

Dec. 16, 1969

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3,483,690

BULKY PLYED YARN

Filed May 10, 1967

Fig. 1

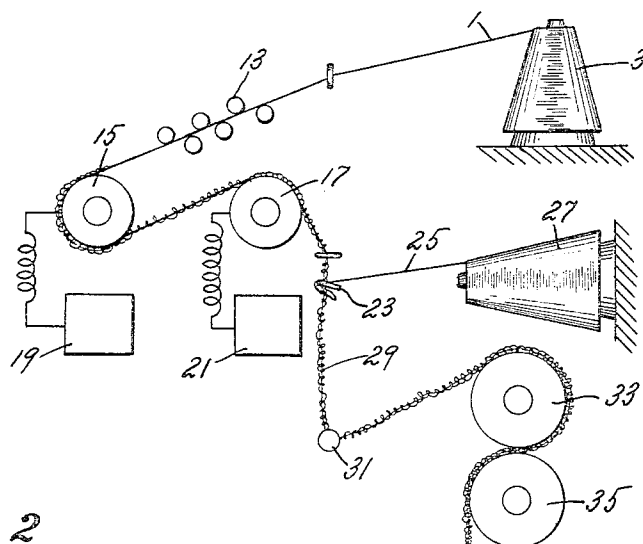


Fig. 2

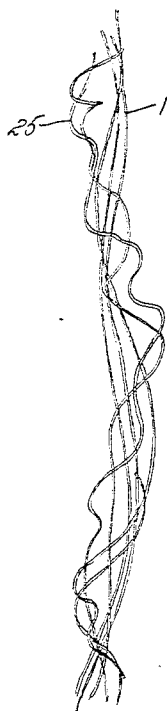
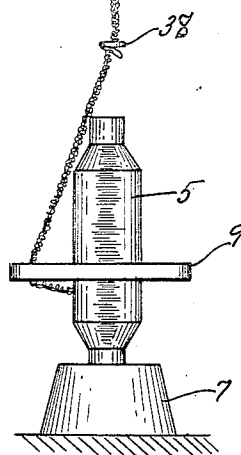
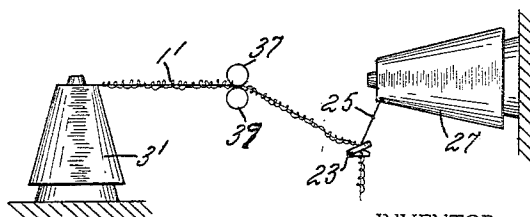


Fig. 3

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3,483,690

BULKY PLIED YARN

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Filed May 10, 1967, Ser. No. 637,399

Int. Cl. D02g 3/02; D01h 13/26

U.S. Cl. 57-140

9 Claims

ABSTRACT OF THE DISCLOSURE

A method for plying continuous multifilament yarns with natural or synthetic yarns into a tow comprising the steps of differentially shrinking the multifilament yarn so as to form a multiplicity of yarn convolutions therein; merging the differentially shrunk filament yarn with a second yarn, and plying the merged yarns to thereby produce a plied bulk yarn having a uniform consistency along the length thereof.

Under the prior art, it was known that multifilament yarns could be bulked to a high degree by causing a large number of randomly spaced loops to be formed in the individual filaments. This was achieved by maintaining the yarn under low tension in contact with at least one heated surface wherein both the temperature of the heated surface and the extent of the contact of the yarn with said heated surface were controlled whereby shrinkage of only some of the individual filaments were effected. A convoluting of the remaining filaments simultaneously occurred. This is known as a differential shrinkage method for texturizing yarns.

Briefly, this invention comprises the steps of differentially shrinking a multifilament yarn whereby a multiplicity of convolutions are formed therein; merging the differentially shrunk yarn with a spun yarn to form a yarn composite and plying the yarn composite whereby the spun yarn clings to the multiplicity of convolutions in the differentially shrunk yarn, thereby resulting in a plied bulk yarn having a uniform consistency along the length thereof.

One object of this invention is to provide a method for plying a continuous multifilament yarn with a second yarn;

Another object of this invention is to achieve an improved stability in textile fabrics manufactured from the product produced by the method described herein.

A still further object of this invention is to manufacture a knitted or woven fabric capable of being cross-dyed to produce a sharply defined heather effect.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description which is to be considered in connection with the accompanying drawings wherein:

FIGURE 1 schematically illustrates the method according to the invention;

FIGURE 2 shows a 150 denier, 34 filament polyester yarn plied with 35/1 cotton yarn, greatly magnified after being subjected to the method of the invention; and

FIGURE 3 schematically illustrates another embodiment of the invention.

The multifilament continuous yarn is one selected from the group consisting of conventional thermoplastic yarns.

Thermoplastic yarns are those yarns which are made by converting synthetic thermoplastic chemicals into yarns with subsequent drawing to render them suitable for use in weaving, knitting, and other textile operations and which have the common characteristic of becoming ductile, or more ductile and decreasing in length on the mere application heat when in the relaxed state. Examples of

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such yarns are polyamides, acrylics, polyesters, polyolefins, tri-acetates, and the like.

With reference to the drawing, the multifilament yarn 1 passes from a supply bobbin 3, supported on a suitable creel holder, through a guide eye 11, then through a tension regulator 13, which controls the tension of the yarn as it is passed over a first heated surface 15 and then over a second heated surface 17.

The shape of these surfaces is not critical. They can have shapes which may be flat, curved, tubular, corrugated, round, or the like. As shown in FIGURE 1, the heated surfaces 15 and 17 are formed as two pins. The pins 15 and 17 are matte finished or sandblasted at their surfaces in order to minimize the friction of the yarn passing thereover. Each of these pins is heated from a separate source in order to obtain a greater control of the bulking of the yarn 1 passing thereover. It is to be understood that only a single pin need be employed or that a single heat source need be used for both pins. It is also within the scope of this invention that the pins themselves could also be the conductor of current passing therethrough whereby they form themselves the resistance heating elements. Other forms of heat, such as radiant, are also within the scope of this invention.

As energy source 19 operatively connected to the first pin 15 maintains it at a temperature ranging from 150 to 400° F., particularly from 250 to 350° F., and a second energy source 21 operatively connected to the second pin 17, maintains it at a temperature ranging from 300 to 600° F. and preferably from 350 to 450° F.

The yarn passes circumferentially over the surfaces so as to just touch the surfaces and the friction is maintained at a minimum. After passing over the second pin 17 the yarn 1 passes vertically downwardly through a pigtail guide eye 23 wherein it is merged with another yarn 25.

The second yarn 25 is one selected from the group comprising cotton, flax, rayon, wool, silk, and both texturized and untexturized thermoplastics as defined above. It is to be understood that yarn 25 can be either in the form of continuous filaments or spun staples.

Yarn 25 is mounted on a supply bobbin 27 supported on a suitable creel holder from which the yarn 25 passes through the guide eye 23 and clings to the differentially shrunk yarn because of the multiplicity of convolutions therein. The resulting composite yarn 29 passes through a grooved guide means 31 and then between a pair of cot rolls 33 and 35 for controlling the speed of the multifilament yarn passing over the pins 15 and 17 as well as the speed of the composite yarn being wound on spindle 7, and finally is plied through a pigtail guide means 37 to a takeup bobbin 5 mounted on a spindle 7; the latter being driven by a belt 9 to control the twist of the yarn while passing over pins 15 and 17.

The temperature of pins 15 and 17, the speed of the yarn passing over the pins, the yarn tension are all correlatively controlled to maintain the tension lower than the dynamic retractive forces of the material being processed in order to insure sufficient shrinkage of the yarn filaments to maintain an overfeed of the multifilament yarn 1 passing through the guide 23. This enables the multifilament yarn to become wrapped around the yarn 25. It is extremely difficult to determine the precise temperatures, yarn speeds and yarn tensions which are obtained in the practice of this invention with the apparatus of the drawing. However, the particular temperature for a given speed and for a given tension can be determined by adjusting the temperature of the pins so as to obtain the shrinkage necessary to produce the convolutions in the thermoplastic yarn 1 as shown in FIGURE 2.

Referring to FIGURE 3, it is also within the scope of this invention to include the treatment of a differentially shrunk yarn which has been wound onto a bobbin and

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stored. In such an embodiment the previously differentially shrunk multifilament yarn 1' is overfed by overfeed means 37 and 39 to guide 23 and merged with yarn 25 as described hereinabove.

I have found that yarn speeds ranging from 100 to 1500 feet per minute, preferably 200 to 800 feet per minute, are quite satisfactory. Likewise, yarn tensions prove quite satisfactory if maintained within a range of 0.05 to 5 grams, preferably from .1 to 1.5 grams.

The twist of the composite yarn 29 is maintained within a range of 0.2 turns per inch to 8.0 turns per inch, preferably 0.25 to 3.0 turns per inch.

It is to be further understood that at high linear speeds, the temperature has to be increased and the tension has to be decreased due to the lowered residence time of the yarn on the heated surfaces. It is actually possible at sufficiently high speeds to have the heated surfaces 15 and 17 higher in temperature than the melting point of the yarn.

The degree of bulking can vary quite markedly according to the conditions of treatment; however, it is not converted into a stretch yarn and the dimensional stability of the composite yarn blend is markedly improved by following the method of this invention.

EXAMPLE I

A 70 denier,¹ 34 filament polyester yarn was passed from a supply spindle 3 at a rate of 600 feet a minute, and a tension below 0.5 gram over pin 15, which was maintained at a temperature of 370° F., then over pin 17 which was maintained at a temperature of 410° F. After passing over the pin 17, the yarn was plied with a 30/1 carded cotton yarn and the composite yarn blend was then twisted 0.25 turn per inch.

This yarn blend demonstrated a marked bulking effect and also possessed both excellent dimensional stability and uniform consistency along the length thereof.

EXAMPLE II

A 200 denier,¹ 20 filament nylon yarn was passed at 213 feet per minute at a tension of 1 gram over pin 15, which was maintained at a temperature of 370° F., then over pin 17 which was maintained at a temperature of 400° F., after which the yarn was plied with a 60/1 carded cotton yarn and the composite yarn blend twisted 2.5 turns per inch. Again this composite yarn exhibited a marked bulkiness and also exhibited excellent dimensional stability.

EXAMPLE III

A 210 denier,¹ 34 filament polypropylene yarn was passed at a speed of 280 feet per minute under a 0.5 gram tension over pin 15 which was maintained at a temperature of 240° F., then was passed over pin 17 whose temperature was maintained at 280° F., after which

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it was plied with a textured nylon "set" superloft yarn (2 ply 70 denier) and the composite yarn blend was twisted 1.7 turns per inch. Again, a marked bulking effect was produced and the stability of the yarn ply was excellent.

EXAMPLE IV

A 150 denier,¹ 68 filament polyester yarn was passed at a speed of 600 feet per minute under a tension of 0.5 gram over pin 15 which was maintained at a temperature of 370° F., then was passed over pin 17 whose temperature was maintained at 410° F., after which it was plied with a 35/1 carded cotton yarn and the yarn blend was twisted 1.35 turns per inch. As indicated hereunder, this yarn blend also exhibited good stability and marked bulking.

What is claimed is:

1. A textile product comprising a multifilament thermoplastic yarn having some only of its individual filaments shrunken with consequent convolution of its remaining filaments and a spun yarn plied in or between the convoluted filaments of the said thermoplastic yarn.

2. A textile product according to claim 1 wherein the multifilament thermoplastic yarn is one selected from the group consisting of polyamides, acrylics, polyesters, polyolefins and tri-acetates.

3. A textile product according to claim 1 wherein the spun yarn is one selected from the group consisting of cotton staples, flax, rayon and wool.

4. A textile product according to claim 1 comprising a 70 denier, 34 filament polyester yarn plied with a 30/1 carded cotton yarn.

5. A textile product according to claim 1 comprising a 200 denier, 20 filament nylon yarn plied with a 60/1 carded cotton yarn.

6. A textile yarn prepared from material including the product of claim 1.

7. A nonwoven textile product prepared from the product of claim 1.

8. A woven textile fabric prepared from the product of claim 1.

9. A knitted textile product prepared from the product of claim 1.

References Cited

UNITED STATES PATENTS

2,777,310	1/1957	Comer	57—140 XR
2,854,812	10/1958	Harris et al.	
2,890,567	6/1959	Taylor et al.	57—140
3,208,125	9/1965	Hall et al.	57—140 XR
3,273,328	9/1966	Bloch	57—34
3,388,547	6/1968	Koga et al.	57—157

JOHN PETRAKES, Primary Examiner

U.S. Cl. X.R.

57—34, 157

¹The denier of each of these multifilament yarns will be increased by an amount commensurate with the degree of shrinkage undergone by them in the treatment according to this invention.