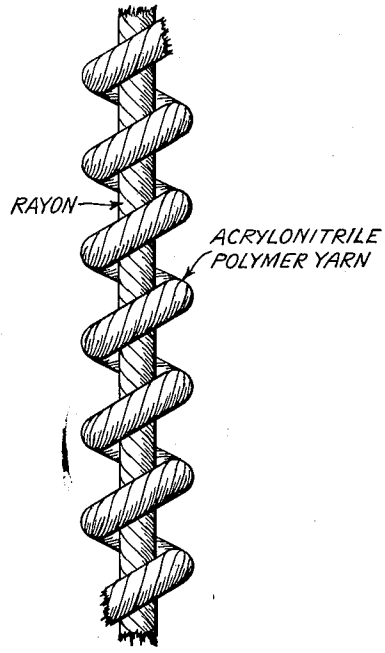
Nov. 6, 1956 W. G. LUTTGE 2,769,300

COMPOSITE TEXTILE YARN

Filed April 3, 1953



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United States Patent Office 2,769,300 Patented Nov. 6, 1956

2,769,300

COMPOSITE TEXTILE YARN

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Application April 3, 1953, Serial No. 346,790

10 Claims. (Cl. 57—140)

This invention relates to new textile products and to a method of producing the same. More particularly, the invention is concerned with the production of composite textile yarns and fabrics formed therefrom, such as knitted and woven sheets, webbing, belts, tapes, and the like. Specifically, the invention is concerned with composite textile yarns comprising essentially hydrophobic fibers spun around a hydroscopic core yarn, whereby fabrics produced therefrom have greatly increased desirable properties, such as increased wind resistance and water resistance.

In the manufacture of textile fabrics it is frequently desirable to modify the natural properties of textile yarns or threads so as to improve certain properties thereof and adapt the yarns or threads to other uses. For example, various attempts have been made heretofore to modify such properties as flexibility, permeability, resistance to abrasion and laundering, shrinkage, stretching, unraveling, and the like, by applying a resinous coating to the yarns or fabrics. While some success has been obtained by employing such a procedure, nevertheless, such resinous compositions have adversely affected the desired features of the finished product, such as appearance, texture, surface absorptivity, hand, and the like.

It has also been the practice heretofore, in order to obtain certain desirable properties in a fabric, to mix together two or more types of fibers prior to the completion of spinning. For example, it has been proposed to mix a natural fiber, such as cotton or wool, and a thermoplastic synthetic resin fiber, such as one formed from a copolymer of a vinyl halide and vinyl acetate, spin said mixture into a yarn, and thereafter render the resin fibers tacky by heat to effect a strong and substantially permanent adhesion between the fibers.

Further, various yarns formed from different fibrous materials have been twisted together to form composite yarns or one yarn wrapped about the other. In this way various desirable properties in finished fabrics made from such yarns have been attained. The present invention relates to composite textile yarns and fabrics wherein the yarns are formed from two or more different spun yarns or continuous filament yarns twisted together or one or more different yarns wrapped about a core yarn which is different from the wrapping yarns.

It is well-known that certain fibers are essentially hydroprobic while others are hydroscopic in nature. Each of such fibers is useful for certain purposes. It has been found that yarns formed from hydrophobic fibers can be utilied with yarns formed from hydroscopic fibers to produce composite yarns which impart new and greatly enhanced desirable properties to fabrics formed therefrom.

It is an object of the present invention to provide a new and improved composite yarn, or strand, or thread which has improved properties with respect to wind and water resistance. It is another object of the invention to provide a method for producing a new and improved composite yarn. It is still another object of the invention

to provide fabrics and like articles made from new and improved composite yarns, which are wind resistant and water resistant. Other objects and advantages of the present invention will be apparent from the description thereof hereinafter.

In general, the objects of the present invention are accomplished by spinning essentially hydrophobic fibers, such as those formed from polymeric acrylonitrile, around a prespun hydroscopic core yarn, such as one formed from viscose rayon continuous filaments or staple fibers. While it is preferred to employ viscose rayon continuous filament yarn as the core of the composite yarn of the instant invention, satisfactory results are obtained when spun viscose rayon yarn is employed as the core yarn in the composite yarn.

The figure of the drawing represents on a magnified scale a composite yarn of a rayon core having an acrylonitrile polymer yarn wrapped thereabout.

The wrapper component of the composite yarn of the present invention is formed from one or more rovings of spun acrylonitrile polymer fibers. By "acrylonitrile polymer" is meant polyacrylonitrile, copolymers and terpolymers of acrylonitrile, and blends of polyacrylonitrile and copolymers of acrylonitrile with other polymerizable mono-olefinic materials. In general, a polymer of monomeric mixture of which acrylonitrile is at least 70% by weight of the polymerizable content, is useful in the practice of the present invention. Besides polyacrylonitrile, useful copolymers are those of 80 or more percent of acrylonitrile and one or more percent of other mono-olefinic monomers. Suitable other monomers include vinyl acetate, and other vinyl esters of monocarboxylic acids, vinylidene chloride, vinyl chloride and other vinyl halides, dimethyl fumarate and other dialkyl esters of fumaric acid, dimethyl maleate and other dialkyl esters of maleic acid, methyl acrylate and other alkyl esters of acrylic acid, styrene and other vinyl-substituted aromatic hydrocarbons, methyl methacrylate and other alkyl esters of methacrylic acid, methacrylonitrile, alpha-vinylpyridine and other vinyl-substituted heterocyclic nitrogen ring compounds, such as the vinyl imidazoles, etc., the alkyl-substituted vinylpyridines, vinyl chloroacetate, allyl chloroacetate, methallyl chloroacetate, allyl glycidyl ether, methallyl glycidyl ether, allyl glycidyl phthalate, and the corresponding esters of other aliphatic and aromatic dicarboxylic acids, glycidyl acrylate, glycidyl methacrylate and other mono-olefinic monomers copolymerizable with acrylonitrile.

Many of the more readily available monomers for polymerization with acrylonitrile, form copolymers which are not reactive with the dyestuffs and may therefore be impossible or difficult to dye by conventional techniques. Accordingly, these non-dyeable fiber-forming copolymers may be blended with polymers or copolymers which are in themselves more dye-receptive by reason of their physical structure or by reason of the presence of functional groups which are chemically reactive with the dyestuff, whereby the dyestuff is permanently bonded to the polymer in a manner which lends resistance to the usual laundering and dry cleaning procedures. Suitable blending polymers may be polyvinylpyridine, polymers of alkyl-substituted vinylpyridine, polymers of other vinyl-substituted N-heterocyclic compounds, the copolymers of the various vinyl-substituted N-heterocyclic compounds and other copolymerizable monomers, particularly acrylonitrile.

Of particular utility are the blends formed of polyacrylonitrile or a copolymer of more than 90% acrylonitrile and up to 10% of vinyl acetate, and a copolymer of vinylpyridine or an alkyl-substituted vinylpyridine and acrylonitrile, the said acrylonitrile being present in sub-

stantial proportions, for example, 50 to 80% to provide heat and solvent resistance, and a substantial proportion of the vinylpyridine or derivative thereof to render the blend receptive to acid dyestuffs. Of particular utility are the blends of copolymers of 90 to 98% acrylonitrile and 2 to 10% vinyl acetate and sufficient copolymer of 10 to 70% acrylonitrile and 30 to 90% vinylpyridine to produce a blended composition with a total of 3 to 8% by weight of vinylpyridine.

To produce the composite yarns of the present invention, one or more rovings, made from one of the acrylonitrile polymers enumerated above, are introduced into a conventional spinning frame and submitted to the usual drafting operation. The core of viscose rayon is set in under the front or delivery rollers to coact with the roving and form a composite twisted yarn, whereby the rayon forms a core around which the roving of acrylonitrile polymer fibers is twisted or wrapped. The viscose rayon core is set under the front or delivery rollers to escape the attenuating action of the drafting rolls.

The composite yarns so produced may be employed in the usual textile operations, such as weaving, knitting, netting, braiding, and the like. However, the composite yarns are of particular utility in the production of barrier type fabrics, i. e., those which are highly wind resistant and water resistant. In producing the barrier type fabrics, the same are constructed as near mathematical limits as is possible. Thereafter, when the fabric is exposed to water in the vapor phase or in the liquid phase, there is a swelling of the hydroscopic core yarn with a consequent blinding of the fabric due to the increased diameter of the composite yarn. As the fabric dries out there is a progressive reduction in yarn diameter and a consequent increase in permeability of the fabric. Such fabrics are particularly useful in the construction of raincoats, wearing apparel, and the like, or any other fabric wherein wind and water resistance are of extreme importance.

In the practice of the present invention the core yarn may be comprised of any viscose continuous filament yarn or yarns spun from viscose staple. The core yarn in turn is covered with a component of an acrylonitrile polymer. In one preferred embodiment of the invention the core yarn of viscose rayon continuous filaments will have a denier of 50 to 1150 and approximately 0 to 5 turns per inch. Correspondingly, the fibers of a viscose rayon staple yarn will have a denier of 1.5 to 10.0 and the yarn will have a twist factor of 2.75. The covering or wrapper component may be one or more rovings of acrylonitrile polymer fiber having an average staple length of 1.5 to 7.0 inches. Preferred acrylonitrile polymer fibers are those having a denier of about 1.5 to 10. Preferably, the finished composite yarn should have a count of 2 to 65 and from 3 to 50 turns per inch. It is to be understood, however, that these figures are all given by way of illustration and the invention should not be limited thereby since various counts, sizes, deniers, thickness, etc., may be employed in the practice of the present invention depending upon the end result desired in the finished composite yarns and fabrics formed therefrom.

In order to more clearly understand the invention, reference should be had to the following illustrative specific examples.

Example I

Bright viscose rayon continuous filament yarn was used as the core yarn, said filament yarn containing 60 filaments and having a denier of 100 and 3 turns per inch. The fibers of the covering or wrapping component were spun from a composition containing a blend of about 85–90% by weight of a copolymer of 97% acrylonitrile and 3% vinyl acetate and a sufficient amount of a copolymer of 50% acrylonitrile and 50% vinylpyridine to give a total vinylpyridine content by weight in the blend of approximately 6%. The covering fibers were processed into an approximately 3.7 to 4.0 hank roving using standard organization. The fibers had a staple length of 2½ inches and a denier of 3.0. The roving was spun around the core yarn to give a final yarn count of 20/s with 20 turns per inch (S twist). To achieve this final count of 20/s, the spinning frame was set up to spin a 32.6/s from the acrylonitrile polymer blend roving. The composite yarn thus produced had good tensile strength and extensibility and when woven into a fabric by standard procedure showed extremely good wind resistance and water resistance due to the hygroscopicity of the viscose rayon core yarn. The fabrics thus produced were readily dyeable by conventional techniques.

Example II

Dull viscose rayon staple having a length of 1 1/16 inches and a denier of 1.5, was spun into a yarn having a cotton count of 40/s and 27 turns per inch (Z twist). The spun viscose rayon yarn was employed as the core yarn and an acrylonitrile polymer blend roving, as employed in Example I was spun around the core yarn to give a composite yarn having a final cotton count of 16/s with 18 turns per inch (S twist). To obtain such a composite yarn the spinning frame was set up to spin a 26.6/s from the acrylonitrile polymer blend roving. The composite yarn exhibited good tensile and extensibility properties and fabrics produced therefrom were extremely wind and water resistant.

By means of the present invention it is possible to produce permeable fabrics suitable for clothing which are also weatherproofed fabrics in that they become a barrier type fabric when wet, as hereinbefore explained, highly wind resistant and water resistant. Consequently, the fabrics of the present invention are dual purpose fabrics. The composite yarns, and fabrics produced therefrom, are readily produced on existing equipment with little increase in cost. By means of the present invention it is possible to produce composite yarns having good hand, texture, surface absorptivity, and appearance. Many other advantages of the present invention will be apparent to those skilled in the art.

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

I claim:

1. A composite yarn for barrier-type textile materials comprising a hydroscopic core of viscose rayon and a hydrophobic wrapping portion of acrylonitrile polymer staple fiber.

2. A composite yarn as defined in claim 1 wherein the polymer is one containing at least 70% by weight of acrylonitrile.

3. A composite yarn as defined in claim 1 wherein the polymer is one containing at least 70% acrylonitrile and at least 2% of vinyl acetate.

4. A composite yarn as defined in claim 1 wherein the polymer is a blend of a copolymer of 90 to 98% acrylonitrile and 2 to 10% vinyl acetate, and sufficient copolymer of 10 to 70% acrylonitrile and 30 to 90% vinylpyridine to produce a blend containing a total of 3 to 8% by weight on the blend of vinylpyridine.

5. A composite yarn for barrier-type textile materials comprising a hydroscopic core portion of continuous filament viscose rayon and a hydrophobic wrapping portion of acrylonitrile polymer staple fiber.

6. A composite yarn for barrier-type textile materials comprising a hydroscopic core portion of viscose rayon staple fiber and a hydrophobic wrapping portion of acrylonitrile polymer staple fiber.

7. A composite yarn for barrier-type textile materials comprising a hydroscopic core of continuous filament viscose rayon and a hydrophobic wrapping portion of polyacrylonitrile staple fiber.

8. A composite yarn for barrier-type textile materials

comprising a hydroscopic core of continuous filament viscose rayon and a hydrophobic wrapping portion of staple fibers formed from a copolymer containing at least 80% by weight in the polymer molecule of acrylonitrile and at least one percent of another mono-olefinic monomer copolymerizable therewith.

9. A composite yarn as defined in claim 8 wherein the mono-olefinic monomer is a vinylimidazole.

10. A composite yarn as defined in claim 8 wherein the mono-olefinic monomer is vinyl acetate.

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