package or drive roll speed) as a function of time. At the beginning of string-up the windup rate equals the crimper feed rate (or crimper feed roll speed) at point A, and no change occurs throughout string-up, as indicated by point B and the interconnecting level line. The gradual reduction in windup rate during the transition from start-up to normal running conditions is indicated by an ogee-shaped curve from point B to point C, designating a lower windup speed or rate value that continues unchanged. Of course, the windup rate can be altered further at will in the event of a change in feed rate, as in the instance of a change in draw ratio, or if a different crimp level is desired at the same feed rate or draw ratio.

FIG. 3 shows, in side elevation, aspirating device or "sucker gun" 35 useful in stringing up the strand by sucking it into intake 36, which forms venturi 37, shown in dotted lines within body 38. Air blown into branch

39, to which is connected a pressurized source (not shown) by tube 40, exhausts through the smaller end of the device, to which is connected collecting net or bag 41. One strand collected therein during start-up is cut off from the rest of the strand once string-up is completed and is subsequently treated as waste. The structure and operation of such a device can be readily found in the art or be devised herefrom by a person having normal skill therein. The same is true of the components of the system illustrated in FIG. 1. If a back-pressure element is used in the stuffing chamber it should be adapted to leaving string-up clearance, as is the gear of wheel-like element so used in List et al. Patent 3,027,619, for example. Also especially useful herein is the "long chamber" type of stuffer crimper, lacking any added back-pressure element, disclosed in my copending patent application Ser. No. 401,160, filed Oct. 2, 1964.

The process of this invention is particularly advantageous in facilitating start-up and reducing waste produced therein. The product thereof is noted for its high degree of uniformity at any desired crimp level. Although a preferred embodiment of the process and apparatus has been described, the invention is merely exemplified rather than limited thereby and is defined in the following claims.

The claimed invention:

1. In a continuous treating process for textile strands comprising feeding a textile strand into a drawing zone at a predetermined rate, drawing the strand therein and withdrawing it and feeding it into a crimping zone at a predetermined rate, crimping the strand in the crimping zone and withdrawing it therefrom at a predetermined rate, the step of stringing up the strand therethrough wherein the initial rate of withdrawal from the crimping zone equals the rate of feed into the crimping zone.

2. The process of claim 1 wherein the rate of withdrawal of the strand is reduced gradually upon completion of string-up to a lower rate.

3. The process of claim 2 wherein the lower rate of withdrawal of the strand from the crimping zone after completion of string-up remains fixed with regard to the rate of feed into the crimping zone.

4. The process of claim 3 wherein the crimped strand is wound into package form at the rate of withdrawal of the strand from the crimping zone.

5. Continuous extrusion - drawing - crimping - windup process for textile strands comprising extruding a fiber-

forming composition into continuous strand form, forwarding the resultant strand into a drawing zone at a predetermined rate, drawing the strand to increased length in the drawing zone and feeding the drawn strand therefrom into a crimping zone at a predetermined rate, stuffer-crimping the drawn strand in the crimping zone and withdrawing the crimped strand therefrom at a predetermined rate, and winding up the strand at the last mentioned rate, including the step of starting the process up by equalizing the strand windup rate with the rate of feed into the crimping zone until the strand is strung up from extrusion to and including windup, and wherein the windup rate is reduced gradually thereafter to a fixed lower operating rate.

6. The process of claim 5 wherein the strand is drawn to at least about four times its initial length and wherein the operating windup rate is at most about eighty percent of the rate of feed of the strand into the crimping zone.

7. The process of claim 6 wherein the strand composition consists essentially of nylon.

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