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METHOD AND APPARATUS FOR MAKING LIMITED STRETCH BULKED YARN

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2 Sheets-Sheet 1

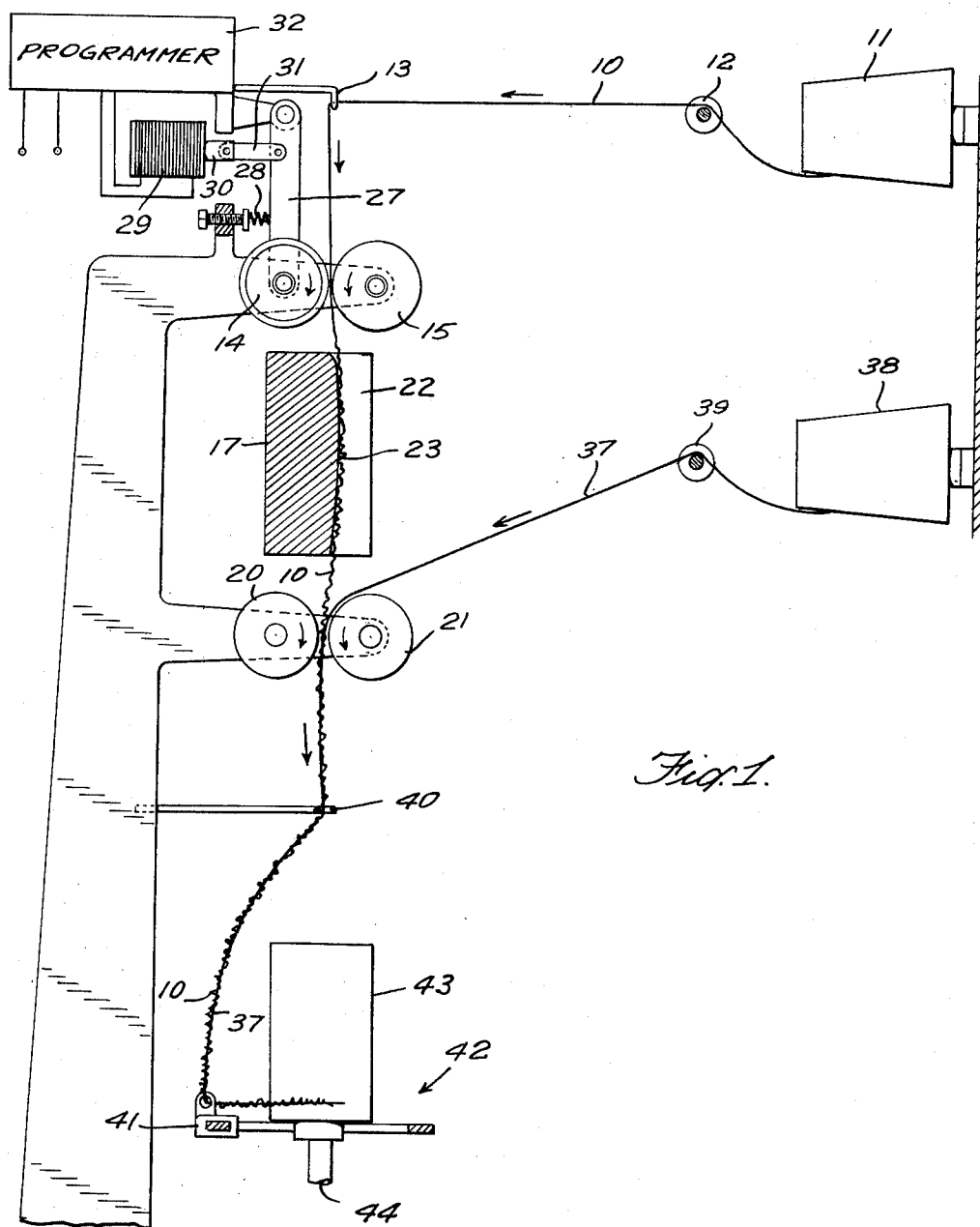


Fig. 1.

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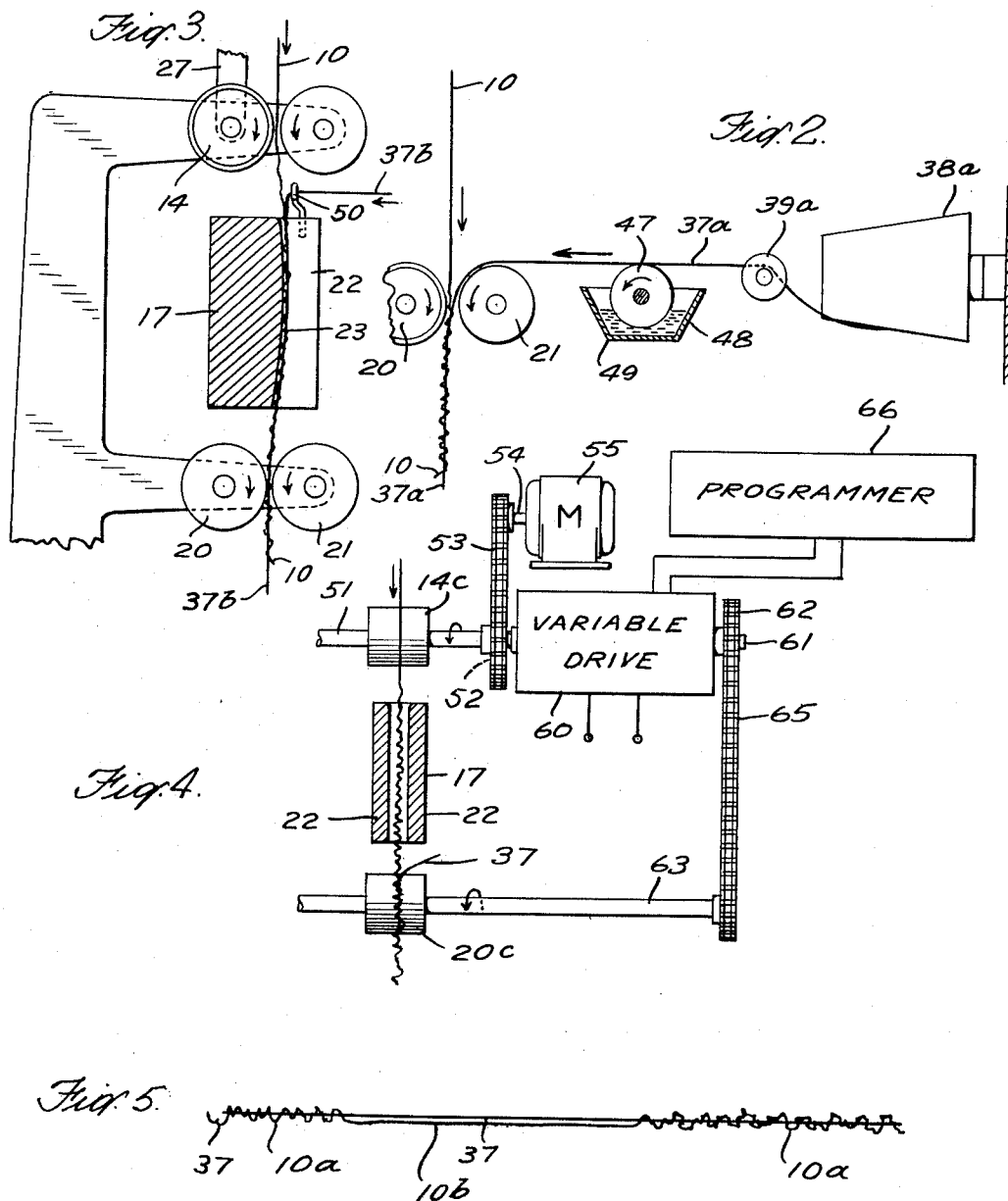
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METHOD AND APPARATUS FOR MAKING LIMITED STRETCH BULKED YARN

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This invention relates to the production of a limited stretch bulked yarn and more particularly to a method and apparatus for producing a yarn composed of one or more continuous synthetic filaments wherein at least some of the filaments are crimped or bulked and others of the filaments are either straight or are less highly bulked.

An object is to provide a yarn of the above type having novel and improved characteristics.

Another object is to provide a method and apparatus for producing a bulked yarn having limited stretch or non-stretch characteristics such that the yarn retains its bulked state when placed under tension during weaving or knitting.

Another object is to provide a yarn of the above type wherein the filaments are bound together by twisting or by a bonding agent in such a way that the less highly bulked yarn controls the stretch characteristics of the yarn and the more highly bulked components retain their bulked effect.

Another object is to provide a yarn of the above type having different degrees of bulk along its length.

Another object is to provide a method of making such a yarn wherein the amount of bulk is varied at predetermined intervals along the yarn for producing a novelty effect.

A further object is to provide a novel and improved method for making a yarn of the above type.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

The nature of the invention will be better understood from the following description, taken in connection with the accompanying drawings in which certain specific embodiments have been set forth for purposes of illustration.

In the drawings:

FIG. 1 is an elevation of an apparatus for carrying out the present method, with parts in section for clarity;

FIG. 2 is a partial elevation of a modified apparatus wherein the core yarn is passed through a waxing station prior to plying;

FIG. 3 is a partial elevation, similar to FIG. 2, illustrating an embodiment wherein the core yarn is passed through the heater with the prebulk yarn;

FIG. 4 is a similar partial elevation showing an embodiment utilizing a variable speed drive for one of the pairs of rolls; and

FIG. 5 is a detail view of a yarn embodying the invention.

Referring to the drawings more in detail the invention is shown as embodied in an apparatus wherein a previously bulked yarn 10 is taken from a package 11 through a tension means 12 and a guide 13 to the bite of a pair of feed rolls 14 and 15, thence downwardly through a heating tube 17 to the bite of a second pair of feed rolls 20 and 21. The yarn 10 may be composed of continuous filaments which have been bulked by suitable means as in a stuffer crimper, false twister, knife edge crimper or air jet and permanently set in bulked state. When this yarn is wound onto a package the crimps are temporarily pulled out and after standing for a period of time the yarn acquires a temporary straight set which is removed by subsequent heating in relaxed state. Hence the yarn 10 may be in straight form at the bite of the

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feed rolls 14 and 15, but resumes its bulked form when heated in the heater 17 provided the tension is relaxed sufficiently at this point to permit the crimps to reform.

If the yarn 10 is derived from a core package or the like wherein the crimp has not been removed the heater may be omitted as the yarn will resume its crimped form without heating when the tension is relaxed.

The heater 17 is shown as comprising a block having a wall 22 adapted to receive a heating element not shown and having a slightly curved surface 23 over which the yarn feeds for heat transfer by conduction.

The feed roll 14 may have a rubber or silicone surface and may be mounted on a pivoted arm 27 for movement toward and away from the roll 15. The roll 14 is pressed against the roll 15 by a spring 28 and may be retracted by a solenoid 29 having an armature 30 connected to the pivoted arm 27 by a link 31. The solenoid 29 may be actuated by a timer 32 having a suitable program device such as a magnetic tape to energize the solenoid 29 at selected time intervals.

The feed rolls 20 and 21 are driven at a predetermined constant speed and the feed rolls 14 and 15 are driven at a greater speed so as to overfeed the yarn 10 into the heater 17 whereby the tension on the yarn is relaxed in the heater 17 for permitting the yarn to rebulk as previously indicated.

Whenever the feed roll 14 is retracted from the feed roll 15 the yarn is pulled directly through the tension means 12 by the lower feed rolls 20 and 21. Tension is thus maintained on the yarn within the heater 17 so that the yarn remains straight as it wipes over the surface 23. The yarn is thus set in straight form so that the crimp is permanently removed from this portion of the yarn. Hence by controlling the energization of the solenoid 29 the duration of the crimped and straight portions of the yarn can be controlled at will. The rolls 14 and 15 may be so positioned that the roll 14 shifts the yarn out of contact with the surfaces 23 when the two rolls are in feeding position thereby leaving the yarn free to rebulk while in the heating zone.

An uncrimped straight filament 37 is taken from a package 38 through a tension means 39 and fed to the bite of the feed rolls 20 and 21 where it is plied with the filament 10. The plied filaments 10 and 37 are fed through a guide 40 to the traveler 41 of a ring twister 42 wherein the filaments are twisted into yarn form and are wound onto a spool 43 carried by a spindle 44.

The filaments 10 and 37 may be bound together by the twist to form a yarn having a combination of controlled stretch and bulk determined by the bulk of the filament 10 and the stretch characteristics of the filament 37. In some instances the friction of the filaments can be increased by treatment with a friction agent such as fine silica or by a pressure sensitive adhesive bonding agent such as a wax or a thermoplastic compound.

If the filament 37 is somewhat bulked, but to a lesser degree than the filament 10 the yarn will have limited stretch characteristics. If the filament 37 is straight the yarn will have non-stretch characteristics. In any event the bulk is maintained while the yarn is under tension.

The embodiment of FIG. 2 shows a modification of the apparatus of FIG. 1 wherein wax or other bonding agent is applied to the filament 37a before it is fed to the bite of the rolls 20 and 21. In this form the filament 37a is fed from a package 38a through a tension means 39a over a waxing roll 47 which dips into a bath 48 of wax or the like in a tank 49. The filament 37a with a coating of melted wax thereon then passes to the bite of the rolls 20 and 21.

In this form the wax is maintained at a temperature above its melting point so that a coating is applied to the filament 37a as it passes over the roll 47. The filament

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37a with its wax coating is pressed into contact with the filament 10 as the two filaments pass through the bite of the rolls 20 and 21 so that the filaments are bonded together before they are twisted on the ring twister. After the yarn has been wound onto a package the wax can be removed by any suitable means such as by heating the yarn to a temperature above the melting point of the wax but below the softening point of the filament material. Various types of low melting wax can be used for this purpose such as bee's wax or carnauba wax.

Of course other bonding agents may be used such as a bonding adhesive which may remain permanently on the yarn.

FIG. 3 illustrates a modified apparatus which may be used in cases where the core filament carries a heat softenable adhesive or bonding agent. In this embodiment it is assumed that the filament 37b carries a coating of such a heat softenable bonding agent. This filament is passed through an eye 50 into the heater 17 together with the filament 10. In passing through the heater the filament 10 is relaxed so that the bulk reforms and the coating on the filament 37b is softened so that the two filaments are bonded together by the pressure of the feed rolls 20 and 21 as they are plied together and passed to the ring twister.

The embodiment of FIG. 4 illustrates a form wherein the relative rates of feed of the two pairs of feed rolls is varied in a time sequence for thereby controlling the position and amount of bulking which takes place in the heating tube. In this form the upper feed roll 14c is mounted on a shaft 51 carrying a gear 52 which is driven by a chain 53 from the shaft 54 of a motor 55. The mating roll 15 not shown is geared to be driven with the roll 14c.

The shaft 51 is connected to the input side of a variable speed device 60 having an output shaft 61 carrying a gear 62 from which a shaft 63 is driven by a chain 65. The shaft 63 carries the roll 20c of the lower pair of feed rolls. Roll 21 (not shown) is geared to be driven with the roll 20c. The variable speed device is actuated by a timer 66 in a predetermined time sequence to vary the relative rate of feed of the upper and lower pairs of feed rolls. With the drive in one position, the two pairs of feed rolls are driven at the same speed. With the drive in another position, the upper pair of feed rolls are driven at a higher rate of speed so as to overfeed the filaments to the heater as in the form of FIG. 1 above described. The variable speed drive can be adjusted for any desired rate of overfeed so as to control the amount of bulking which is allowed to take place. The variable speed drive may also be set to provide different rates of overfeed in its two positions so that the yarn becomes differently bulked at spaced intervals according to the setting of the program timer.

To avoid repetition the parts in FIGS. 2, 3 and 4 which are identical with those of FIGS. 1 have not been repeated in the latter figures.

A representative product is shown in FIG. 5 wherein the core yarn 37 is shown as substantially straight and the bulked yarn 10 is shown as having bulked portions 10a and straight portions 10b. The portions 10b correspond to the yarn lengths where the filament 10 is pulled into straight form while in the heater 17 and the portions 10a correspond to the lengths where the filaments are relaxed and rebulked while in the heater 17. While only two filaments have been shown for purposes of illustration it is to be understood that the yarn may be composed of several filaments of each type. Also the portions represented as straight may be crimped or bulked, but to a lesser extent than the portions 10a. The core yarn 37 may also have a limited degree of crimp to impart a limited degree of stretch to the product.

The crimps have been indicated as of the type normally formed in a stuffer crimper. The invention is also applicable to filaments or yarns bulked in other ways as above specified.

In some instances the yarn 37 may also constitute a

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bulked yarn, in which case the areas of the straight portions 10b of the yarn 10 will have non-stretch characteristics and the areas 10a, where both filaments are bulked, will have stretch characteristics. In this instance the bulked and non-bulked areas of the yarn will be reversed when the yarn is placed under tension as the bulk of the yarn 37 will be retained in the areas 10b, whereas the crimp in both yarns may be pulled out by tension in the areas 10a.

As a further embodiment the second yarn 37 may be omitted in some instances leaving a single filament 10 having alternate bulked and less highly bulked or straight portions.

What is claimed is:

1. The method of making a limited stretch yarn composed of at least two filaments one of which is in the state of having been bulked and then temporarily set in straight form and the other of which is less highly stretchable than said bulked filament which comprises passing said first mentioned filament through a relaxing zone in substantially tensionless state to cause the bulk to be restored thereto, combining said last filament with said less highly stretchable filament, and twisting said filaments together to form a plied yarn wherein the stretch characteristics are determined by the second mentioned filament and the bulk is due to the first mentioned filament.

2. The method set forth in claim 1 in which said second mentioned filament is provided with a coating of a bonding material prior to plying with said first mentioned filament for thereby bonding said filaments together.

3. The method set forth in claim 1 in which said second mentioned filament is provided with a coating of a heat-bondable material and is passed through said heating zone with said first mentioned filament for activating said heat-bondable material prior to plying the two filaments together.

4. The method of making a limited stretch, bulked yarn from at least two filaments one of which is in straight form and the other of which is in the state of having been bulked and then temporarily held in straight form, which comprises passing said previously bulked filament through a relaxing zone in substantially tensionless state to cause the bulk to be restored thereto, combining the same with said straight filament, and twisting the filaments together to form a plied yarn wherein the straight filament limits the stretch characteristics of the yarn and the bulked filament provides the bulk characteristics.

5. The method of making a yarn having controlled stretch characteristics from at least two filaments one of which is composed of heat-settable material which has been bulked and heat-set in bulked form and the other of which is less highly stretchable than the first filament when the latter is in the bulked state which comprises passing the first filament in substantially tensionless state through a heating zone to remove the temporary straight set and allow the bulk to be restored, combining the first and second filaments, and twisting the same together to form a plied yarn wherein the stretch is determined by the second filament and the bulk is determined by the first filament.

6. The method set forth in claim 5 in which the tension of said first filament while in said heating zone is varied in a predetermined pattern so as to vary thereby the extent of bulking which takes place and form a yarn having alternate highly bulked areas and less highly bulked areas.

7. Apparatus for making a yarn having controlled stretch characteristics from a pair of filaments one of which has been bulked and preset in bulked state and then given a temporary straight set and the other of which is in substantially straight form which comprises two pairs of feed rolls spaced apart to provide a yarn treating zone therebetween, means driving said pairs of rolls at predetermined rates with the first pair operating at a faster

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rate than the second pair for thereby overfeeding filaments to said treating zone, means feeding said first filament under tension to said first pair of feed rolls and through said treating zone to said second pair of feed rolls, means feeding said second filament under tension to said second pair of feed rolls, and a twister receiving both of said filaments from the exit of said second pair of feed rolls and adapted to twist the filaments together to form a plied yarn wherein the bulk is determined by the relaxed state of said first filament and the stretch is determined by the characteristics of said second filament. 10

8. Apparatus as set forth in claim 7 in which a heater is disposed in said treating zone for heating said filament as it passes therethrough.

9. Apparatus as set forth in claim 7 in which means is provided to vary the amount of overfeed of said first pair of rolls at predetermined intervals. 15

10. Apparatus as set forth in claim 9 in which said last means comprises a variable speed drive and a timed program device is connected to vary the characteristics of said variable speed drive at predetermined intervals. 20

11. Apparatus as set forth in claim 9 in which said last means comprises a device for periodically shifting one

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feed roll of said first pair out of feeding relationship with the other roll of said pair for thereby varying the overfeed effected thereby.

12. Apparatus as set forth in claim 7 including a coating roll disposed to contact said second filament, and means applying a layer of coating material to said coating roll prior to plying thereof with said first filament.

References Cited in the file of this patent

UNITED STATES PATENTS

788,292	Verlenden	Apr. 25, 1905
2,254,881	Bell	Sept. 2, 1941
2,769,300	Luttge	Nov. 6, 1956
2,904,953	Groombridge et al.	Sept. 22, 1959
2,976,667	Racicot	Mar. 28, 1961
2,997,838	Sinski	Aug. 29, 1961
3,009,310	Murchie et al.	Nov. 21, 1961
3,012,397	Servage	Dec. 12, 1961
3,013,379	Breen	Dec. 19, 1961
3,016,677	Langway	Jan. 16, 1962
3,029,591	Scragg	Apr. 17, 1962
3,061,998	Bloch	Nov. 6, 1962