April 13, 1943. A. S. HUNTER 2,316,245

YARN PREPARATION

Filed June 25, 1941 2 Sheets-Sheet 1

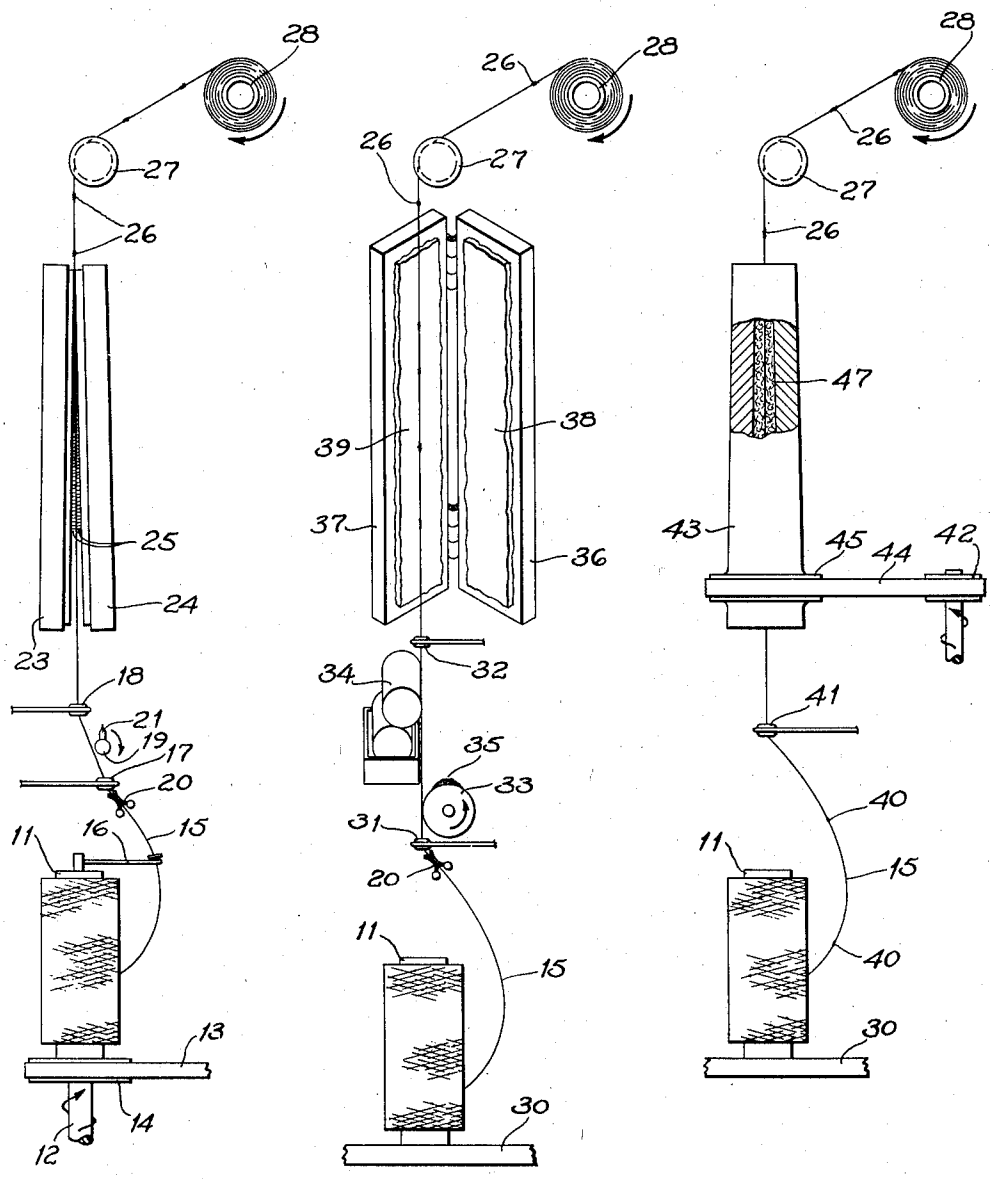

Fig. 1 Fig. 2 Fig. 3

Archibald Stuart Hunter
INVENTOR

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YARN PREPARATION

Filed June 25, 1941 2 Sheets-Sheet 2

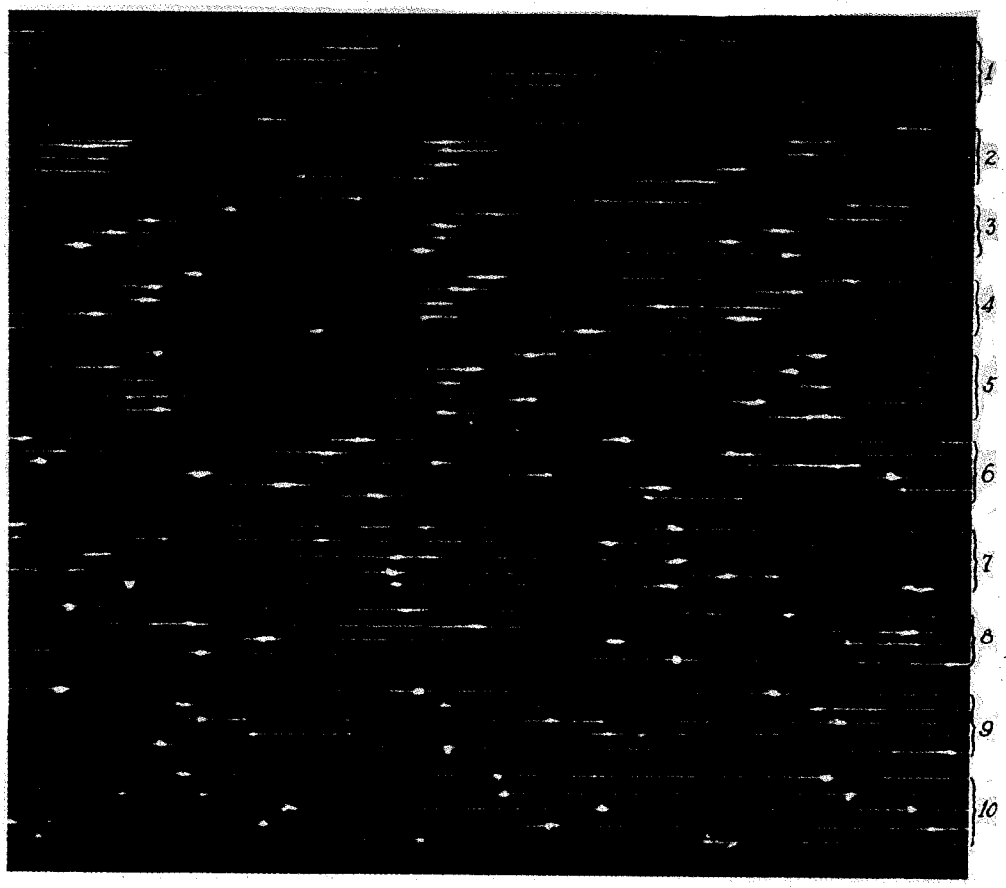

Fig. 4

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YARN PREPARATION

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Application June 25, 1941, Serial No. 399,611

9 Claims. (Cl. 28—1)

The present invention relates to a new process and apparatus for the production of a new yarn structure. More specifically, it relates to an improvement in the gathering and collecting of severed filaments of a continuous filament yarn and forming said severed filaments into compact bunches or nubs at intervals along the yarn. This application is a continuation-in-part of my copending application Serial No. 299,170, filed October 12, 1939.

In the copending application mentioned above, various types of collecting, brushing, or gathering devices are described. In general, these devices comprise resilient, yieldable yarn-contacting means such as brushing or rubbing elements moving axially in both directions along the length of a yarn having severed filaments. The brushing or rubbing elements are provided with a resilient, non-packing surface, such as provided by certain types of pile fabric, for instance broadloom carpet, wool pelt, flannel, felt, etc. By this means, the severed filaments of the yarn are collected and compacted into nubs from both directions along the length of the yarn.

It is an object of this invention to provide an improved process and apparatus for compactly gathering and collecting the severed filaments of a continuous filament yarn into bunches or nubs of entangled filaments, the bunches or nubs being anchored and entwined to unsevered filaments of the yarn.

Other objects will appear hereinafter.

The objects of this invention are accomplished, in general, by cutting, tearing or otherwise severing some of the filaments of a continuous filament yarn at intervals along the length thereof, and repeatedly passing said yarn, alternately in opposite directions along its length, between resilient, yieldable yarn-contacting elements which are fixed relative to the axial dimension of the yarn.

Several modifications of the apparatus suitable for use according to the principles of the present invention are shown in the accompanying illustrations. The following detailed description, when taken in connection with the accompanying illustrations, will serve to disclose in detail the various features of the present invention. The specifically described and illustrated forms and modifications of apparatus and process are not, however, to be considered as limiting the invention thereto.

In the illustrations:

Figure 1 is a side elevational view of one form of the apparatus for producing yarn containing nubs in accordance with this invention.

Figure 2 is a side elevational view, with the yarn-contacting device shown in perspective, of a modified form of apparatus for producing yarn having filamentous nubs in accordance with the present invention.

Figure 3 is a side elevational view of another modification of apparatus for use in accordance with this invention.

Figure 4 is a photolithographic drawing showing the manner in which filamentous nubs are produced on yarn by the process and apparatus of the present invention.

Referring to Figure 1 of the drawings, reference numeral 11 designates a yarn package support such as a core, bobbin or the like. The yarn package support 11 is positioned on the spindle 12 of an uptwisting device. The spindle is rotated by means of belt 13 and pulley 14. The yarn, as it is unwound from the package support 11, passes through the flyer 16 then between tensioning device 20 (the tensioning device is preferably a pinch tensioning mechanism of the type disclosed in the United States patent to Guenther No. 2,223,912). After passing through the tensioning device the yarn is led through yarn guides 17 and 18. A filament severing mechanism 21 is positioned between yarn guides 17 and 18. The filament severing device 21 comprises a knife blade mounted on a rotating shaft 19. As the knife blade contacts the yarn at each revolution of the shaft 19, a small number of filaments of the yarn 15 are severed. The yarn containing intermittently severed filaments then passes between yarn-contacting elements 23 and 24. These yarn-contacting elements are provided with resilient, yieldable surfaces 25 on opposite sides of the traveling yarn, which surfaces are adapted to rub or brush the severed ends of the filaments to gather and entangle the same between the remaining continuous filaments so as to form substantially compact nubs 26 in the yarn. After passing between the yarn-contacting elements 23 and 24, the yarn is passed about guide roller 27 and is then wound on a yarn package support 28. Obviously, the yarn will be traversed longitudinally along the package support 28 as it is being wound thereon in a well-known manner. It will be noted that the yarn-contacting elements 23 and 24 are positioned at an angle to each other so that they have a progressively firmer contact with the yarn as the yarn passes between the elements. The positioning of the elements in this manner is not essential to the operativeness of

the device, but under certain circumstances the severed filament ends will be more satisfactorily gathered into filamentous nubs along the yarn.

Referring to Figure 2 of the drawings, a yarn package support 11 is fixed on a support base 30. The yarn 15 drawn from the package is passed through the yarn tensioning device 20 and then through fixed yarn guides 31 and 32. As the yarn passes between the two yarn guides, it will be intermittently abraded by contact with the rotating abrasion roll 33. The roll 33 is substantially circular in diameter and is smooth surfaced except at one raised point 35 on which is positioned an abrasive material such as sand paper. The abraded yarn then passes into contact with a liquid applying roll 34. The liquid applying roll 34 is adapted to apply any type of finish, size, or liquid to the yarn. The abraded yarn is then passed between yarn-contacting elements 36 and 37 which are provided with resilient, yieldable yarn-contacting pads 38 and 39. The elements 36 and 37 are hinged to each other and may be pressed into contact with the yarn with any desired firmness. The yarn then passes about yarn guiding roller 27 and finally is wound on yarn supporting element 28.

Referring to Figure 3 of the drawings, the yarn 15 is drawn from the fixed package 11 which contains a yarn in which some of the filaments are severed at intervals along the length of the yarn. The yarn 15 is passed through yarn guide 41 and then through the annular thread contacting element 43. The internal periphery of yarn-contacting element 43 is provided with a resilient, yieldable yarn-contacting pad 47. The yarn within the element 43 is completely surrounded by the contacting pad 47. By drawing the yarn through the element 43, the severed ends of the yarn will be gathered and entwined about the remaining continuous filaments to form nubs 26 at intervals along the yarn. The element 43 is rotated by means of pulleys 42 and 45 and belt 44. By rotating the element 43, the severed ends of the filaments are caused to wrap about the remaining continuous filaments of the yarn as the nubs are formed. The yarn then passes about yarn guiding roll 27 and is finally wound on the yarn package support 28. When the yarn is passed a second time through this device with the rotating yarn-contacting element tending to place a twist in the opposite direction to that put in the yarn during the first passage of the yarn through the device, the severed filament ends gathered at the nub tend to become more entangled and more securely anchored rather than to untwist from the yarn.

Referring to Figure 4 of the drawings, numeral 1 designates sections of yarn as they appear after the filaments in the yarn have been severed but before the yarn has been passed between yarn-contacting elements. Numerals 2, 3, 4, 5, 6, 7, 8, 9 and 10 designate, successively, appearances of the yarn after it has been passed between yarn-contacting elements a successive number of times in opposite directions along the length of the yarn. It will be noted that the section of yarn designated by numeral 10 contains substantially compact filamentous nubs which may not easily be removed from the yarn. The sections of the yarn designated by numerals 3, 4 and 5 contain loose, fluffy nubs which are quite securely anchored in the continuous yarn filaments. Such loose, fluffy nubs may be desirable for some purposes and can be obtained by passing the yarn a less number of times through the yarn-contacting elements.

The following specific example is given to illustrate the preferred procedural steps of the process of this invention as applied to a particular yarn.

A regenerated cellulose yarn produced by the viscose process having 3 turns per inch twist and composed of 100 filaments of 1 denier each, is passed through two suitable tensioning and guiding devices to impose a constant tension of about ⅓ gram per denier on the yarn between the guides. The yarn under tension traveling at a rate of 6,000 inches per minute is passed adjacent a suitable abrading and severing mechanism, which is rotated at a speed of 2,000 to 3,000 R. P. M., and therefore is adapted to make an abrading contact with the yarn at spaced intervals of 2 to 3 inches. Each abrading contact of the abrading element with the yarn is adapted to sever a portion of the filaments, for example from 10 to 40 or more. The abraded yarn is then passed between a pair of stationary felt pads, such as shown by numeral 25 in Figure 1 and wound up on a bobbin. The bobbin is removed and the yarn unwound therefrom and passed again through the stationary felt pads, after which it is again collected on a bobbin. This procedure is repeated until the yarn has passed through the snubbing device ten times. In some instances the nubby yarn may be steamed to further set and anchor the nubs.

The severed or abraded and brushed yarn produced as a result of this treatment contains at spaced intervals of 2 to 3 inches, nubs or bunches of compact entangled filament ends which are securely anchored to and entwined with unsevered filaments. The appearance is similar to that of the abraded and collected filament yarn shown in section 10 of the photolithographic figures of the drawings.

The invention is applicable to all types of continuous filament yarn, such as cellulosic yarns made from viscose, cuprammonium cellulose, cellulose esters, for instance cellulose acetate, cellulose propionate, cellulose butyrate, mixed esters such as cellulose aceto-propionate or cellulose aceto-butyrate, cellulose ethers such as methyl cellulose, ethyl cellulose, benzyl cellulose or glycol cellulose or cellulose ether-esters or continuous filament yarns produced from casein or other proteins or from synthetic polymers or resins, such as polyvinyl acetals and polyvinyl alcohol, thermoplastic filaments such as polyvinyl acetate, polyvinyl chloride or interpolymers of vinyl acetate and vinyl chloride, ethyl methacrylate, styrene, polythene, polyvinyl formal, synthetic linear polymers such as synthetic linear polyamides, polyethers, polyesters, polyacetals and polyanhydrides such as disclosed in Carothers United States Patent No. 2,071,250, and natural silk. The yarn may be of any size and composed of very fine filaments such as 1 denier or less or of larger filament sizes such as 2 to 4 denier or more. For instance, viscose rayon yarns of the following sizes and filament counts: 75 denier-40 filament, 100 denier-100 filament, 100 denier-60 filament, 150 denier-60 filament, and 250 denier-150 filament, lend themselves admirably to the process of this invention.

The method and apparatus of severing filaments of the yarn as described in my copending application Serial No. 299,170 are suitable for use in accordance with the present invention. However, the process of this invention is not limited

thereto, and any suitable means of severing the filaments may be used.

If desired, the apparatus of the present invention may be used in conjunction with a rotary brushing device of the type described in the above-mentioned application.

The yarn-contacting surfaces, when used in the collection of the severed filament ends, may be any suitable material which will cause the filament ends to be rubbed, brushed, pushed and entangled into nubs. A resilient, yieldable, non-packing surface is preferred, such as certain types of pile fabric, for instance broadloom carpet, wool pelt, flannel, felt, velvet, etc., also glass mesh pads, short bristle brushes, providing the bristles are not too hard and stiff, roughened soft rubber or sponge rubber, or other spongy or open surface material can be used satisfactorily.

It is apparent that many variations can be made on the apparatus of this invention without departing from the spirit thereof. The facing felt pad surfaces between which the yarn passes may be compressed together or they may be just touching. The felt pads may be arranged to slant so that at the point of entrance of the yarn, said felt pads may be apart as much as ⅛ inch, while at the other end they may be compressed together. By this means, the collecting force of the pads on the severed filaments will be increased as the yarn passes between them.

As a further modification, the yarn may be given a slight twist as it passes between the pads by rotating the bobbin from which the yarn is withdrawn. By revolving the felt pads around the circumference of the yarn as it passes therebetween the ends of the severed filaments are twisted around the uncut filaments. Both the bobbin and the pads may be revolved at the same time either in the same or opposite directions. It may be further desirable to divide the pads into two sections, upper and lower, and while maintaining the lower section fixed, revolve the upper section. The yarn-contacting elements are stationary according to the process of this invention relative to the axial dimension of the yarn, i. e., they do not move along the length of the yarn either in the direction the yarn is moving or in the opposite direction.

The apparatus needed to pass the yarn between the felt pads and to collect it thereafter is simple and common to the textile art. A standard uptwister machine on which is mounted the yarn-contacting elements of this invention is suitable.

The length of the yarn-contacting elements may vary with the particular apparatus with which they are to be associated. In general, they may vary in length from 1 to 3 feet. The felt pads need be only of such a width that the yarn will not slip from between the surfaces during the snubbing operation, for example, they may be from 1½ to 3 inches wide.

The number of times the yarn is passed between the brushing elements depends somewhat upon the length of the brushing surfaces of the elements, upon the type of brushing surface used and upon the nature of the yarn (denier of and number of filaments). In general, it is necessary to pass the yarn between the brushing elements at least two times in each direction along the length of the yarn.

While satisfactory nub formation may be obtained with dry untreated yarn, improvements may be realized by moistening the yarn with water or aqueous or non-aqueous liquid finishes, oils, textile dopes, etc., in the course of collection of the nubs. As a result of this treatment, the nubs are prevented from loosening during subsequent textile handling.

The yarn produced in accordance with this invention is admirably suited for the fabrication of high quality, fine weight, novelty fabrics possessing an excellent hand, very attractive appearance and good draping qualities. Such fabrics have a very pleasing, refined appearance and a desired sheerness which has heretofore been impossible without sacrificing the novelty effect. The yarn of this invention may be used either in the filling or warp, or in both, in the production of woven goods, or as a knitting yarn. As a filling yarn for crepe fabrics, this yarn serves admirably and noticeably enriches the fabric.

The nubby yarn produced by means of this invention may be plied as by twisting the same together with one or more continuous filaments or spun yarns of the same type, for example, viscose rayon nubby yarn plied with uniform denier, continuous filament viscose rayon yarn. In addition, the nubby yarn of this invention may be combined in any suitable way with one or more yarns of another type, for instance, by combining the nubby viscose rayon yarn with a continuous filament cellulose acetate yarn, or by combining two or more of these nubby yarns, one of which may be viscose rayon and the other cellulose acetate. The mixed yarns may be used in the preparation of woven or knitted fabrics, or in conjunction with other yarns in woven fabrics; e. g., in either warp or filling. Additional novel effects may be obtained by using this nubby yarn and other types of yarn intermittently in either the warp or filling, or both, or by feeding different yarns in alternation into the knitting machine.

By the process of this invention, it is possible to obtain nubs having a wide range of characteristics, for example, from a very loose, fluffy nub to a hard, compact nub. The process further lends itself to applying a twist to the yarn and at the same time twisting the severed filament ends around the unsevered filaments during the snubbing operation. The apparatus suitable for use in accordance with this invention is not complicated and may be easily constructed and used.

Since it is obvious that many changes and modifications can be made in the details hereinabove described without departing from the nature and spirit of the invention, it is to be understood that the invention is not to be limited to the said details except as set forth in the appended claims.

I claim:

1. A process for the production of yarn containing filamentous nubs which comprises repeatedly passing yarn containing severed filaments, alternately in opposite directions along its length, between resilient, yieldable yarn-contacting surfaces which are fixed relative to the axial dimension of the yarn.

2. A process for the production of yarn containing filamentous nubs which comprises repeatedly passing yarn containing severed filaments, alternately in opposite directions along its length, between rotating resilient, yieldable yarn-contacting surfaces which are fixed relative to the axial dimension of the yarn.

3. A process for the production of yarn containing filamentous nubs as defined in claim 1, in which the yarn-contacting surfaces are pressed more firmly into contact with the yarn as the yarn progresses between said surfaces.

4. A process for the production of yarn containing filamentous nubs which comprises severing some of the filaments of continuous filament yarn at intervals along the length thereof, and repeatedly passing said yarn, alternately in opposite directions along its length, between resilient, yieldable yarn-contacting surfaces which are fixed relative to the axial dimension of the yarn.

5. A process for the production of yarn containing filamentous nubs which comprises severing some of the filaments of continuous filament yarn at intervals along the length thereof, and repeatedly passing said yarn, alternately in opposite directions along its length, between rotating resilient, yieldable yarn-contacting surfaces which are fixed relative to the axial dimension of the yarn.

6. A process for the production of yarn containing filamentous nubs which comprises severing some of the filaments of continuous filament yarn at intervals along the length thereof, and repeatedly twisting and simultaneously passing said yarn, alternately in opposite directions along its length, between resilient, yieldable yarn-contacting surfaces which are fixed relative to the axial dimension of the yarn.

7. In an apparatus for the production of yarn containing filamentous nubs, means for unwinding from one package and winding on another package a yarn in which some of the filaments are intermittently severed along the length thereof, and rotating resilient, yieldable yarn-contacting surfaces disposed on opposite sides of said yarn and between said packages, said surfaces fixed relative to the axial dimension of the yarn and rotating about an axis which substantially coincides with the longitudinal axis of the yarn and having contact with the yarn to gather and entangle severed ends of said severed filaments.

8. In an apparatus for the production of yarn containing filamentous nubs, means for unwinding from one package and winding on another package a continuous filament yarn, means between said packages for intermittently severing some of the filaments of said yarn, and resilient, yieldable yarn-contacting surfaces disposed on opposite sides of said yarn and between said severing means and said wind-up package, said surfaces fixed relative to the axial dimension of the yarn and having contact with the yarn to gather and entangle severed ends of said severed filaments.

9. In an apparatus for the production of yarn containing filamentous nubs, means for unwinding from one package and winding on another package a continuous filament yarn, means between said packages for intermittently severing some of the filaments of said yarn, and rotating resilient, yieldable yarn-contacting surfaces disposed on opposite sides of said yarn and between said severing means and said wind-up package, said surfaces fixed relative to the axial dimension of the yarn and having contact with the yarn to gather and entangle severed ends of said severed filaments.

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