Feb. 14, 1961 R. BOUVET 2,971,322

STRETCH YARN

Filed May 4, 1956

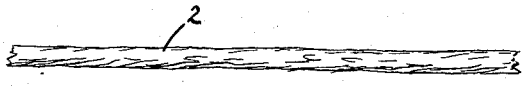

Fig. 1

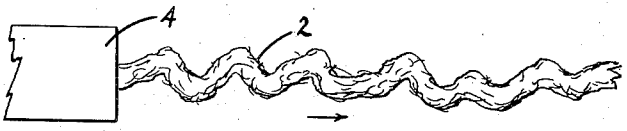

Fig. 2

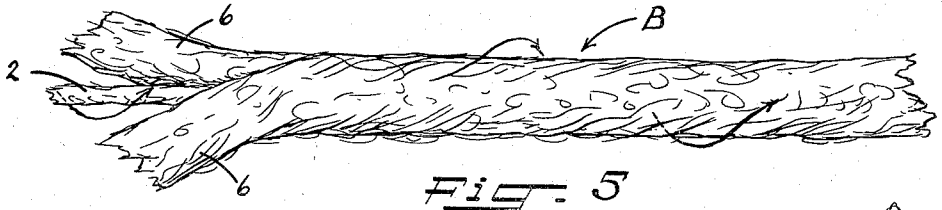

Fig. 5

Fig. 6

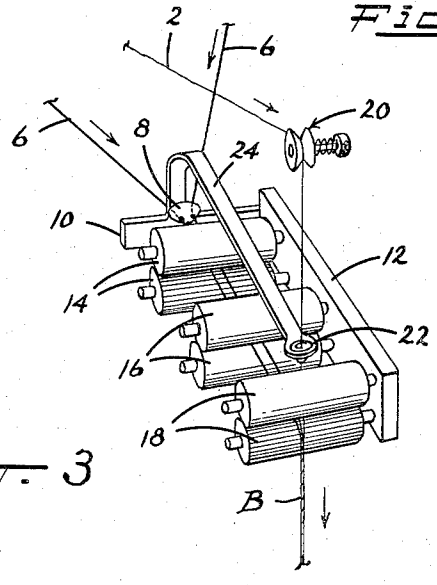

Fig. 3

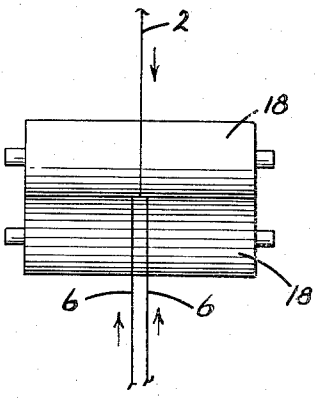

Fig. 4

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STRETCH YARN

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2 Claims. (Cl. 57—140)

The present invention relates to a new and novel type stretch yarn.

In particular, the invention relates to a yarn similar to that type now used in producing "stretch" articles of wearing apparel such as "stretch" socks for men, "stretch" stockings for women, etc. These "stretch" articles are produced and sold without reference to a particular numerical size of the article since the stretchable characteristic of the items makes it possible to accommodate a wide range of numerical sizes.

It is one object of my invention to provide a novel and improved composite "stretch" yarn.

Another object of my invention is to provide a novel and improved composite "stretch" yarn which has the appearance, uniformity and feel of spun yarn.

Still another object of my invention is to provide a novel and improved composite "stretch" yarn which is less expensive than the "stretch" yarns now on the market.

A further object of my invention is to provide a novel and improved composite "stretch" yarn wherein only a portion of the total yarn weight comprises yarn of a stretchable nature.

A final object of my invention is to provide a novel and improved method for producing the composite "stretch" yarn of the above objects.

Other objects and advantages of my invention will become more apparent from a study of the following description and drawing wherein:

Figure 1 shows a length of the core yarn of my composite "stretch" yarn;

Figure 2 shows the core yarn of my composite "stretch" yarn after a permanent crimp has been formed therein;

Figure 3 is a diagrammatic view showing an apparatus for applying a fibrous covering of non-stretchable nature to the crimped and tensioned core yarn;

Figure 4 is a detail of a portion of the apparatus of Figure 3;

Figure 5 shows the composite "stretch" yarn in a stretched or tensioned state after the crimped core yarn has been covered or plated with a fibrous covering of non-stretchable nature; and

Figure 6 shows my composite "stretch" yarn including the crimped core and covering in its relaxed state.

Briefly, my composite "stretch" yarn consists of a core portion of crimped thermosensitive organic plastic fibers or filaments which have that property known as a "plastic memory," and a fibrous covering for the core yarn portion which covering is formed of non-stretchable fibers. The crimped thermosensitive core fibers or filaments comprise at least 15% by weight of the total composite yarn weight.

The term "plastic memory," as used in this specification and claims, designates the property of a fiber made from a resin or plastic material such as nylon, a polyester resin, an acrylonitrile resin, which when crimped and heat set in the crimp form will always return to the crimp form from its tensioned non-crimp form after the tension has been released. Fibers having this property are made by heating or crimping the fiber by mechanical means or the like and subjecting the fiber while in the crimp form to heat sufficient to set the fiber in the crimp form. When the fiber is subjected to tension, it will straighten out and the crimp will be removed. However, upon releasing the tension, the yarn will return to its crimp form. This crimping is unaffected by moisture, water or the like.

A novel method is provided for producing the composite "stretch" yarn. In carrying out the method, the core yarns or fibers first undergo a crimping operation whereby a permanent crimp is set within the core yarns or fibers. The crimped core is then stretched a sufficient amount to straighten out the crimp in the yarn after which a fibrous covering of non-stretchable nature is then applied to the core portion. When the tension applied to the core yarn is relleased, the composite yarn will assume a crimped form in view of the return of the core yarn to its original crimp form.

Referring now to Figure 1 of the drawing, there is shown the core yarn or portion **2** of my composite "stretch" yarn. The core **2** is shown in its natural or non-crimped state. The core portion of my composite "stretch" yarn consists of certain type plastic organic continuous filaments or it may be a fibrous spun yarn consisting of certain type plastic organic staple fibers. For purposes of my invention, the core filaments or fibers comprise those organic plastic fibers or filaments which exhibit the phenomenon known as a "plastic memory." Such fibers and filaments can be formed only from a limited class of certain organic plastic thermosensitive materials. Among these "plastic memory" yarns are those of the acrylic fiber class which are formed from polymers and copolymers of acrylonitrile and are sold commercially under the names of Acrilan, dynel or Darvan. Dacron, a polyester fiber, which is produced from a chemical composition of ethylene glycol and terephthalic acid, has also been found satisfactory for my purpose. Nylon, generally formed from diamines and dicarboxylic acids (adipic acid), has been found to be extremely successful when used as a core yarn for my composite "stretch" yarn. As mentioned above, one common property of these yarns is that when heated to certain temperatures, they may be reshaped as desired. Upon cooling, the reshaped contour is permanently set in the yarn. Another property common to these type yarns is that they all have that property known as a "plastic memory" as defined above.

Figure 2 shows the core yarn **2** in crimped condition after it has been discharged from the crimping and crimp-setting apparatus or station **4**. There are several known and accepted methods and apparatus now in use for crimping and setting such yarns formed from the materials listed above. A few of these known methods are the Helanca, Ban-Lon, Agilon, and the Fluflon methods. All of these methods generally involve the steps of heating the thermosensitive filaments or fibers to a desired temperature at which temperature the shape or physical structure of the filaments may be altered and permanently set in crimped form.

A fibrous covering is applied to the crimped core **2**, preferably by the apparatus and method shown in Figure 3. Since, as mentioned above, the covering for the core **2** is formed of fibrous material, the composite stretch yarn has the feel and character of a spun yarn. As seen in Figure 3, a pair of fibrous rovings (continuous bundles of staple fibers) **6, 6** are drawn from separate supply sources (not shown). They are brought together in a side-by-side, spaced-apart, parallel relationship by a double trumpet guide **8** which is secured to a cross bar **10** which is in turn affixed to a support **12**. The rovings **6, 6** are carried through a series of draw-

ing rolls, generally designated as **14, 16 and 18** whereby the rovings **6, 6** are spun. These rollers maintain the rovings in their side-by-side, spaced-apart, parallel relationship. The journals and driving means for the drawing rolls are not shown since they do not constitute a part of the present invention. The crimped core yarn **2** is fed from a supply source (not shown), over a tension device **20** which may consist of a pair of opposing and cooperating discs. The tension device **20** temporarily removes the crimp from the core **2** so that it may be more efficiently and thoroughly incorporated into the rovings **6, 6**. The core **2**, in its non-crimped condition, then passes through an eye guide **22** formed in the end of an overhanging arm **24** affixed to the cross bar **10**. The eye guide **22** lies just to the rear of the draw rolls **18** and is so aligned with the rolls **18** that it conducts the core yarn **2** to the rolls **18** between the rovings **6, 6** at a point equidistant from each roving **6**. The feeding and positioning of the core yarn **2** between the rovings **6, 6** is shown more clearly in Figure 4. It is extremely important that the core yarn **2** be fed between the rovings at a point exactly between the two rovings of larger bulk (equidistant from the two rovings) so that when the core **2** and the rovings **6, 6** are twisted together after they emerge from the rollers **18** (see Figure 3) to form the composite yarn B, the core **2** will be embedded, so to speak, in the rovings **6, 6**. By twisting the rovings **6, 6** and core yarn **2** after they emerge from the rolls **18, 18**, the rovings and core are incorporated into a unitary structure which is firmly held together. The thickness of the rovings **6, 6** and the corn yarn **2** may be varied as desired to produce whatever denier composite yarn is desired. The final composite yarn B preferably has a twist of one to three turns per inch. However, as many turns per inch as desired may be incorporated in the composite yarn.

The cover rovings **6, 6** comprise continuous bundles of staple fibers which are of a non-elastic or non-stretchable nature. Many types of fibers may be used in forming the cover. Among those found desirable are the pure cellulosic fibers such as cotton, the regenerated cellulose fibers such as viscose rayon, cellulose acetate, etc. and other types of fibers.

Figure 5 shows the composite "stretch" yarn B in its stretched or tensioned condition. As seen therein, the core **2** is completely embedded in the rovings **6, 6** and is uniformly covered by the rovings.

Figure 6 shows the composite "stretch" yarn B in its relaxed position. As seen therein, the core or "plastic memory" yarn **2** has reassumed its originally set crimped form since it tends to turn to its original form once the stretch tension applied to the yarn has been released. The convolutions of the cover rovings **6, 6** are close enough to one another so that a complete uninterrupted fibrous cover is formed around the stretchable core **2** when in either a relaxed or stretched condition.

The weight of the core yarn with respect to the total weight of the composite yarn may be varied to produce composite yarn of desired "stretch" ranges and strength. Satisfactory composite stretch yarns have been formed by using core yarn portions which comprise 15 to 60% of the total yarn weight. Preferably, the core yarn constitutes approximately 25% by weight of the total yarn weight. When the percentage of the stretchable core is reduced below 15%, its effectiveness is markably minimized to the extent that the resultant composite yarn is void of any practicable "stretch" ability.

Men's socks were produced with my composite yarn wherein a core yarn of nylon filaments constituted 25% of the total weight of the yarn. The remaining 75% of the yarn weight constituted a fibrous roving cover of

bright viscose rayon. After testing, it was found that the socks extended 60% from their relaxed condition and that the elastic recovery was complete. With such an extensive range of "stretch," a generous margin is provided for whereby the sock producers may eliminate the old practice of producing different size socks.

There are, of course, many recognized uses for stretch yarns of this nature other than the men's socks mentioned above. All manner of snug-fitting garments may be produced from my composite yarn. "Stretch" sweaters, having the feel and appearance of sweaters formed from spun yarn, may also be produced.

There are several advantages found with my stretch type yarn which are not inherent with other types of stretch yarns on the market. The main advantage is that only a fairly low percentage of the expensive core or stretchable yarn is required. The remainder of the yarn may be made up of less expensive material. Garments produced from my "stretch" yarn could easily, retail at lower prices than those on the market today. Since only a fairly low percentage of the total yarn weight is subjected to the crimping treatment, which is rather an expensive operation, a great saving is provided in the total cost of the yarn production. In addition, my stretch yarn has the feel and appearance of spun yarn which is a highly desirable feature with apparel producers today. The fibrous covering is of a hydrophilic nature whereby better absorption of moisture is effected which adds to the comfort of the wearer. It is further evident that the composite yarn may be uniformly dyed since the convolutions of the cover rovings are positioned on the core yarn in close relationship whereby complete coverage is provided in both the relaxed and stretch state of the yarn.

It is to be understood that changes and variations may be made without departing from the spirit and scope of the present invention as defined in the appended claims.

I claim:

1. A method of producing a composite stretch-type yarn comprising feeding a pair of fibrous rovings of non-stretchable nature in a side-by-side, spaced-apart, parallel relationship to a twisting station, feeding a crimped core yarn having a plastic memory between the rovings at a point equidistant from each roving, drafting the rovings as they are fed to the twisting station, tensioning the crimped yarn prior to its introduction between the rovings to temporarily remove the crimp from the yarn, twisting the drafted rovings and the yarn together, and relaxing the tensioned yarn so that the yarn and drafted rovings twisted together assume a crimped condition.

2. A stretch-type composite yarn comprising a crimped thermosensitive multifilament organic plastic core element, a fibrous covering around said core element, said covering comprising a pair of viscose rayon rovings wound around said core element so as to completely cover said core element in both its stretched and relaxed conditions, and said crimped core element comprising from 15% to 60% of the total yarn weight.

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