Jan. 1, 1963 W. B. THOMAS 3,070,950

METHOD OF PRODUCING A COMPOSITE YARN

Filed Sept. 14, 1960

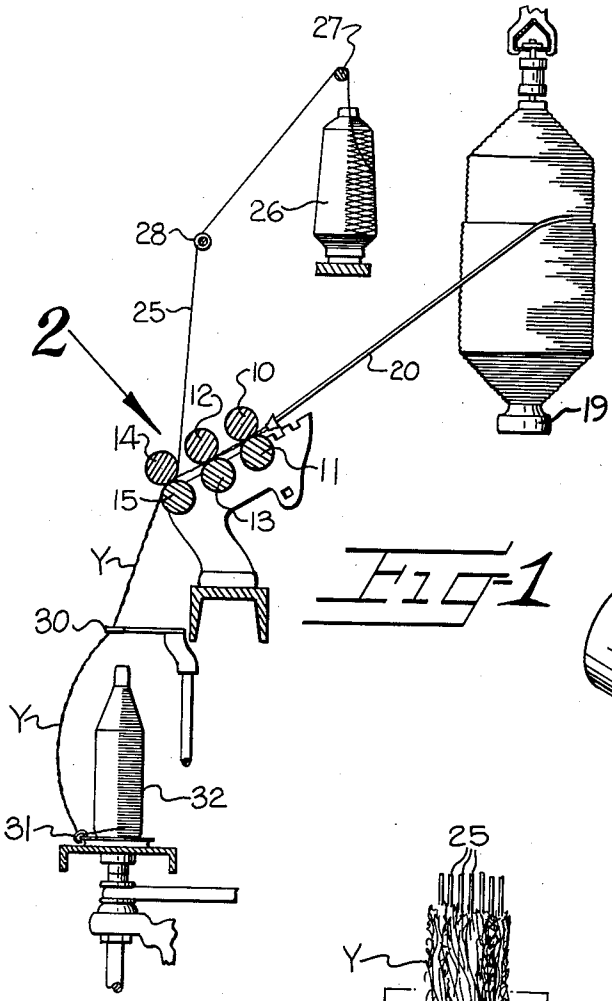

Fig-1

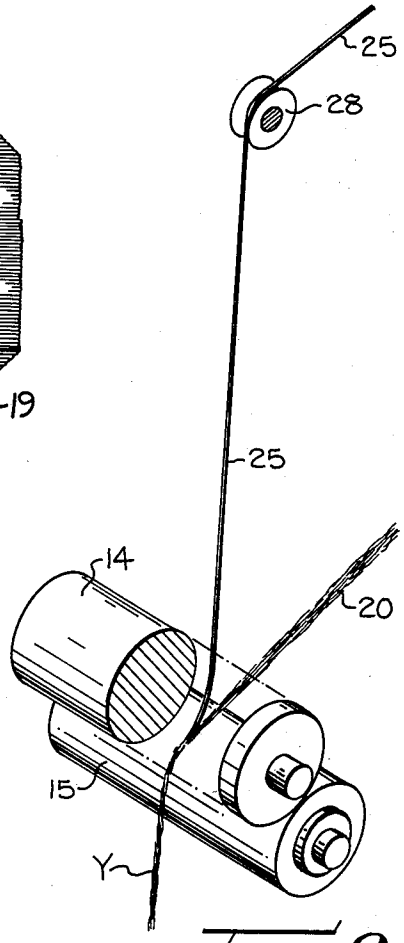

Fig-2

Fig-3

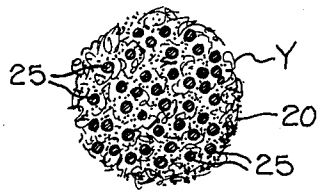

Fig-4

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United States Patent Office 3,070,950 Patented Jan. 1, 1963

3,070,950

METHOD OF PRODUCING A COMPOSITE YARN

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Filed Sept. 14, 1960, Ser. No. 55,989
2 Claims. (Cl. 57—157)

This invention relates generally to an improved method of producing a composite yarn. More particularly, this invention relates to a method of producing a composite yarn that contains a plurality of texturized continuous filaments, which have a tendency to curl or crimp when not under tension, and staple fibers which are intermingled therewith and locked in the continuous filaments. The resulting composite yarn product has the advantage of high bulk and stretchability with the appearance and feel of the spun staple yarn and wearing qualities and strength of the texturized filaments.

In prior attempts to obtain a composite yarn having the appearance and feel of a spun yarn and the stretchable characteristics of a texturized filamentary yarn, a strand of stretchable continuous filament yarn has been used as a core and a spun staple yarn has been wrapped around the core of stretchable yarn. While this type of composite yarn is stretchable, it does not have high bulk and because the two yarns are merely plied together, the wrapping yarn may slide along the length of the stretchable core and pile up in a knot exposing the bare stretchable core and causing breakage of the yarn and/or defects in the fabric. Many attempts have been made to successfully ply or double the two types of yarn together in various ways to prevent the piling up of the staple yarn along the length of the stretchable core yarn. However, even when these attempts have been successful in preventing the piling up of the staple yarn, in some portions of the finished fabric the core yarn is exposed and in other portions of the fabric, the staple yarn is exposed. Methods of wrapping or plying a staple yarn with a stretchable textured core yarn are disclosed in U.S. Patent No. 2,854,812 issued to C. W. Harris et al. on October 7, 1958, and U.S. Patent No. 2,777,310 issued to Marvin H. Comer on January 15, 1957.

In other attempts to obtain a composite yarn having the appearance and feel of a spun yarn, a strand of untextured continuous filament yarn has been combined with spun staple fibers and then twisted to lock the staple fibers in the untextured filaments. While this type of composite yarn has the appearance and feel of a spun yarn, it does not have any stretchability and no greater bulk than the total size of the continuous filaments and the spun staple fibers. This type of composite yarn is disclosed in U.S. Patent No. 2,825,199 issued to J. W. Hicks, Jr., on March 4, 1958.

With the foregoing in mind, it is a primary object of the present invention to provide an improved method of producing a composite yarn of the type having high bulk and elasticity with the appearance and feel of spun staple yarn.

It is another object of the present invention to provide a method of producing a composite yarn of the above type in which staple fibers are spun into and intermingled with a plurality of texturized continuous filaments and then the composite strand is twisted to lock the staple fibers into the filaments and prevent the staple fibers from becoming displaced or sliding along the length of the filaments.

It is another object of the present invention to provide a method of producing a composite yarn which is easily adaptable for a wide range of uses by varying the degree of bulk and/or stretchability of the yarn.

It is another object of the present invention to provide

a method of producing a composite yarn of the above type in which the degree of bulk and/or stretch of the yarn may be controlled by simply varying the percentages of staple fibers and/or filaments in the yarn, varying the amount of twist applied after the staple fibers and filaments are combined, varying the texturizing, denier and/or number of continuous filaments, or varying the type and size of the staple fibers.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which—

FIGURE 1 is a schematic view of one type of apparatus which may be utilized to produce a bulky stretchable composite yarn by combining texturized continuous filaments and staple fibers;

FIGURE 2 is a schematic isometric view of a portion of the apparatus showing the manner in which the texturized continuous filaments and the staple fibers are joined together and then twisted to interlock the staple fibers in the filaments;

FIGURE 3 is an enlarged elevational view of a length of composite yarn produced in accordance with the present invention and illustrating the texturized continuous filaments extending from opposite ends of the yarn;

FIGURE 4 is a greatly enlarged somewhat diagrammatic transverse sectional view through the yarn shown in FIGURE 3 and illustrating the manner in which the staple fibers are distributed in and interlocked by the texturized continuous filaments.

The texturized continuous filaments which form a part of the composite yarn of the present invention may be texturized by any of several well known conventional methods which impart a crimp or curl to the yarn, when relaxed. For example, a strand of multifilament synthetic yarn may be treated by twisting, heat-setting and then untwisting on conventional spinning equipment or by false twisting; the synthetic yarn may be texturized by running the same over a heated blade; by running the synthetic yarn between a heated gear arrangement; overfeeding the synthetic yarn into a stuffing box; or by running the synthetic yarn past a fluid jet to disrupt the filaments. The texturizing of the synthetic multifilament yarns to produce a continuous multifilament stretchable yarn forms no part of the present invention as the texturized strand utilized in the present invention may be processed in any number of ways to achieve the desired degree of stretchability or extensibility of the texturized strand.

The texturized continuous filament strand may be formed of any one of several available types of thermoplastic synthetic yarns which may be texturized to impart stretchability thereto. For example, nylon or Dacron may be used as well as others.

The staple yarns which form a part of the composite yarn of the present invention may be any of many different types of staple yarns available. For example, the staple yarns may be of natural fibers such as cotton or wool or they may be of synthetic fibers, such as nylon, Dacron, or the like, which have been cut into the desired staple length. It is preferred that the staple fiber material be supplied in the form of a sliver, a roving or the like in which the fibers have been substantially alined and partially drafted before they are introduced to and intermingled with the texturized continuous filaments of the stretchable strand.

Referring to the drawings, and particularly to FIGURES 1 and 2, one type of apparatus is shown which may be utilized to combine the strand of texturized continuous filaments and the staple fibers and then twist the same to form the composite yarn of the present invention. The parts of the apparatus shown are of the type generally found on a conventional spinning frame having a

series of pairs of drafting rolls which include rear rolls 10, 11, intermediate rolls 12, 13, and front or delivery rolls 14, 15. A suitable bobbin 19 supplies a roving strand of staple fibers 20 which is drawn through the pairs of rotating drafting rolls to elongate the strand 20 and draft the staple fibers the desired amount. The conventional driving arrangement of the spinning frame is arranged so that the rotational speeds of the pairs of drafting rolls may be regulated to vary the amount the roving strand 20 is drafted before it passes from the pairs of front delivery rolls 14 and 15.

A strand 25, comprising a plurality of texturized continuous filaments, is withdrawn from a yarn supply package 26, passes over a guide rod 27, over a guiding roller or element 28 and is drawn beneath the upper front delivery roll 14 where it joins the roving 20 of the staple fibers, in a manner to be presently described. It is preferred that the strand of texturized filaments have only a small amount of twist imparted thereto so that as they pass beneath the roll 14, the filaments will form a flat ribbon as they join the flattened ribbon of staple fibers 20. Then as they pass from between the rolls 14, 15, the ribbons of continuous filaments 25 and staple fibers 20 combine and the staple fibers of the strand 20 intermingle among, around and between the continuous filaments 25 so that the staple fibers are completely integrated with the continuous filaments to form the composite yarn indicated at Y.

As the composite yarn Y leaves the bight of the delivery rolls 14 and 15, it is directed downwardly through a pig-tail yarn guide 30, through a rotating traveler 31 and onto a rotating take-up package 32. The take-up package 32 includes a rotating bobbin which is rotated in the conventional manner to impart the desired amount of twist in the yarn Y before the same is wound onto the bobbin. The speed of the delivery rolls 14, 15 in relation to the speed of the take-up package may be varied in the conventional manner to impart the desired amount of twist to the yarn Y. If the strand 25 has a small amount of twist in it when it is delivered to the roll 14, then the twist applied to the composite yarn Y should be in the opposite direction to cause the filaments to return to zero twist before being finally twisted. This allows the filaments to open up and separate as soon as they pass between the rolls 14, 15 to let the staple fibers intermingle therewith.

Referring to FIGURE 3, it will be noted that the composite yarn Y is made up of the individual texturized continuous filaments 25 which are shown projecting outwardly from opposite ends thereof and the intermingled staple fibers 20 which cover and substantially obscure the texturized filaments 25. The sectional view of the yarn Y, shown in FIGURE 4, illustrates the separation of the filaments 25 and the intermingling of the staple fibers 20 therewith. Thus, the resulting composite yarn Y has the feel and appearance of the staple fibers 20 and also has great strength which is provided by the texturized filaments 25. When the yarn Y is relaxed, the filaments 25 tend to return to their crimped or curled condition to thereby expand the yarn and give the same high bulk and stretchability. In order to speed up the crimping or curling of the filaments 25 to bulk the yarn, the yarn, or the fabric made therefrom, may be subjected to heat. This heat may be dry or wet and may be applied before or during the finishing and/or dyeing process.

The speed of the drafting rolls may be maintained in the same relationship so that the same amount of staple fibers are fed to and intermingled throughout the length of the texturized filament strand 25. However, if desired, the speed of the drafting rolls can be varied at times to feed a greater amount of staple fibers to the texturized filament strand 25 and then feed a lesser amount of staple fibers to the texturized filament strand 25. By varying the speed of the drafting rolls in this manner the resulting composite yarn would have the appearance of a slub yarn.

It has been found that composite yarns made in accordance with the present invention have many uses in the textile field where bulkiness and/or stretchability of the yarn is desired. For example, the composite yarn may be utilized in knit swimsuits and the like where the bulk and feel of a cotton garment is desired while it is also desirable to have a certain amount of elasticity to provide a snug fit. The present composite yarn may also be utilized as the terry or pile yarns in towels, rugs, blankets or the like where bulkiness and resiliency in the loops or tufts of the fabric is desirable so that the loops will recover when crushed and remain full and fluffy appearing. The composite yarn may also be utilized in the knitting of hosiery where it is desired to have bulkiness combined with elasticity.

Another important advantage of the composite yarn of the present invention is that novel coloring effects may be achieved in the yarn. When the filaments and staple fibers have different dyeing characteristics, either cross-dyeing or union-dyeing may be utilized. Also, the filaments and staple fibers may be precolored to secure blended or contrasting colors in the final yarn.

Although the present composite yarn has many applications, it is believed to be helpful to a better understanding of the invention to describe a practical embodiment of the yarn which is given solely by way of example.

Example

One type of standard cotton yarn presently used to form the loops or tufts of a woven carpet is a 1.375/1 cotton count yarn which yields 1155 yards per pound and in order to provide proper coverage, a carpet mill will form 14 tufts or pile loops per inch in the capet with this size of all cotton yarn. In order to form a comparable size composite yarn in accordance with the present invention, any suitable sliver of roving staple cotton fibers is fed between the drafting rolls and drafted down to a cotton count 1.67/1. A strand of texturized filaments of nylon having 34 filaments and a total denier 70 is joined with the drafted cotton staple fibers as the two pass between the front delivery rolls 14 and 15 where the cotton staple fibers are intermingled with the texturized filaments and the composite yarn is given a twist of approximately 3¼ turns per inch before it is collected on the take-up package 32.

The resulting composite yarn, before bulking, is the same size as the standard 1.375/1 cotton yarn usually used and yields the same number of yards per pound. The composite yarn formed contains 84% cotton staple fibers and 16% texturized continuous filaments. It has been found that only eight tufts or pile loops per inch are required of the composite yarn and when the carpet is finished, the composite yarn will bulk approximately 20% to provide the same coverage as the cotton yarn which required fourteen tufts per inch. It is apparent that with a lesser number of tufts or pile loops required per inch, a lesser amount of the composite yarn will be utilized in making the carpet thereby reducing the cost of manufacture.

Also, using the composite yarn of the present invention as the pile yarn in a carpet, the overall weight of the carpet will be reduced by approximately 20%, the pile loops or tufts of the composite yarn have greater strength and wear longer than loops or tufts formed of cotton yarns. Also, the pile loops or tufts formed of the present composite yarn have more resiliency than loops or tufts of cotton yarn and will return to their normal position after remaining crushed for a considerable length of time.

It has been found that composite yarns can be made in accordance with the present invention which have a wide range of sizes. Also, by varying the amount and type of texturized filaments and/or staple fibers utilized, the characteristics of the composite yarns formed there-

from can be formed to suit a wide range of uses. Generally, it has been found that the higher the percentage of texturized filaments used the greater the bulk and stretchability of the composite yarn and the lower the percentage of texturized filaments used the lower the bulk and stretchability of the composite yarn. From an economical point of view, it would not be practical to utilize more than 50% of texturized filaments because the texturized filaments are so much more expensive than cotton staple. Also, when more than 50% of texturized filaments are utilized, the composite yarn begins to take on more of the characteristics of the texturized filaments and no longer has the predominate appearance of a spun staple yarn. Some bulking is present in a composite yarn utilizing less than 5% of texturized filaments, however, the amount of bulking would be too small to be of any real value. For the above reasons, it is contemplated that the percentage of texturized filaments utilized will be within the range of from 5 to 50% and in most instances the percentage of texturized filaments will be within the range of from 10 to 40%.

The amount of twist applied to the composite yarn also affect the degree of bulk and elasticity of the composite yarn. Generally, the more twist applied to the yarn the less bulk and elasticity because if the yarn is highly twisted, the texturized filaments do not have the freedom to return to crimped or curled position when relaxed. In most cases, it is preferred that the amount of twist be low, less than 5 turns per inch, although this will be determined by the size of the composite yarn, the amount and character of the texturized filaments and/or staple fibers.

Other factors can also change the degree of bulk and elasticity of the composite yarn. For example, the finer the denier of the individual filaments of the texturized strand utilized, the resulting composite yarn will be more bulky, have more elasticity and have a softer hand. If the type and/or size of staple fibers is changed, the characteristics of the resulting composite yarn will also be changed. For example, it is generally true that the longer the staple fibers the less bulk and elasticity of the composite yarn.

From the foregoing, it will be apparent that composite yarns having varying degrees of bulk and elasticity can be made in accordance with the present invention and these composite yarns can be used in making a wide variety of fabrics. The degree of bulkiness and elasticity of the composite yarn can be controlled by varying the percentages of texturized filaments and/or staple fibers, the amount of twist applied after the staple fibers and filaments are combined, varying the texturizing, denier and/or number of continuous filament, and/or varying the type and size of the staple fibers. While it is preferred that the percentage of texturized filaments be generally less than the percentage of staple fibers, it is within the scope of the present invention to change these percentages if desired. The percentages of texturized filament and staple fibers in the composite yarn are determined by the desired characteristics of the composite yarn and/or resulting fabric and may be changed to provide the desired characteristics.

It is thus seen that an improved bulky and stretchable composite yarn and method of making the same has been provided in which staple fibers are intermingled and locked in a plurality of texturized filaments and the composite yarn and/or fabric knit or woven therefrom has the hand, feel and appearance of a spun staple yarn and the strength and elasticity of a stretchable filamentary yarn.

In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. A method of producing a composite yarn containing a plurality of texturized continuous filaments and staple fibers which comprises drafting a single roving of staple fibers to a predetermined degree to form a ribbon of the staple fibers, feeding a single twisted strand of texturized continuous filaments while guiding the strand of filaments into contact with the ribbon of staple fibers during the last stages of the drafting of the staple fibers to cause the staple fibers to intermingle with the texturized continuous filaments, and then applying twist to the combined filaments and staple fibers in a direction opposite the direction of twist in the strand of texturized continuous filaments to initially remove the twist from the strand of filaments and then apply thereto to lock the staple fibers between and among the filaments.

2. A method of producing a high bulk of texturized concomposite yarn including a plurality of texturized continuous synthetic filaments and cotton staple fibers intermingled therewith and having the appearance and feel of the staple fibers and the wearing qualities and strength of the texturized filaments, said method comprising the steps of drafting a single strand of the cotton staple fibers to a predetermined degree by passing the strand through a plurality of drafting rolls defining a drafting zone, feeding a single twisted strand of the texturized continuous synthetic filaments into contact with the strand of staple fibers immediately prior to the staple fibers leaving the drafting zone to cause the staple fibers to be intermingled with the texturized continuous filaments, and then delivering the combined texturized continuous filaments and staple fibers from the drafting zone while applying twist to the combined filaments and staple fibers in a direction opposite the direction of original twist in the strand of texturized continuous filaments to initially remove the twist from the strand of filaments and then apply twist thereto to cause the staple cotton fibers to be interlocked between and among the continuous filaments.

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(1st Addition to No. 1,158,282)

(Corresponding British 850,059, Sept. 28, 1960)

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,070,950 January 1, 1963

William B. Thomas

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 35, for "capet" read -- carpet --; column 5, line 23, for "affect" read -- effects --; lines 51, 56 and 57, for "filament", each occurrence, read -- filaments --; column 6, line 26, after "apply" insert -- twist --.

Signed and sealed this 11th day of June 1963.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents