YARN TEXTURING APPARATUS AND METHOD
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The present invention relates to yarn texturing wherein yarn is wound on spools by passing through meshed gears, and more particularly to such texturing which is adapted for texturing textile denier yarns. In a known method and apparatus for texturing thermoplastic yarns, as typified by Bromley et al. U.S. Patent 3,024,516, yarn is simultaneously drawn from a draw pin and crimped by multiple passes through a set of meshed gears with a separator roll. The yarns typically processed according to the Bromley et al. apparatus ranged from nearly a thousand to several thousand total denier. The individual filament deniers were typically sixty denier per filament (DPF) before texturing, and about twenty DPF after texturing. Due to the heavy denier yarn processed in the Bromley et al. apparatus, several passes of the yarn around the gears were necessary to get enough traction to draw yarn. Since the individual filaments had a large denier, relatively coarse pitched gears and comparatively wide clearance between the gears was necessary, which increased the need for several passes through the gears.

When textile denier yarns (those having total denier ranging up to a few hundred and filaments with about 15-20 DPF before texturing and about 2-7 DPF after texturing) are gear textured, it has been found to be possible to texture the yarn in a single pass through the gears, and thus to considerably simplify the necessary apparatus and the yarn stringup. According to the present invention, gears having a relatively large number of teeth per inch are used. These gears are closely meshed in order to provide adequate crimping action and enough traction to draw the yarn. The yarn is formed into a filament sheet just prior to its passage through the meshed portion of the gears in order to avoid uneven running and breaking of filaments by the gears. These results are achieved by the apparatus to be described.

Accordingly, a primary object of the invention is to provide a method and apparatus for texturing yarn.

A further object is to provide such a method and apparatus wherein the yarn is textured by a single pass through meshed gears.

A further object is to provide such a method and apparatus wherein the geometry is arranged so as to require a minimum number of parts and a simple stringup.

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

The invention accordingly comprises the several steps and the relation of one or more of such steps with respect to each of the others, and the apparatus embodying features of construction, combinations of elements and arrangements of parts which are adapted to effect such steps, all as exemplified in the following detailed disclosure, and the scope of the invention will be indicated in the claims.

For a more complete understanding of the nature and objects of the invention, reference should be made to the following detailed description and the accompanying drawings, in which FIGURES 1 and 2 are fragmentary schematic perspective views of apparatus according to the invention.

Referring now to FIGURE 1, yarn 20 from a spin cake 22 or other convenient source is fed by driven nip rolls 24 to a brake or other snubbing device 26, illustrated as an electrically heated hot pin. A conventional guide 27 may be provided to guide yarn 20 to nip rolls 24. Yarn 20 then passes through meshed gears 28 and 30, which are positively driven so as to stretch or draw the yarn in the region between pin 26 and the gears. Yarn 20 then passes through a pigtail guide 32 to a suitable windup mechanism 34, which may be of any desired type.

In order to positively locate the point of contact between yarn 20 and gears 28 and 30 while reducing the number of auxiliary guides to the minimum, the axis of pin 26 is skewed with respect to the axes of gears 28 and 30. Advantageously pin 26 lies in the plane in which the gears rotate, and is perpendicular to the path of yarn 20.

The filaments of yarn 20 during passage around the draw pin are formed into a filament sheet, the transverse dimension of which is perpendicular to the axes of the gears. Passage of the yarn as a round bundle or as a filament sheet thus oriented directly through the meshed portion of the gears could result in uneven running and breaking of the filaments by the gears since the gears are closely meshed. According to the present invention, the gears 28 and 30 are mounted so that the axis along which the yarn travels between pin 26 and the gears forms an acute angle with a perpendicular line between the gear axes, causing yarn 20 to wrap around part of the periphery of one of the gears in an arc extending over several degrees before contacting the remaining gear. This arrangement forms the filaments into a filament sheet spread on the surface of the first gear contacted and having its transverse dimension parallel to the gear axes, as best illustrated in FIGURE 2, so that the yarn may pass through the meshed portion of the gears without breakage. Advantageously, draw pin 26 is so mounted that a line perpendicular to the axes of gears 28 and 30 forms an angle greater than 90° with the axis of draw pin 26. Since the yarn passes through the meshed portion as a filament sheet, the number of gear teeth per inch of gear circumference may be increased and the clearance between the gears may be reduced. These factors produce sufficient traction to draw and crimp the yarn in a single pass through the gears without danger of cutting the filaments.

In a specific example for texturing yarn of nylon 66 having thirteen filaments and forty total denier after texturing, the angle between the yarn axis and a perpendicular line between the gear axes was 45°. Gears 28 and 30 had diameters of 1% inches and 25% inches, respectively, and each gear had 64 teeth per inch of diameter. Draw pin 26 was electrically heated to about 185° C., and the apparatus was designed to provide a draw ratio of between 2.25 and 2.50. The yarn ran smoothly through the apparatus, and possessed excellent bulking characteristics.

It may be seen from the above written description and the accompanying drawing that there has been disclosed an efficient and simple method and apparatus for texturing yarns. By wrapping the yarn about a portion of the periphery of one of the gears before the yarn enters the meshed portion of the gears, the yarn is formed into a filament sheet properly oriented to run smoothly through the gears. This permits a greater number of gear teeth per peripheral inch, with closer spacing between the meshed teeth than would otherwise be possible, and in turn permits texturing and drawing the yarn in a single pass through the gears. As an added feature of the invention, orienting the draw pin 26 to be skewed with respect to the axes of gears 28 and 30 positively locates the yarn on the gears, preventing the yarn from wandering off the gears. Since the yarn can be drawn and textured by a
single pass through the gears, it is possible to eliminate the separator roll which would be required with multiple passes through the gears. The disclosed apparatus is simple, and provides an economical and reliable process for producing textured yarns.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in carrying out the above process and in the construction set forth without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described our invention, what we claim as new and desire to secure by Letters Patent is:

1. Apparatus for bulketing a multi-filament yarn, comprising in combination:
   (a) a pair of driven meshed yarn-crimping gears,
   (b) a source of multi-filament yarn to be bulked, said source supplying yarn to be passed through said gears,
   (c) a snubbing mechanism positioned between said source and said gears for exerting a predetermined braking effort on said yarn whereby said yarn is drawn in the region between said gears and said snubbing mechanism,
   (d) said snubbing mechanism being oriented with respect to said gears so that said yarn wraps around part of the periphery of a first of said gears and forms into a substantially flat filament sheet on said periphery before entering into the region where said gears mesh,
   (e) and yarn takeup means for collecting said yarn after a single pass through said gears.

2. The apparatus defined in claim 1 wherein said snubbing mechanism has an axis skewed with respect to the axes of said gears sufficiently to positively locate the point at which said yarn contacts said gears.

3. The apparatus defined in claim 1, wherein the braking effort exerted by said snubbing mechanism and the closeness of the meshing of said gears are proportioned to draw said yarn to between 2.25 and 2.50 times its original length.

4. Apparatus for bulketing a multi-filament yarn, comprising in combination:
   (a) a pair of driven meshed yarn-crimping gears,
   (b) a source of multi-filament yarn to be bulked, said source supplying yarn to be passed through said gears,
   (c) and a heated draw pin mounted between said source and said gears,
   (d) said yarn being wrapped about said draw pin whereby said yarn is drawn in the region between said gears and said draw pin,
   (e) said draw pin being skewed with respect to the axis of said gears sufficiently to positively locate the said yarn, and being mounted with respect to said gears so that said yarn wraps around part of the periphery of a first of said gears and forms into a substantially flat filament sheet on said periphery before entering into the region where said gears mesh.

5. A method for texturing yarn in a single pass through a pair of meshed crimping gears, comprising in combination:
   (a) drawing said yarn from a heated draw pin having its axis skewed with respect to the axes of said gears,
   (b) and passing said yarn around part of the periphery of a first of said gears so that said yarn forms a filament sheet on said periphery before entering into the region where said gears mesh.

6. Yarn treating apparatus comprising in combination:
   (a) a pair of meshed yarn-crimping gears rotating in a plane,
   (b) a heated draw pin having an axis positioned in said plane,
   (c) a line in said plane joining the axes of said crimping gears forming an angle with said draw pin axis greater than 10°.

7. The apparatus defined in claim 4, further comprising yarn takeup means for collecting said yarn after a single pass through said gears.

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