

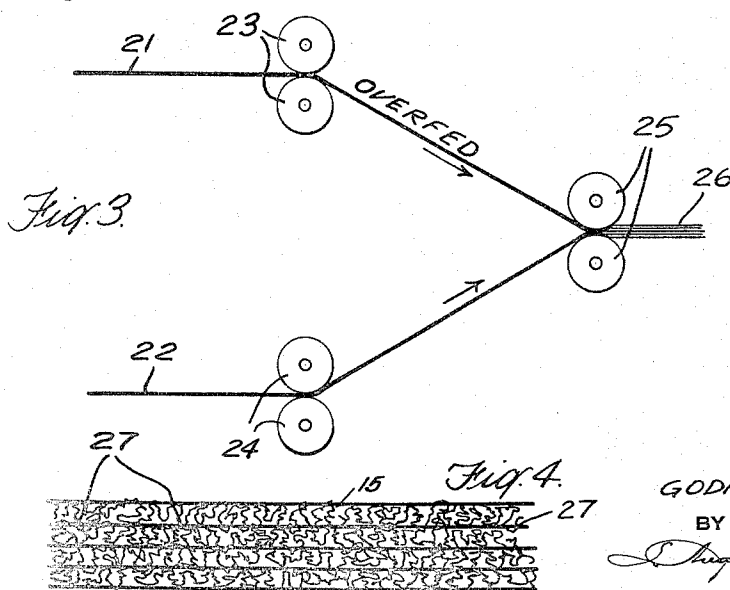
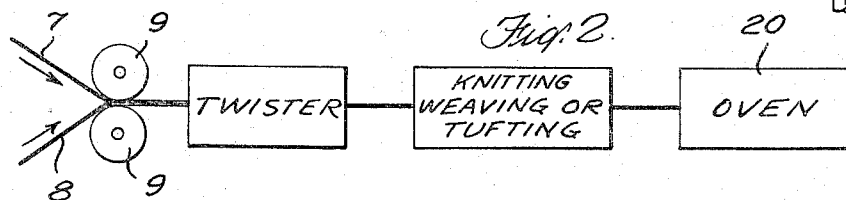
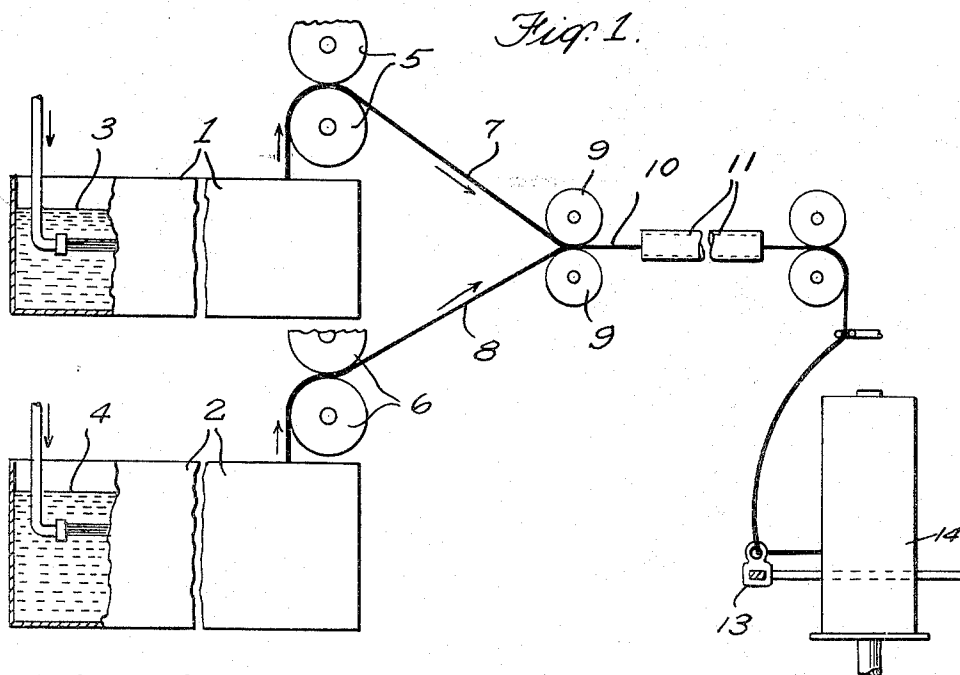
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METHOD FOR MAKING BULKED CONTINUOUS FILAMENT YARNS

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METHOD FOR MAKING BULKED CONTINUOUS FILAMENT YARNS

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4 Claims. (Cl. 57—157)

This is a divisional application of my application Serial No. 852,515, filed November 12, 1959, now Patent No. 3,061,998, which, in turn, is a continuation-in-part of my application Serial No. 497,776, filed March 29, 1955, and now abandoned.

This invention relates to a method of making continuous filament yarns. More particularly, this invention relates to a method of making bulked continuous filament synthetic yarns.

An object of this invention is to provide a novel method for making continuous filament yarn.

Another object is to provide a novel method for making a bulked continuous filament synthetic yarn.

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

In accordance with one embodiment of the present invention, two bundles of continuous filaments composed of the same or of different synthetic materials and derived from separate spinnerets feeding into the same or into different spinning baths are so processed that the two bundles of filaments have different shrinkage characteristics. These bundles are then combined and subjected to treatment adapted to shrink the various filaments in the bundle.

As a result of this differential shrinkage, one group of filaments will shrink more than the other group, and by maintaining the filaments of greater shrinkage relatively straight while the filaments are shrinking, the filaments of less shrinkage will be drawn and pulled up causing them to deviate from a straight line condition into gathers, puckers, folds, loops, or other shapes, herein referred to generally as crimps, at various points along their length, thereby forming a bulked yarn.

Alternatively, the combined bundle of filaments may be spun into yarn prior to the shrinkage treatment, fabricated into a finished fabric as by knitting, weaving, or tufting, after which the product may be subjected to shrinkage treatment for causing the yarn to bulk in the manner above set forth.

In a further embodiment, the bulking effect may be obtained by feeding two groups of filaments into a common bundle at different rates, whereby the overfed group is caused to pull up into crimps to produce a bulky yarn as above specified.

In any of the above instances the various filaments may be joined at spaced intervals or at the points of crossover if desired, as by suitable heat treatment or by the use of suitable adhesives. This effect may also be obtained by combining crimped filaments with straight uncrimped filaments which are joined at points of contact. In any case, the yarn is composed of a combination of straight filaments and crimped filaments, the straight filaments giving the yarn dimensional stability and the crimped filaments providing the necessary bulking effect.

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

In the drawing:

FIG. 1 is a diagrammatic view illustrating one method

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of producing a bulked yarn in accordance with the present invention;

FIG. 2 is a similar view illustrating a different sequence of steps in carrying out the invention;

FIG. 3 is a similar diagrammatic view illustrating the steps involved in accordance with a further embodiment of the invention; and

FIG. 4 is an enlarged detail view illustrating in exaggerated form a yarn embodying the invention.

Referring to the drawing more in detail, FIG. 1 illustrates a process wherein continuous filaments are extruded from spinnerets 1 and 2 respectively into spinning baths 3 and 4 respectively, from which they are withdrawn by feed rolls 5 and 6 respectively as filament bundles 7 and 8. In the spinning baths 3 and 4 the filaments are coagulated, drawn and fixed in accordance with standard spinning techniques to produce synthetic filaments having shrinkage characteristics which depend upon the amount of drawing and the fixation to which they have been subjected, including the amount they have been allowed to stabilize by shrinking and relaxing under heat or steam.

In carrying out the above process, the rolls 5 and 6 may be operated at the same speed, the preliminary treatment of the bundles in advance of rolls 5 and 6 may be such that bundle 7 has been relaxed more than 8 and is thus in a more dimensionally stable state.

This could include producing bundle 7 at a faster rate so that after the shortening due to relaxing it may still be fed at the same rate as bundle 8. Hence, the bundle 7 is more highly stretched than the bundle 8 and consequently has higher shrinkage characteristics than the bundle 8.

In another embodiment, one of the filament bundles, such as the bundle 7, may be processed in the bath by stretching and finishing in the usual manner but without relaxing, while the other bundle, such as bundle 8, may be processed by stretching, finishing and relaxing to cause the same to shrink so that upon subsequent treatment the bundle 8 will shrink slightly, if at all, whereas the bundle 7 when relaxed will shrink to a substantial extent.

The filament bundles 7 and 8 are combined at feed rolls 9 to form a combined bundle 10 of continuous filaments in substantially parallel relationship. This bundle 10, with the filaments substantially parallel and relatively straight, is fed through a heating zone indicated as a pipe 11 carrying steam or a heated liquid for shrinking the shrinkable filaments.

When these filaments are passed in contact through the heater 11 wherein they are subjected to shrinkage conditions the filaments 7 contract a greater extent than the filaments 8, while the filaments are maintained relatively straight, thereby causing the filaments 8 to have an excess length which is pulled up into crimps 15 to form a bulked filament bundle which is then spun into yarn form on the ring twister 13 and is wound onto a package 14 for subsequent use.

In carrying out this process, the filaments extruded from the two spinnerets are preferably of the same composition, although in some instances the two bundles may be composed of different materials. Such filaments may be composed for example of polypropylene, polyethylene, Vinyon, Dynel, Saran, Orlon, nylon, or other materials which are suitable for making synthetic textile fibers.

If, for example, the filaments are composed of polypropylene it may be assumed that the filaments extruded from the spinneret 1, after coagulation and stretching for orientation with whatever relaxation is needed, are stretched by an additional 18% to 20%, whereas the filaments extruded from the spinneret 2 are stretched by an additional 1% to 2% only.

The filament bundle 7 may thus have shrinkage characteristics 18% to 20% greater than the filament bundle 8.

After shrinkage, the filaments in bundle 8 will accordingly have a length correspondently greater than the more shrinkable filaments of the bundle 7.

The same general percentage characteristics would apply to filaments composed of the other synthetic materials above mentioned.

The filaments in the bundles 7 and 8 may be of the same denier or may be of different deniers. Preferably, the more highly shrinkable filaments in the bundle 7 are of larger denier than the less highly shrinkable filaments in the bundle 8.

The filaments in bundle 7 may, for example, be five denier and the shrinkable filaments in the bundle 8 of two denier. In this way the finer filaments are pulled up into crimped form and bulked in the final product.

In the above process the filaments, after being stretched as above indicated by the rolls 5 and 6 respectively, are set in a conventional manner so as to retain their stretched length until relaxed by treatment in the tube 11. The various synthetic filaments above named, after being stretched and set under tension, are relaxed by heat or heat and moisture and upon relaxation are allowed to shrink to the extent above set forth.

As a further example, acrylic filaments such as Orlon or modacrylic filaments such as Dynel may be given a stretch in the spinning bath of the order of some 900% and subjected to the usual finishing step to produce a filament which is highly shrinkable upon being relaxed by heat. One set of filaments, such as the filaments in the bundle 8, may be subjected to heat treatment to relax the filaments and allow them to shrink into a dimensionally stable condition whereas the relaxing step is omitted in the treatment of the filaments in the bundle 7. Then when the combined filaments are subjected to shrinkage treatment as above mentioned, the filaments in the bundle 7 shrink by some 18% to 20% of their original length to pull up the filaments 8 into crimped form and form a bulked yarn as above mentioned.

This process is preferably carried out continuously with the spinning of the filaments as above set forth. In some instances, however, it may be desirable to package the filaments after stretching and setting and before combining them into a single bundle or yarn which is subjected to the shrinkage treatment above mentioned.

In the embodiment of FIG. 2, the filament bundles 7 and 8 are produced as in FIG. 1. In this figure, however, the bundle is spun into yarn form prior to the shrinkage treatment and is then fabricated into a woven, knitted or tufted fabric, after which the fabric is subjected to treatment as in a dryer or oven 20 to effect the shrinkage of the filaments as above mentioned, thereby causing the yarn to bulk and produce a fabric having the characteristics of a fabric made from spun yarn.

A further embodiment of the invention is shown in FIG. 3 wherein two bundles of filaments 21 and 22, which are composed of any of the synthetic materials above mentioned or combinations thereof, are fed by rolls 23 and 24 respectively to a roll 25, wherein they are combined into a bundle 26.

In this form the rolls 23 may be operated at a higher feed rate than the rolls 24, so that the bundle 21 is overfed with respect to the bundle 22, thereby causing the excess length of filaments in the bundle 21 to crimp and produce a bulked yarn 26 having the characteristics above mentioned.

In any of the above embodiments the filaments may be bonded together at intervals by suitable means, as by a heating element which is adapted to contact the yarn at intervals, or to apply heat thereto at intervals for softening the synthetic filaments and causing them to become bonded together, or by applying a bonding adhesive to the filaments at spaced points along their path of travel. Dynel, for example, may be heat softened to

a bondable state at temperatures of the order of 180° to 250°. Alternatively, Dynel or Orlon may be softened by a solvent such as acetone, or Saran may be softened by a solvent such as methyl ethyl ketone for causing the filaments to bond to adjacent filaments at points of contact. Alternatively, Dynel filaments may be bonded together by the application of an adhesive such as neoprene rubber in methyl ethyl ketone or other adhesives commonly used for bonding synthetic fabrics. Saran itself may be used as an adhesive for Saran filaments. This bonding of the filaments together may take place at points 27 as indicated in FIG. 4 and serves to maintain the crimps relatively uniformly spaced along the filaments.

Alternatively, the bundle may be heated throughout its length or a bonding agent applied uniformly therealong for bonding the various filaments at their points of crossover.

In a further embodiment of the present invention, continuous synthetic filaments which have been previously crimped in any known manner, as for example, by false twisting techniques or stuffer crimper techniques, may be combined with uncrimped continuous filaments of the same material with or without treatment to provide bonding at the points of crossover between adjacent filaments to thereby produce a bulked yarn having dimensional stability.

In a further embodiment, the shrinkable and non-shrinkable filaments may be composed of different materials. For example, the more readily bondable filaments may be composed of Dynel, whereas the non-shrinkable and less readily bondable filaments may be composed of Orlon. When the Dynel and Orlon filaments are blended and heated to a temperature to cause the Dynel filaments to shrink, these filaments may then become softened to an extent that they bond to the Orlon filaments at points of crossover, thereby causing the latter to pull up into crimps and form a bulked yarn as above described. Similar results may be obtained with other combinations of bondable and less bondable filaments.

In the above examples the less shrinkable filament component may be composed of a plurality of individual filaments, the more highly shrinkable component may be composed of a plurality of filaments, or in some instances of a monofilament.

Obviously, the terms crimped and straight, shrinkable and non-shrinkable, bondable and non-bondable and dimensionally stable are used herein in a relative sense only.

The bundles can be combined in a singles yarn by opening the individual bundles as by an air jet or by separating the filaments by suitable guides and combining the bundles with the various filaments interleaved uniformly or with one group predominantly on the outside and the other group predominantly on the inside.

Also, two bundles of different characteristics may be obtained by extrusion of two materials of different compositions from a composite spinneret, wherein one material is extruded, for example, through openings disposed around the center of the spinneret and the other composition is extruded from openings disposed around the periphery so that the filaments from the latter openings are disposed largely on the outside of the finished bundle while the filaments from the first openings are disposed on the inside. In this case two materials which are capable of being processed in substantially the same manner, or coagulated in the same bath, or in air, may be used. For example, Saran and cellulose acetate, both of which may be air dried, may be used in this process. When these materials are subjected to the same processing as would be necessary for the treatment of the composite bundle, they will have different shrinkage characteristics which render them suitable for making the bulked yarn as above described.

What is claimed is:

1. The method of making a bulked continuous filament yarn comprising combining in interleaved relation the filaments of a first group of continuous filaments and the filaments of a second group of continuous filaments to produce a singles yarn, with the filaments of one group distributed among the filaments of the other group and throughout the yarn, the shrinkage of one group of filaments being different from the shrinkage of the other group of filaments, and subjecting the resulting interleaved bundle of filaments to conditions adapted to cause the higher shrinkage filaments to contract in length while the higher shrinkage filaments are maintained relatively straight and to draw up the less shrinkable filaments into a bulked state, whereby in the finished singles yarn certain filaments are uniformly crimped throughout at least a portion of their length to provide bulk and other filaments are in relatively straight form to provide dimensional stability.

2. The method of claim 1 including the step of bonding the crimped filaments and the relatively straight filaments at points of crossover.

3. The method of claim 1, wherein the filaments of the two groups are combined in interleaved relationship by separating the filaments of one group and interleaving the filaments of the other group between the filaments of the first group.

4. The method of claim 1, wherein the filaments of the two groups are produced by extruding spinning solutions through spinneret openings and then coagulating

the extruded filaments, and wherein the coagulated filaments of one group are stretched to a substantial greater amount than the filaments of the other group and after the filaments of the two groups are interleaved, the filaments are subjected to relaxing conditions to cause differential shrinkage of the filaments of the two groups.

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