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METHOD AND APPARATUS FOR CONVERTING CONTINUOUS
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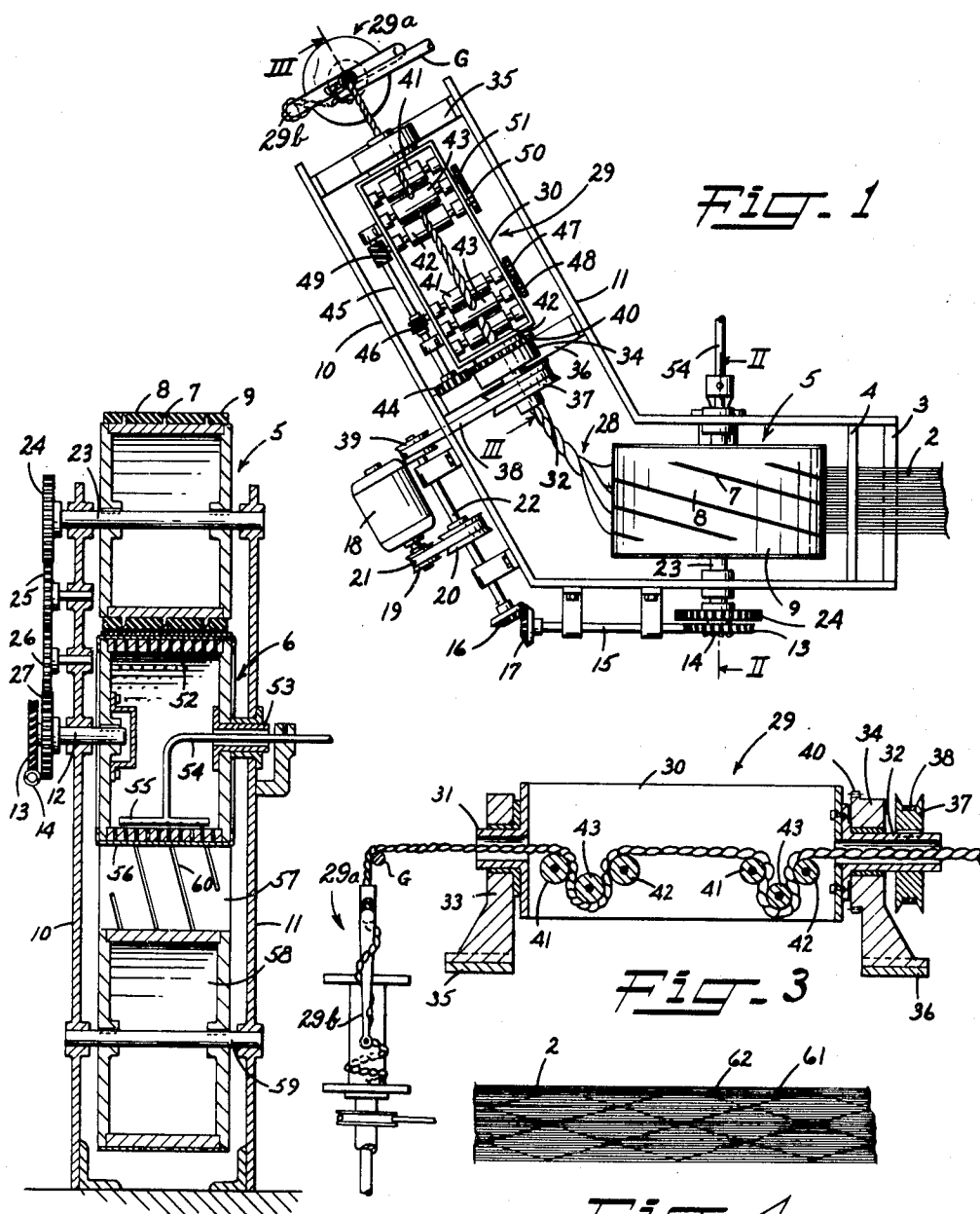


Fig. 2

Fig. 4

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METHOD AND APPARATUS FOR CONVERTING CONTINUOUS FILAMENTS INTO SPINNABLE SLIVERS

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This invention relates to an improved method and apparatus for converting a continuous filament bundle such as may be obtained from artificial fiber spinning machines into a fibrous bundle similar in characteristics to a top or sliver of natural fibers.

In the procedures heretofore employed for converting a heavy denier bundle of continuous filaments into a top or the like, all the filaments in the bundle have generally been cut along a plurality of spaced diagonal lines. This complete severing of the bundle has heretofore required special precautions to maintain the continuity of the filamentary bundle after cutting. In other procedures involving what may be termed stretch-breaking of the continuous filaments, the imparting of the stretch causes a reduction in the elongation of the fibers and imparts non-uniform strength, dyeing and other characteristics to the yarns, fabrics and other textile products made therefrom.

In accordance with the present invention, a novel and improved system is provided in which the difficulties of maintaining continuity are entirely overcome and the disadvantages of non-uniform characteristics of fiber products are minimized. Other objects and advantages of the invention will be apparent from the description hereinafter.

In general, the method of the present invention involves disrupting only a portion of the filaments in a continuous filament bundle at spaced intervals thereof, twisting the product containing disrupted filaments in such a manner that the continuous filaments wrap themselves about the disrupted filaments and subsequently disrupting the remainder of the filaments in the twisted bundle.

The method may be accomplished in various ways and by utilizing various mechanisms. For example, a band of the continuous filaments may be fed longitudinally through a suitable device for disrupting a portion only of the band. Such a device may be a cutter, one or more high potential electric spark gaps disposed across the path of travel of the band; or abrasive means moved transversely of the band. Such devices are adjusted to cut only part of the filaments in the bundle, such as through a predetermined thickness of the band from one surface thereof or entirely through alternate longitudinal strips in the band of material. The disrupting in the former case, may be to any desired depth and advantageously, it may extend from the top surface of the band to at least half the thickness

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of the band, or preferably to such greater thickness than half as would cut as many of the filaments in the band as possible without causing the disrupted filaments to interfere with, or render ineffective, the twisting operation in which the unbroken filaments are wrapped about the disrupted filaments.

Any suitable arrangement may be employed for twisting the unbroken filaments in the band about the disrupted filaments and, while in the twisted condition, the remainder of the continuous filaments are disrupted either by cutting or stretch-breaking. The cutting may be accomplished by imparting relative rotation to the traveling twisted band and a knife projecting into the outer periphery of the twisted band. Preferably, disruption may be effected by subjecting the twisted band or rope of filaments to a breaking stretch between drafting rollers. After the second disrupting step, the filamentary bundle, which has easily been maintained in a continuous condition throughout the process, may be collected or it may be passed to textile processing machines, such as twisting and/or drawing mechanisms for converting the bundles to a roving or yarn.

A preferred embodiment of mechanism for accomplishing the invention is shown in the drawing, in which—

Figure 1 is a plan view,

Figure 2 is a vertical cross-section taken on line II—II of Figure 1,

Figure 3 is a vertical section taken through line III—III of Figure 1, and

Figure 4 illustrates diagrammatically the relationship of the successive steps of disruption to the longitudinal axis of the band of continuous filaments.

With reference first to Figures 1 and 2, the continuous filament band or bundle 2 proceeds from any suitable source of supply over a guiding bar 3 and then under guide bar 4 to the nip between a cutting drum 5 and a drum 6 therebelow. Guides 3 and 4 assist in maintaining the band of filaments in parallelized, spread-out condition as they proceed to the nip between the drums 5 and 6. The cutting drum 5 is provided with a plurality of helical blades 7, the spaces between which may be occupied by helically-extending intermediate portion 8 of a slitted cylindrical elastic band 9. The drums 5 and 6 are supported in suitable bearings in a frame having lateral members 10 and 11. The drum 6 is driven by means of shaft 12 carrying the worm wheel 13 which is driven by the worm 14 on a driving shaft 15 which is driven through bevel gears 16 and 17 by

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means of a motor 18, pulleys 19 and 20, belt 21 and shaft 22.

The cutting drum 5 is keyed to shaft 23 which is driven by means of gears 24, 25, 26 and 27, the last named being keyed to shaft 12 to which the drum 6 is keyed. Blades 7 have approximately the same linear velocity as the drum 6.

As the partially disrupted band leaves the cutting stage, it is twisted at 28 by means of a rotating twisting head 29 and proceeds over a guide G to a collecting device 29a in the form of a flier twister, the flier of which is designated by 29b. As shown in Figures 1 and 3, this rotating head comprises a frame 30 having trunnions 31 and 32 rotatably mounted within bearings 33 and 34 secured to transverse members 35 and 36 secured to the side frames 10 and 11 respectively. A pulley 37 keyed to the trunnion 32 is driven by means of a belt 38 and a pulley 39 keyed to the shaft 22.

The twisting head 29 comprises two sets of rolls each set having two rolls 41 and 42 and an intermediate laterally offset roll 43, at least two of each set being driven by means hereinafter described, and all of them being rotatable. In the embodiment shown, the set of three rolls furthest from the twisting position 28 has a linear peripheral speed sufficiently greater than that of the nearer set of rolls so that stretching and breaking of the undisrupted filaments is effected.

A ring of teeth 40 carried upon the periphery of the bearing 34 provides a stationary ring gear which meshes with the gear 44 carried on the lateral shaft 45 rotatably secured in the frame 30. Shaft 45 carries a worm 46 which meshes with a worm wheel for driving the roll 41 of the first set of rolls. Intermeshing gears 47 and 48 which are fixed to the shafts carrying rolls 41 and 43 respectively serve to transmit the rotation of roll 41 to roll 43. Roll 42 as shown rotates idly.

A similar arrangement is provided for rotating the rolls of the further set. A spiral gear 49 meshes with a spiral gear on the shaft carrying roll 42 of the second set, and roll 43 of the second set is driven by means of gears 50 and 51 on the respective shafts carrying rolls 42 and 43. Roll 41 of the second set rotates idly. The pitch of the spiral gear 49 is so related to the pitch of the thread of worm 46 that the second set of rolls have the desired greater peripheral speed as compared to that of the first set of rolls.

As so far described, the apparatus accomplishes the method of first cutting the upper surface of the band of more or less parallel fibers 2, twisting the undisrupted fibers about the cut fibers at position 28, and then breaking the remainder of the fibers by stretching. Preferably, the cutting at the first stage is performed along a diagonal line with respect to the width of the band and the twisting is preferably performed in such a manner that the twisted bundle leaving the twisting position is inclined at an angle to the direction of delivery of the partially disrupted band to the twisting position. This tends to prevent the disrupted filaments from falling off the band before the fibers reach the twisting position and facilitates the wrapping of the undisrupted filaments about the disrupted filaments at this position in a uniform manner.

If desired, the apparatus may be operated in such a manner that the undisrupted filaments leaving the first disrupting stage are weakened at spaced points along the band so that the stretching affects practically only the weakened portions thereof and thereby avoids imparting

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reduced elongation and different dyeing properties to the fibers thus produced. In order to accomplish this, the apparatus shown has additional features now to be described. The lower drum 6 (see Figure 2) has a perforated peripheral wall 52 and one bearing is in the form of a hollow trunnion 53 through which a liquid-supplying pipe 54 extends. The pipe 54 may terminate in a transverse distributing pipe 55 to spread the liquid across the width of the drum. The peripheral wall 52 is covered with a felt 56 which serves to absorb the liquid uniformly and a slitted flexible belt 57 of rubber, stainless steel or the like runs about the drum 6 and about the lower idler drum 58 carried on the shaft 59.

The slits 60 allow the liquid to be forced into the band of fibers along diagonal lines at the time pressure is exerted during cutting. In Figure 4, the direction of cuts made by the knives is shown by dot-and-dash lines 61, whereas the lines along which liquid is supplied extend in the direction indicated by the dotted lines 62. Preferably, these lines intersect as shown, though they may have any desired inclination to the length of the band. Alternatively, lines 62 along which the band is wetted may be more or less parallel to line 61 along which first cutting occurs but with lines 62 disposed intermediate adjacent lines 61 so that the positions of successive disruption are offset along the length of the filamentous bundle or band.

Any suitable liquid may be introduced into the drum 6 for the purpose of weakening the undisrupted filaments in the twisted band, depending upon the particular nature thereof. For example, water alone may suffice, particularly in the case of filaments of regenerated cellulose such as are produced by the viscose or cuprammonium processes. Alternatively, a solvent for the filamentary materials may be applied for the purpose of weakening them. Examples of solvents are acetone for cellulose acetate or vinyl resin filaments, zinc chloride and sulfuric acid for regenerated cellulose, etc.

The method of the present invention may be accomplished by operating the apparatus shown with or without the introduction of liquid into the drum 6. If desired, the drums 6 and 58 and related parts may be replaced with a simple cylindrical drum against which the cutting drum 5 may be pressed.

It is to be understood that changes and variations may be made without departing from the spirit and scope of the present invention as defined in the appended claims.

I claim:

1. The method of converting a continuous aggregate of filaments of indefinite length into a staple fiber product without loss of continuity thereof comprising continuously feeding the aggregate as a band of generally parallelized filaments, disrupting a portion only of the filaments in the band at intervals, twisting the band with the disrupted filaments generally disposed within the undisrupted filaments, and then disrupting previously undisrupted filaments in the twisted band.

2. The method of converting a continuous aggregate of filaments of indefinite length into a staple fiber product without loss of continuity thereof comprising continuously feeding the aggregate as a band of generally parallelized filaments, disrupting filaments in the upper portion of the band at intervals, twisting the band with the disrupted filaments generally disposed within

the undisrupted filaments, and then disrupting previously undisrupted filaments in the twisted band.

3. The method of converting a continuous aggregate of filaments of indefinite length into a staple fiber product without loss of continuity thereof comprising continuously feeding the aggregate as a band of generally parallelized filaments, disrupting filaments in the upper portion of the band at intervals, twisting the band while deflecting the band through an acute angle at the twisting position with the disrupted filaments generally disposed within the undisrupted filaments and then disrupting previously undisrupted filaments in the twisted band.

4. The method of converting a continuous aggregate of filaments of indefinite length into a staple fiber product without loss of continuity thereof comprising continuously feeding the aggregate as a band of generally parallelized filaments, disrupting filaments in the upper portion of the band at intervals along lines inclined to the length of the band, twisting the band with the disrupted filaments generally disposed within the undisrupted filaments, and then disrupting previously undisrupted filaments in the twisted band.

5. The method of converting a continuous aggregate of filaments of indefinite length into a staple fiber product without loss of continuity thereof comprising continuously feeding the aggregate as a band of generally parallelized filaments, disrupting filaments in the upper portion of the band at intervals along lines inclined to the length of the band, twisting the band while deflecting the band through an acute angle at the twisting positions with the disrupted filaments generally disposed within the undisrupted filaments, and then disrupting previously undisrupted filaments in the twisted band.

6. The method of converting a continuous aggregate of filaments of indefinite length into a staple fiber product without loss of continuity thereof comprising continuously feeding the aggregate as a band of generally parallelized filaments, disrupting a portion only of the filaments in the band at intervals, weakening filaments in the band at intervals, twisting the band with the disrupted filaments generally disposed within the undisrupted filaments, and then stretch-breaking previously undisrupted filaments in the twisted band.

7. The method of converting a continuous aggregate of filaments of indefinite length into a staple fiber product without loss of continuity thereof comprising continuously feeding the aggregate as a band of generally parallelized filaments, cutting a portion only of the filaments in the band at intervals, twisting the band with the cut filaments generally disposed within the uncut filaments, and then stretch-breaking previously uncut filaments in the twisted band.

8. The method of converting a continuous aggregate of filaments of indefinite length into a staple fiber product without loss of continuity thereof comprising continuously feeding the aggregate as a band of generally parallelized filaments, cutting filaments in the upper portion of the band at intervals, weakening filaments in the band at intervals, twisting the band with the cut filaments generally disposed within the uncut filaments, and then stretch-breaking previously uncut filaments in the twisted band.

9. The method of converting a continuous aggregate of filaments of indefinite length into a staple fiber product without loss of continuity

thereof comprising continuously feeding the aggregate as a band of generally parallelized filaments, cutting filaments in the upper portion of the band at intervals along lines inclined to the length of the band, twisting the band while deflecting the band through an acute angle at the twisting position with the cut filaments generally disposed within the uncut filaments, and then stretch-breaking previously uncut filaments in the twisted band along lines inclined to the length of the band.

10. Apparatus for treating a continuous aggregate of filaments of indefinite length comprising means for disrupting a portion only of a continuously traveling band of the filaments at intervals, means for twisting the undisrupted filaments about the disrupted filaments, a second means for disrupting filaments in the band, and means for feeding the filaments through the first disrupting means, the twisting means, and the second disrupting means.

11. Apparatus for treating a continuous aggregate of filaments of indefinite length comprising means for disrupting a portion only of a continuously traveling band of the filaments at intervals, means for applying a weakening fluid to the band at intervals, means for twisting the undisrupted filaments about the disrupted filaments, a second means for disrupting filaments in the band, and means for feeding the filaments through the first disrupting means, the fluid-applying means, the twisting means, and the second disrupting means.

12. Apparatus for treating a continuous aggregate of filaments of indefinite length comprising means for disrupting a portion only of a continuously traveling band of the filaments at intervals, means for applying a weakening fluid to the band at intervals, said applying means and disrupting means being juxtaposed for substantially simultaneous operation upon the band passing therebetween, means for twisting the undisrupted filaments about the disrupted filaments, a second means for disrupting filaments in the band, and means for feeding the filaments through the first disrupting means, the fluid-applying means, the twisting means, and the second disrupting means.

13. Apparatus for treating a continuous aggregate of filaments of indefinite length comprising means for cutting a traveling band of the filaments at intervals along lines inclined to the length of the band, said cutting means comprising a movable knife-carrying member and a movable pressure-member against which the knife-carrying member presses the band in cutting, an aperture in the pressure-member, and means responsive to the pressure between the knife-carrying member and the pressure-member for supplying the aperture with a liquid.

14. Apparatus for treating a continuous aggregate of filaments of indefinite length comprising a rotary cutting member, a rotary pressure-member toward which the cutting member presses the band during cutting, means for introducing a liquid into the pressure-member, and means carried about the pressure-member for distributing the liquid to predetermined portions of the band during cutting.

15. Apparatus for treating a continuous aggregate of filaments of indefinite lengths comprising a rotary cutting member, a rotary pressure-member toward which the cutting member presses the band during cutting, means for introducing a liquid into the pressure-member, the

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peripheral wall of the pressure-member being liquid-permeable, a compressible, liquid-permeable cover carried on said wall, and an apertured member for controlling the distribution of the liquid to the band being cut.

16. In combination, means for cutting filamentary material, means whereby a band of filamentary material is passed to the cutting means, a twister head arranged to receive and twist the band discharged from the cutting means, and means carried by the twister head and engaging the twisted band for disrupting filaments in the band.

17. In combination, means for cutting filamentary material, means whereby a band of filamentary material is passed to the cutting means, a twister head arranged to receive and twist the band discharged from the cutting means, and means carried by the twister head and engaging the twisted band at spaced points along its length for stretching the filaments in the band to break them.

18. In combination, means for cutting filamentary material, means whereby a band of filamentary material is passed to the cutting means, a twister head for twisting the band arranged to withdraw the band from the cutting means in a direction inclined laterally of the band at an acute angle from the direction of discharge therefrom, and means carried by the twister head for stretching filaments in the band to break them.

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19. In combination, means for cutting the upper portion of a band fed thereto along lines inclined to the length of the band, a twister head for twisting the band arranged to withdraw the band from the cutting means in a direction inclined laterally of the band at an acute angle from the direction of discharge therefrom, and means carried by the twister head for stretching filaments in the band to break them.

20. In combination, means for cutting the upper portion of a band fed thereto along lines inclined to the length of the band, means for applying a liquid to the underside of the band prior to discharge from the cutting means along lines inclined to the length of the band, a twister head for twisting the band arranged to withdraw the band from the cutting means in a direction inclined laterally of the band at an acute angle from the direction of discharge therefrom, and means carried by the twister head for stretching filaments in the band to break them.

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