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YARN AND FABRIC OF MIXED FIBERS

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This invention relates to the production of a yarn, or fabric containing the same, from a mixture of fibers, at least two parts of the mixture comprising fibers of relatively different deniers.

An object of the invention is the economic and expeditious production of yarns that may be woven into a fabric, especially of the type employed in men's summer suits, which has the appearance and hand of fabric made entirely of animal fibers. A further object of our invention is the production of yarns and fabrics from a mixture of artificial fibers and animal fibers or hairs wherein the artificial fibers employed comprise a mixture of fibers of at least a small or medium denier and a large denier, and the amount of animal fibers or hairs in the mixture is at most 50%. Other objects of the invention will appear from the following detailed description.

There is a great need for light-weight fabrics for both men's and women's summer wear. This need is satisfied in part by 10-ounce to 7-ounce wool worsteds. These light-weight worsteds, however, must be formed from selected wool fibers and by an expensive worsted process in which there is a great loss of wool. Thus, the resulting material is too expensive to be used except in the most expensive suits and clothing and can be purchased only in a few localities in the word. Prior to this invention, the only way that these fine light-weight fabrics could be made with the existing conversion machinery was through the use of the very finest fibers, namely the wool 80's, as graded in accordance with the U. S. official standard, with but a very minute proportion of coarser fibers. In the separation of the 80's from the raw fleece and the combing of these fine fibers for spinning the yarn, a large proportion of the fibers was torn and broken and, in that state, they could be used only for woolen yarns.

By employing this invention, light-weight fabrics having the appearance, hand and other properties of worsted and woolen fabrics may be formed of fibers containing no or only a small percentage of animal fibers. The yarn may be formed without the tearing action of "gill boxes", combing devices and fulling machines and, therefore, much of the strength of the fibers, formerly lost, is saved. The fabric formed from or containing the yarns, processed in accordance with this invention, may resemble the finest of worsted fabrics. The fabrics of the instant invention are strong; they tailor well and they drape better than ordinary worsted. Moreover, they are capable of being colored in such a way that novel effects are produced. The fabrics do not develop holes when infested with moths; they absorb substantially less odors from the body or the atmosphere than all-wool fabrics and they are weakened much less by the action of perspiration.

It is known that fabrics containing a mixture of animal fibres and artificial fibers are made by a variety of processes. The majority of these fabrics, however, although they may have the desired appearance, have a boardy or rag-like hand. In some instances this defect in the feel of the cloth may be overcome by special finishes applied to the fabric. We have found, however, that fabrics of the desired appearance and hand may be formed by employing as an artificial fiber component of the yarn a mixture of artificial fibers of small or medium denier and artificial fibers of relatively large denier. The large denier fibers produce a more voluminous and more resilient yarn while the fine denier fibers produce in the yarn a better dispersion of the mixed fibers and give to the fabric formed from the same a surface which is wool-like to the touch.

In accordance with our invention, we prepare a yarn or fabric from or containing artificial fibers, which yarns and fabrics appear like yarns or fabrics formed entirely of animal fibers and have resiliency, voluminosity and great strength. The proportion of artificial fibers to animal fibers may be in the ratio of 50:50 to 95:5. However, exceptional results are obtained with a ratio of about 70 parts of artificial fiber and about 30 parts of wool fiber. Although it is preferable to employ some animal fiber in the production of certain fabrics, such as men's wear fabrics, good-appearing fabrics may be produced employing only artificial fibers. The yarns or fabrics are produced in accordance with this invention by employing a mixture of artificial fibers, some of which are of a large denier and some of which are of a small or medium denier.

The artificial fibers may be any suitable artificial fiber or mixture of artificial fibers, such as fibers of reconstituted cellulose formed by the cuprammonium or viscose method, of cellulose nitrate, of de-esterified cellulose nitrate and, more particularly, of the organic esters and ethers of cellulose which have the property of blending with the wool fiber in such a way as to give in the finished product the appearance and hand of an all-wool yarn. Examples of the organic esters of cellulose are cellulose acetate, cellulose formate, cellulose propionate and cellulose butyrate, while examples of cellulose ethers are ethyl cellulose, methyl cellulose and benzyl cellulose.

Artificial fibers may be formed by any suitable method, for example, by extruding the organic ester of cellulose, dissolved in a volatile solvent, through suitable orifices into a solidifying medium, thus forming substantially continuous filaments. A plurality of these filaments, as they are formed or from a plurality of pre-formed packages, may be grouped together into the form of a rope or which may be a band processed by applying thereto effect materials embossed to form crimps, and cut or torn to suitable lengths. Fibers from 1½ inches to 12 inches in length may be employed in forming the yarns. However, it is preferred to use fibers from 2 inches to 5 inches in length for most types of processing. When forming the yarns by the woolen method, it is preferable to employ fibers of about 3 inches to 4½ inches in length as shorter fibers produce a weak yarn and longer fibers tend to be torn on the carding device and broken down to non-uniform lengths, thus producing a yarn of non-uniform strength. It is also preferable to employ artificial fibers having a curl or crimp. For instance, the artificial fibers, if they contain cellulose acetate or other organic derivatives of cellulose, may be embossed by means of heated serrated rolls. The embossing is preferably performed so that there are about 16 crimps per inch with a 10 to 20% reduction in length of the fibers.

The artificial filaments or fibers may contain, or have applied as a coating, suitable effect materials such as pigments, filling materials, dyes or lakes, fire retardants, plasticizers, sizes, lubricants, etc. These effect materials may be applied to the yarns as a coating during their formation or during any winding operation with or without the aid of swelling agents for the derivative of cellulose where yarns having a derivative of cellulose base are employed, or the effect materials may be dispersed in the fibers by incorporating them in the spinning solution from which the filaments are formed.

The artificial fiber component of the yarn consists of artificial fibers of two or more deniers dispersed rather evenly in each other. For instance, yarn may be formed containing from 20 to 45 parts of 5 denier per filament fibers and 20 to 45 parts of 2 denier per filament fibers and 20 to 40 parts of wool 64's, as graded in accordance with the U. S. official standard; or the yarn may be formed containing 20 to 45 parts of 1.5 denier per filament fibers, 20 to 45 parts of 10 denier per filament fibers, 20 to 45 parts 5 denier per filament fibers and 20 to 40 parts of wool fibers. For the purposes of this invention, the fine denier fibers may be fibers having a denier of from less than 1 to 4 denier per filament while the medium size denier, if employed, may be fibers having a denier of from 3.5 to 5 denier per filament, while the large denier fibers may be fibers having a denier of from 5 to 20 or more per filament.

Artificial fibers having any suitable cross-section may be employed. For instance, fibers of bulbous, flat, hollow or round cross-section may be employed. Flat thin cross sectional fibers may be employed to produce a luster and added voluminosity. The artificial fibers may also have any suitable luster. For instance, lustrous, bright, dull, matt, etc. fibers may be employed.

Any type of animal fibers may be employed, for example, Merino (Australian and South American), Merino-Lincoln, Southdown Lincoln, Shetland, cashmere, camel, llama, etc. These wools may vary in length and crimpiness, depending upon the locality in which the animals were raised. The lengths may be from ½ inch to 12 inches. Any suitable diameter or grade of fibers may be employed. Thus, worsted-appearing yarns may be formed employing fine, half blood and three-eights, or, under U. S. official standard, 80's to 50's, or carpet stock grade of fibers or mixtures of these. Thus, grades and lengths of wool may be employed to form fabrics suitable for men's summer wear which have the desired appearance and hand, which grades and lengths could not heretofore be employed.

The mixture of fibers containing at least some artificial fibers of a small or medium and a large denier, with or without animal fibers, may be processed into yarn in any suitable manner. For instance, the yarn may be formed by the woolen system in which the wool and synthetic yarn components are blended sufficiently by passage through a picker or other opening and blending device, then fed to a woolen card by means of a Bramwell or other automatic feed where it is converted into fine rovings by the action of worker and stripper rolls acting with the carding cylinder and finally the action of ring doffers, rubber aprons, tape condensers and rubber aprons, or like condensing device. The rovings may be spun into yarn on a mule or a ring spinning frame with at least as much draft as can be obtained with 100% wool.

Of particular importance is the conversion into yarn of the mixed fibers on the cotton system as yarns of extremely fine size can be prepared with high commercial strength very economically whereas with the 100% wool, such is not the case. On the cotton system, such stock lengths as from 1 inch to 2½ inches may be employed for the synthetic yarn. Where there is a considerable difference between the lengths of the synthetic yarn stock and the wool stock, say, for example, synthetic yarn stock 2 inches, wool or other animal stock 3 to 8 inches, it is preferable to recut the wool or chop this to shorter lengths.

The cottom card may be fed with a Bramwell or other automatic feed or may be fed by means of the well known Lap. The cotton card may be of the revolving flat top type card or may employ workers and strippers which type is known in the trade as a roll top card and frequently as a waste card. Alternatively, a woolen card may be employed and either the rovings led together and wound up in sliver form or else the ring doffer or tape condenser or cotton roving forming device removed and the doffed web from the last doffer condensed in the manner employed on conventional cotton cards. Similarly, a worsted card may be employed and the sliver therefrom drawn and spun on the cotton system.

In any of these yarn forming systems, it is not essential that the fibers of different origin be blended more or less prior to the carding. An advantageous way of obtaining a thorough intermingling of the fibers of different origin with a thorough straightening of the animal fiber component is to card first all the fibers of different origin separately. For example, a set of woolen cards may have two breaker cylinders acting independently and not in sequence. On one may be carded cellulose acetate fiber and on the other wool fiber. The wool fiber receives a better carding than it would were it carded with a synthetic fiber as the wool acts better by itself and is not protected by smoother fibers of lower coefficient of friction. The web or sliver of each of these

breaker cards may then be led together and carded on a finisher card or cylinder.

In processing the yarns, the artificial staple fibers, which may be coated with a wool fiber lubricant in a volatile or non-volatile, aqueous or non-aqueous carrier, may be opened up on the wool picker, on a first breaker of a carding device or similar machine. The artificial staple fibers of different deniers may be mixed during the opening up operation or they may be mixed with the wool fiber separately in any suitable manner and the mixture oiled, picked, opened up and carded or otherwise formed into yarns by any suitable method.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention what we desire to secure by Letters Patent is:

1. A yarn comprising at least 50% of a mixture of fibers of the same organic derivative of cellulose at least 1½" in length and of at least two different deniers, one group of said fibers being of fine denier and the other being of large denier.

2. A yarn comprising at least 50% of a mixture of fibers of cellulose acetate at least 1½" in length and of at least two different deniers, one group of said fibers being of fine denier and the other being of large denier.

3. A yarn comprising at least 50% of a mixture of fibers of cellulose acetate of from 2 to 5" in length and of at least two different deniers, one group of said fibers being of fine denier and the other being of large denier, said fibers having crimps embossed thereon.

4. A yarn comprising a mixture of fibers containing wool fibers and at least 50% of a mixture of fibers of the same organic derivative of cellulose of from 2 to 5" in length and of at least two different deniers, one group of said organic derivative of cellulose fibers being of fine denier and the other being of large denier.

5. A yarn comprising a mixture of fibers containing wool fibers and at least 50% of a mixture of fibers of cellulose acetate of from 2 to 5" in length and of at least two different deniers, one group of said cellulose acetate fibers being of fine denier and the other being of large denier.

6. A yarn comprising a mixture of fibers containing wool fibers and at least 50% of a mixture of cellulose acetate fibers of from 2 to 5" in length and of at least two different deniers, one group of said cellulose acetate fibers being of fine denier and the other being of large denier, and the wool fibers being of a denier different from the deniers of the cellulose acetate fibers.

7. A yarn comprising a mixture of fibers containing wool fibers and a mixture of organic derivative of cellulose fibers of from 2 to 5" in length and of at least two different deniers, one of said groups of organic derivative of cellulose fibers being of fine denier and the other group being of large denier, the wool fibers constituting approximately 30% of the yarn and being of a denier different from the deniers of the cellulose derivative fibers, and the organic derivative of cellulose fibers having crimps embossed thereon.

8. A yarn comprising a mixture of fibers containing wool fibers and a mixture of cellulose acetate fibers of from 2 to 5" in length and of at least two different deniers, one of said groups of cellulose acetate fibers being of fine denier and the other group being of large denier, the wool fibers constituting approximately 30% of the yarn and being of a denier different from the deniers of the cellulose acetate fibers, and the cellulose acetate fibers having crimps embossed thereon.

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