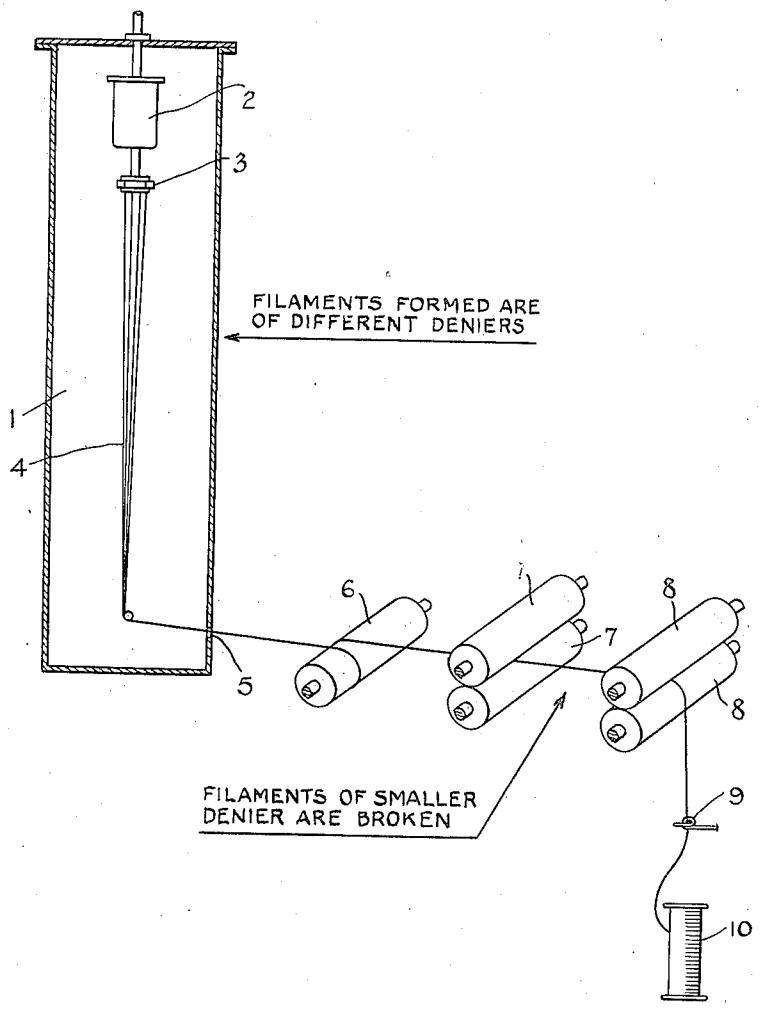
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METHOD OF PREPARING TEXTILE MATERIALS

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METHOD OF PREPARING TEXTILE MATERIALS

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This invention relates to the manufacture of yarns, and particularly yarns of cellulose acetate or other organic derivatives of cellulose, having the appearance of spun yarn or yarn made from staple fiber, and relates also to fabrics made from such yarns.

An object of the invention is the economic production of "staplized yarn," i. e. one having the appearance of being composed of short lengths of fiber spun to a yarn and which is formed of continuous filaments which after the filaments are grouped together to form a yarn are subjected to an operation to break the continuity of some, but not all, of the filaments associated in the yarn, so that the resulting yarn has a number of broken ends which give it, when twisted, the appearance of a spun yarn. Another object of the invention is to reduce the number of steps formerly necessary to produce such a yarn. A still further object of the invention is the production of a more uniform and stronger staplized yarn and one which knits into a fabric of a softer hand. Other objects of the invention will appear from the following detailed description.

Imitation spun yarn, or staplized yarn, has been made by processes where some filaments of a continuous filament yarn are broken to break the continuity of same. Such a process is described in U. S. Patent No. 2,098,980 to Sowter. Other methods have been employed wherein some of the filaments of the yarn are cut or torn to produce a similar effect. I have now found that a similar appearing yarn may be produced more economically and at the same time produce a stronger yarn which knits into a softer fabric.

In accordance with my invention, I spin a yarn from a solution of a suitable organic derivative of cellulose in a solvent therefor by extruding the solution through a jet containing two or more different dimensions of holes into a drying atmosphere or a precipitating medium such that the yarn contains at least two sizes of filaments. It is preferable to have the holes of one dimension well distributed among the holes of the other dimension. However, the holes in the jets may be arranged so that the filaments of one size are toward the outside of the yarn while the filaments of the other size or sizes are fairly well grouped in the center of the yarn. Also, the larger holes may be in one side of the jet with the smaller holes on the other side of the jet, so that the resulting yarn after having suitable twist imparted thereto will have the appearance of a doubled yarn. The different sized holes may be of the same shape or different shape. After the spinning of the yarn and while it contains little or no twist, say under 5 to 10 turns per inch and preferably about 1 turn or less per inch, the yarn is subjected to a drawing or stretching action such that the finer or weaker filaments are broken, yet substantially few of the coarser filaments are broken. This yarn may then be further twisted, doubled, etc., and woven, knitted, netted or knotted into a fabric as the sole yarn thereof or in connection with other types of yarn.

This invention aims to produce a staplized yarn of cellulose acetate or other organic derivative of cellulose. Examples of other organic derivatives of cellulose are the cellulose esters and cellulose ethers. Examples of the cellulose esters, besides cellulose acetate, are cellulose formate, cellulose propionate and cellulose butyrate, while examples of the ethers of cellulose are ethyl cellulose, methyl cellulose and benzyl cellulose. It is also applicable to yarns of regenerated or reconstituted cellulose, which yarns are formed by spinning a solution of suitable cellulosic material through a jet into substantially continuous filaments.

Any number of holes may be formed in the jets, say from 20 to 200 or more, and the ratio of large holes may be as desired. The size of the holes will depend somewhat upon the type of solution being spun and the apparatus upon which the jet is mounted. For spinning cellulose acetate filaments from a 25% solution of cellulose acetate in acetone the smaller holes may be of about 0.052 mm. in diameter, while the larger holes may have a diameter of about 0.070 mm., and the device may exert sufficient drawdown during spinning to produce filaments of about 2.5 denier and 6 denier, respectively.

The size and number of holes may be such that any weight and number of yarns may be produced, say from 30 denier to 1,000 denier or more and from 30 to 1,000 filaments or more in number. For instance, yarns in accordance with this invention may be formed from 1,000 denier 104 filaments, 750 denier 150 filaments, 170 denier 40 filaments, 220 denier 40 filaments, 180 denier 60 filaments or any other suitable denier filament count arrangement. As there can be little drawing or drafting action during the twisting or formation of the staplized yarn unless stretching of the heavier filaments is resorted to, which stretching is within the scope of this invention, the size of the twisted yarn will be slightly larger than the yarn as it is spun, i. e. as it issues from

the spinning device and containing little or no twist.

The yarn as it issues from the spinning device or taken from a package may have the finer filaments broken by leading the same through two sets of nip rollers, the forward set, i. e. the set from which the yarn issues, being driven under slightly greater speed than the rear set. These two sets of nip rollers may be spaced from 1 inch to 10 or more inches apart and the spacing thereof will determine the length of fiber into which the smaller denier or weaker filaments are broken. After the yarn leaves the forward nip rollers it may have twist inserted thereto or it may be wound into a package and effected upon a separate device. Also the yarn thus produced may be doubled with a similar yarn, a continuous filament yarn or a yarn formed of staple fiber. If desired, some drafting of the yarn may be accomplished by subjecting the yarn prior to its entrance into the nip rollers to the softening action of a solvent vapor, steam or other medium which will allow the larger denier or stronger filaments to stretch while the smaller denier or weaker filaments are broken and drafted during the stretching of the larger filaments.

The continuous filament yarns may be staplized by any suitable method. In place of the method described above, which requires stretching of the filaments to the break, it may be staplized, for instance, by abraiding rolls with little or no stretching or drafting. By this modification the first pair of rolls which the yarn encounters does not form a true nip. The lower roll of the pair is milled, i. e. has a rough surface and the top roll is comparatively light and bears down on the yarn with only a very light self-load. The second pair of rolls the yarn encounters forms a definite nip under relatively high load and controls the linear speed of the yarn. The second pair of rolls pulls the yarn forward at a linear speed greater than the peripheral speed of the milled roll of the first pair. In that this first pair of rolls is travelling at a surface speed less than that of the yarn and the top roll does not form a positive nip, the yarn slips forward and is broken in places on this pair of abraiding rolls. The lower denier filaments break more readily than the coarser filaments.

The yarns prior to or after the stretching operation which breaks the smaller denier or weaker filaments may be subjected to any of the processes now employed to change the physical or chemical nature thereof. For instance, the yarns may be treated and boiled in water to produce a delustered yarn; they may have sizes and lubricants applied thereto; they may have dyes and fugitive tints applied thereto or they may be otherwise modified. The basic yarn may be of high, medium or low luster, the luster being modified, for example, by the incorporation of pigments, by treatment with boiling soap solution or other aqueous liquors or by any other method, and similarly the yarns doubled therewith may be of normal luster or the luster may be suitably modified. The association of lustrous and non-lustrous yarns or filaments may take place before or after the breaking of constituent filaments.

The yarns or mixed yarns of the invention may be woven, knitted or otherwise made up into fabrics consisting solely of said yarns or containing them in admixture with other yarns. For example, the yarns may be introduced into the weft or warp or both to produce a woven fabric having the appearance of one constituted wholly of staple fiber yarn or having pattern effects with or without differential luster. The invention is particularly applicable to knitted fabrics of all kinds where the yarns of this invention constitute the sole or principal constituent of the fabric. Knitted fabrics made of yarns produced in accordance with this invention are exceptionally well suited for ladies' underwear fabrics as they have the appearance of being made of staple length fiber and yet they are extremely soft and have high covering power.

As an illustration of this invention, but without being limited thereto, the following example is given:

Example

A 25% solution of cellulose acetate dissolved in acetone is extruded through a spinning jet having 40 holes, 20 of which holes are 0.052 mm. in diameter and the other 20 are 0.070 mm. in diameter. This solution is spun into an evaporative medium consisting essentially of air and the pull on the thread as it is formed is such that the resultant yarn is between 166 and 170 denier with 20 filaments of about 2.5 denier and 20 filaments of about 6 denier. This yarn is wound into a package during which there is inserted about 0.6 turn per inch of twist. The yarn is then placed on a staplizing device and passed to the two sets of nip rollers spaced about 12 inches apart and the speed of the forward set of rollers is sufficiently greater than the speed of the rear set of rollers that the finer filaments are broken into lengths averaging from 10 to 14 inches. This fabric is knitted by circular knitting into a fabric. The yarn runs exceptionally well in the circular knitting machines and the fabric produced contains no thin places nor slub holes.

The above example is merely illustrative of one type of yarn that may be produced in accordance with this invention. Where three sizes of filaments are employed, for instance, all of the smaller denier or weakest filaments will be broken and a part of the medium size filaments may be broken while the coarse or heavy filaments will be substantially continuous.

An arrangement for carrying out my invention will now be described with reference to the accompanying diagrammatic drawing.

The drawing shows a spinning cell 1 containing a spinneret generally indicated by reference numeral 2. This spinneret is provide with a jet 3 containing at least two sizes of orifices through which are extruded in a downward direction a bundle of filaments 4 containing filaments of at least two different deniers. The bundle of filaments 4 is led through an opening 5 over a draw roller 6 and through pairs of rollers 7, 7 and 8, 8, each pair of which is operated at a different speed from the other and in such a manner as to break only the filaments of smaller denier. The bundle of filaments, now containing staple fibers, is passed through a pig-tail guide 9 onto a suitable collecting device 10.

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

Having described my invention, what I desire to secure by Letters Patent is:

1. Process for the manufacture of staplized yarn, which comprises extruding a solution of an organic derivative of cellulose through a jet containing at least two sizes of holes into an evaporative atmosphere, collecting the filaments thus formed into a yarn and subjecting the yarn to a stretching operation whereby the filaments extruded through the smaller size holes are broken while retaining the heavier filaments, extruded through the larger size holes, in substantially continuous form.

2. Process for the manufacture of staplized yarn, which comprises extruding a solution of cellulose acetate through a jet containing at least two sizes of holes into an evaporative atmosphere, collecting the filaments thus formed into yarn and subjecting the yarn to a stretching operation whereby the filaments extruded through the smaller size holes are broken while retaining the heavier filaments, extruded through the larger size holes, in substantially continuous form.

3. Process for the manufacture of staplized yarn, which comprises extruding a solution of an organic derivative of cellulose through a jet containing at least two sizes of holes into an evaporative atmosphere, collecting the filaments thus formed into a yarn and subjecting the yarn to a stretching operation over successive limited increments thereof whereby the filaments extruded through the smaller size holes are broken while retaining the heavier filaments, extruded through the larger size holes, in substantially continuous form.

4. Process for the manufacture of staplized yarn, which comprises extruding a solution of cellulose acetate through a jet containing at least two sizes of holes into an evaporative atmosphere, collecting the filaments thus formed into a yarn and subjecting the yarn to a stretching operation over successive limited increments thereof whereby the filaments extruded through the smaller size holes are broken while retaining the heavier filaments, extruded through the larger size holes, in substantially continuous form.

WILLIAM WHITEHEAD.