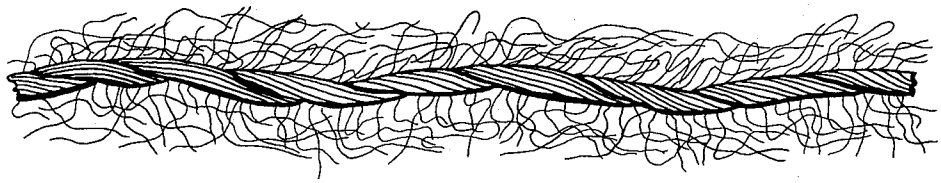
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YARN FOR NOVEL FABRICS

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YARN FOR NOVEL FABRICS

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This invention relates to novel yarns and fabrics of synthetic fibers.

Among the most desirable luxury apparel fabrics from natural fibers are thos which have a surface characterized by many loose, protruding fiber ends. Angora fabrics, containing rabbit hair, are typical of these materials. The presence of rabbit hair or other specialty fiber gives the fabric a luxuriously soft handle which is greatly prized. Specialty fibers of this type cannot generally be made into yarns by themselves and are much too high in price to permit their exclusive use in fabrication of the whole garment. Usually the specialty fiber is blended with a major proportion of another stronger, less expensive fiber to produce a yarn and the yarn is then woven or knitted into a fabric which has a large portion of the specialty fiber present on the surface. Unfortunately, these loose, protruding specialty fibers tend to shed very easily. This is not only inconvenient to the user, but in addition, after a fairly short period of wear and maintenance, the garment loses much of its desired appearance due to excessive loss of surface fibers.

It is an object of this invention to provide fabrics from synthetic fibers having on the surface a high concentration of free-end fiber tips, the other ends of these fibers being securely locked into the body of the structure. It is another object to provide synthetic fiber yarns having along the length of the yarn a large number of protruding free-end fiber tips which are fastened firmly into the yarn, giving a yarn structure suitable for the manufacture of woven and knitted fabrics with a desirable novelty surface appearance.

These objects are achieved in knitted and woven fabrics made from yarns containing between about 50% and about 95% of a high-residual-shrinkage low denier per filament synthetic fiber staple, the remainder of the yarn consisting of a high denier per filament synthetic fiber staple. The high denier fibers have from 2 to 15 times the denier per filament of the low denier fibers, and the low denier fibers do not exceed 10 denier per filament. Yarns of this invention are twisted during spinning (twist multiplier of from about 2.0 to about 3.6) whereby the high denier fiber ends are caused to protrude from the yarn, and these ends also protrude from the surface of any fabric into which the yarn is converted. The free fiber ends can readily be oriented parallel to one another, and while they are free of the fabric surface, they lie substantially along this surface, rather than protruding perpendicular therefrom. The very low angle of protrusion gives a sleek, soft surface, rather than a rough one. The high denier fibers are locked into the fabric by treating the fabric after its formation with heat or chemical means to relax the high shrinkage fibers. The term "high shrinkage fiber" refers to a fiber capable of shrinking at least 10% and up to 45% in length upon exposure to water at 100° C. for 10 minutes.

The drawing illustrates a specific embodiment of the yarn of this invention as it appears when viewed at low magnification. The low denier fibers 1 in the core anchor protruding high denier fibers 2 so that, as shown, the free ends have a low angle of protrusion along the surface of the yarn. Fabric formed of this yarn as disclosed in Example 1 has an appearance similar to that of angora fabric and the protruding fibers are tightly held in the fabric.

In a preferred embodiment of this invention knitted fabrics are prepared from yarns of blended high and low

denier staple fibers of an acrylonitrile polymer containing at least 85% combined acrylonitrile, all fibers possessing residual shrinkage of about 15% to about 25%, the free ends of the heavy denier per filament fibers protruding from the yarn surface. The preferred yarns are prepared with a twist multiplier of 3.0 to 3.6. After knitting, the fabric is treated by known means, e.g., with boiling water, to shrink the fibers, whereby the high denier per filament fibers are locked securely into the fabric structure at one end while the other end remains free and protrudes from the surface of the fabric giving a luxurious angora-like surface appearance.

The fabrics of the present invention should not be confused with pile fabrics in which a large number of tufts, loops, and strand ends are caused to stand stiffly and vertically away from the fabric surface. In the fabrics of this invention, protruding fiber ends appear singly on the fabric surface, although rather closely spaced, and have a distinct tendency to lie either along the fabric surface or at an angle to it rather than stiffly erect from the surface. The high denier fibers used in this invention are at least 1½ inches long and preferably from 3 to 8 inches long and protrude from the yarn surface after shrinkage treatment by an amount equal to at least ¼ inch and preferably as much as one-fourth the length of the fibers.

In distinction from known fabrics of the angora type, which are similar in appearance to the fabrics of the present invention, these new materials do not tend to shed the protruding surface fibers. Rather, because the ends are securely locked by shrinkage into the fabric body, these materials exhibit the same ease of care, washability, and durability, even after long wearing and rough handling, which are characteristic of most synthetic fiber fabrics. In addition, these fabrics show a high degree of resistance to pilling.

The following examples illustrate specific embodiments of the invention.

Example 1

A yarn is prepared by breaking and blending an acrylic fiber tow containing 60% 3 denier per filament acrylic fibers (94% acrylonitrile, 6% methyl acrylate, 0.33% sodium styrene sulfonate), which has been solution-dyed to a black color, and 40% 10 denier per filament undyed acrylic fiber. The fibers are broken to 8-inch staple lengths. Residual shrinkage of the fibers is about 20%. The blended broken sliver is then crimped and doubled as is conventional in preparation of knitting yarns, using, however, a high twist multiplier of 3.25. Flexing of the yarn during spinning causes the high denier fibers to migrate toward the surface of the yarn to protrude as shown in the drawing. The yarn is then knitted into a plain jersey structure (courses x wales=28 x 34) by normal knitting techniques and the resulting fabric is relaxed by scouring at the boil. A fabric results which has a background of closely knitted dense structure containing a large number of loose fiber ends of the 10 denier per filament fiber. These ends, which protrude from about ¼ inch to one inch, are easily oriented in any direction, for example, by brushing the fabric. However, they are tightly held by the base structure and are not dislodged from the fabric by brushing. Pulling on any individual fiber end causes the fiber to break rather than pull out of the fabric base and, even then, breakage occurs only after considerable strain as would be expected from the high tenacity of acrylic fiber materials. There is no tendency for this fabric to shed or to pill. Shearing the fabric enhances its uniformity and appearance. The appearance of this fabric is unique and remarkably attractive with many white free ends protruding from the black background of the surface. This protrusion of white fiber ends on a black background

gives a highly attractive silky appearance similar to angora fabrics.

Example 2

Following a procedure similar to that in Example 1, a tow is prepared containing 60%, 3 denier per filament acrylic fiber and 40% 10 denier per filament acrylic fiber, both in a natural shade. The mixed fiber tow is processed to give an unrelaxed yarn with high twist multiplier and this yarn is knitted into a fabric. Because of the fact that this fabric is made wholly of unrelaxed yarn, the knitted fabric, after relaxation, is much more stable and resistant to stretching and distortion than most knitted fabrics; it has a handle and drape quite similar in effect to many woven fabrics, and resembles a suiting fabric to a surprising degree.

Example 3

Yarn is prepared from acrylic fiber staple tow as described in Example 1. However, instead of preparing a knitted fabric, the yarn is used as filling in a woven fabric in which the warp yarn consists of continuous filament synthetic fibers. In this way it is possible to maintain considerable tension on the warp so that the flexure of yarn necessary in a woven construction is achieved by the bending of the filling yarn, in this case the specialty yarn containing the potentially free ends. Following the weaving of the fabric which is a filling-effect weave construction 100 by 70 count, the fabric is scoured in boiling water to relax the fibers and thereby to develop the free end effect while simultaneously locking the high denier fibers securely in the fabric. The result is a dense fabric with many free ends protruding from the surface, this time on each side of the fabric. This fabric has a pleasant, soft, warm hand, and is different from known knitted or woven fabrics of synthetic fibers. Yarns spun from a blend of fibers having a denier per filament differential of from about 3 to 10 or more produce fabrics which exhibit a desirable glitter.

In addition to the specific fabric constructions described above, it is possible to adopt the principles of the present invention to a wide variety of other fabrics. While a plain jersey stitch is used in the preparation of some knitted fabrics, it is also possible to use, for example, an interlock stitch, lay-in, or other knitted constructions. In regard to woven constructions, it has been found that the novelty surface effect characteristic of the present invention is achieved most readily in twills and similar fabric construction rather than in fabrics such as satin and the like. The maximum degree of free end protrusion is achieved when yarns containing fibers of different deniers are subjected to a high degree of flexure.

Although fibers of acrylonitrile polymers containing at least 85% combined acrylonitrile are preferred in practicing the present invention, fibers from other polymeric materials may be used, provided that the fibers as spun into yarn retain a sufficient degree of residual shrinkage potential so that after the fabric is formed the heavy denier filaments can be loosened to cause them to protrude from the base of the fabric and relaxed to lock into the basic fabric the end which does not protrude. Fibers having widely varying deniers may be utilized, for example, a light denier

per filament fiber can be used in counts as low as 1 denier per filament and as high as 10 denier per filament, and the coarse denier per filament fiber can be anywhere from 2 to 15 times as heavy, that is, have anywhere from 2 denier per filament up to 150 denier per filament. A characteristic free end construction is attained in any case when residual shrinkage has been fully effected. In very heavy denier per filament construction the fabric will lose some of its fine silky feeling and is stiffer and harsher and, therefore, somewhat less attractive for some uses. Staple lengths for the yarns employed in the present invention can range from about 2 inches up to about 8 inches. Blends of staple yarn and continuous filament yarn may be blended while still developing the free-end protruding fibers. Of course, it will readily be understood that it is not possible to use 100% continuous filament yarns in the practice of the present invention.

The claimed invention:

1. A novel yarn comprising a blend of high and low denier synthetic organic staple fibers, a substantial number of the high denier fibers having free ends protruding at least ¼ inch from the yarn surface, the opposite ends of these fibers held in the yarn due to frictional constraint with the low denier fibers, the low denier fibers being less than about 10 denier per filament and the high denier fibers having a denier from about 2 to about 15 times that of the low denier fibers.

2. The yarn of claim 1 in the form of a fabric.

3. The yarn of claim 1 in which the fibers are acrylonitrile polymer fibers containing at least 85% combined acrylonitrile.

4. The yarn of claim 1 in which the low denier fibers possess at least 10% residual shrinkage.

5. The yarn of claim 4 in the form of a fabric.

6. The yarn of claim 4 in which the fibers are acrylonitrile polymer fibers containing at least 85% combined acrylonitrile.

7. The yarn of claim 6 in the form of a fabric.

8. The yarn of claim 1 in which all fibers possess at least 10% residual shrinkage.

9. The yarn of claim 8 in which the fibers are acrylonitrile polymer fibers containing at least 85% combined acrylonitrile.

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