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TREATMENT OF YARN

Camille Dreyfus, New York, N. Y., and George R. Blake, Cumberland, Md., assignors to Celanese Corporation of America, a corporation of Delaware

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This invention relates to the treatment of yarn and other textile materials and relates more particularly to the conditioning of yarn made of organic derivatives of cellulose whereby the same may be more successfully subjected to knitting or other textile operations.

An object of our invention is to treat yarns containing organic derivatives of cellulose with a conditioning fluid whereby the same are rendered more pliable and therefore more suited for use in textile operations, such as knitting, where they are subjected to rather sharp bends and turns. A further object of our invention is to treat yarns or other textile materials containing organic derivatives of cellulose with a conditioning fluid containing a substance that is a solvent or is at least a latent solvent for the organic derivative of cellulose contained in such yarns. Other objects of this invention will appear from the following detailed description.

The knitting of yarns made of organic derivatives of cellulose presents serious difficulties, since if attempts are made to form a closely knit fabric from such yarns, on certain machines, such as a Wildman circular knitting machine, forming a straight stitch, serious defects or faults develop because of the lack of pliability of such yarns. In order to condition such yarns, animal or vegetable oil such as olive oil, or mineral oils have been applied thereto. While olive oil renders such yarn pliable to a certain degree, after a storage of the yarn for a period of time, yarn coated therewith does not knit as well as is often desired. Moreover the frictional resistance of the yarn treated with olive oil increases very rapidly. Mineral oils do not impart pliability to as great an extent as may be desired, and moreover are not readily removed from the fabric made from such yarns by the ordinary scouring baths.

We have found that if yarns containing cellulose acetate or other organic derivatives of cellulose are treated with a conditioning fluid containing a substance that is a solvent or at least a latent solvent for the cellulose acetate or other organic derivative of cellulose, the so-treated yarn has highly increased flexibility, and knit fabrics of close construction may be formed therefrom, which fabrics are substantially free from defects occurring in fabrics made from insufficiently conditioned yarn. Moreover upon storage of such treated yarn, the knitting and other properties of the same are not deleteriously affected, and in some cases are even improved after a period of time.

According to this invention, yarns or other textile materials containing organic derivatives of cellulose are treated, before being subjected to a fabric-forming textile operation, with a conditioning fluid comprising at least a latent solvent for the organic derivatives of cellulose contained in such yarn or materials, i. e., a latent solvent or a solvent for said organic derivatives of cellulose.

The textile materials to be treated in accordance with our invention may be in the form of yarns containing a plurality of filaments made of cellulose acetate or other organic derivative of cellulose. On the other hand the textile materials may be in the form of artificial bristles or straw containing such cellulose acetate so as to make it possible to knot, bend or braid them more easily. While we prefer to treat textile materials containing cellulose acetate, such textile materials may contain other organic derivatives of cellulose such as cellulose formate, cellulose propionate, cellulose butyrate, ethyl cellulose, methyl cellulose and benzyl cellulose.

The yarn to be treated need not consist wholly of yarns of cellulose acetate but may also contain fibres of other materials such as natural silk, artificial fibres of reconstituted cellulose, wool, cotton, etc. The yarns of cellulose acetate may be formed from continuous filaments or the same may be spun from short staples or short lengths of such filaments.

While we prefer to use ethyl oxy butyrate as the solvent in the case of treatment of cellulose acetate yarns, other solvents or latent solvents may be used, preferably those that are relatively non-volatile, i. e. having a boiling point above 120° C. and that are soluble in or readily removable by water. Examples of other relatively non-volatile solvents or latent solvents for cellulose acetate that are more or less soluble in water are benzyl alcohol, diacetone alcohol, monoacetin, diacetin, acetol (acetyl carbinol), cyclohexanone, cyclopentanone, ethyl lactate, dimethyl tartrate, etc. Less preferably, relatively non-volatile solvents or latent solvents for cellulose acetate not soluble in water, such as triphenyl phosphate, a mixture of triphenyl phosphate and tricresyl phosphate, or triacetin may be employed.

The reason that relatively non-volatile solvents or latent solvents are preferred is that upon storage of the conditioned yarn such materials do not tend to evaporate readily and therefore the treated yarns retain their pliability for a long period of time. Since it is desirable

that the solvents or latent solvents be removed from the fabric after it is formed from the treated yarn, if they are water soluble they can be readily removed in the ordinary scouring and/ or dyeing operations.

While the conditioning fluid applied to the yarn may consist wholly of one or a mixture of two or more of the solvents or latent solvents, generally it is preferable to dilute the same with a liquid that dissolves such solvent or latent solvent but which has no solvent action on the cellulose acetate or other organic derivative of cellulose of the yarn. Examples of such diluents are water and preferably a relatively non-volatile liquid miscible with water such as ethylene glycol, diethylene glycol, propylene glycol, ethers of glycols, such as the mono ethyl ether of ethylene glycol, etc. Generally the amount of diluent present is such that the concentration of the solvent or latent solvent for the cellulose acetate is from 2% to 30% or more of the conditioning fluid. The concentration of the conditioning fluid with respect to the solvent or latent solvent may be more than 30% and up to 100%, provided it is not applied in such amounts and such concentrations as to dissolve the filaments of the yarns or to cause them to stiffen or coalesce together.

As to the amount of conditioning agent applied to the yarn, this also may be varied, and we have found that, for instance in the case of a conditioning agent containing ethyl oxy butyrate in amounts of 2 to 5% of the weight of the conditioning agent, if quantities of such conditioning agents equal to 10 to 20% of the weight of the yarn being treated are applied to the yarn, excellent results are obtained.

The conditioning fluid may be applied to the yarn in any suitable manner. Thus it may be applied by the immersing of hanks of yarn to be treated in a bath containing the conditioning fluid. If desired, the conditioning fluid may be applied to the yarn while it is in transit from package to package. This may be done by passing the yarn over pads or wicks that are impregnated with the conditioning fluid or by passing over rollers, the bottoms of which are immersed in the conditioning fluid. The conditioning fluid may be dripped onto the yarns while they are in transit, and also the yarns may be caused to dip into a bath containing the conditioning fluid while they are in transit prior to being wound onto a suitable package. In another form, the conditioning fluid may be applied as a spray onto cones, bobbins, pirns or other packages while the same are being wound, so that the spray is being continuously applied during the formation of the package. If desired, the yarn may be treated at the spinning cabinet with the conditioning agent while it is being transmitted from the spinning cabinet in which it is spun from solutions of organic derivatives of cellulose and prior to being wound and/ or wound and twisted into yarn.

The yarn treated in accordance with this invention is very pliable and flexible, and may be knitted, woven or subjected to any other suitable textile operations, to form knitted or woven fabric, hosiery, or other articles.

After the fabric is formed, it is highly desirable that the solvent or latent solvent be completely removed from the fabric by scouring or during dyeing or any other finishing operation. We have found that the solvent or latent solvent tends to lower the melting point or safe iron-

ing point of the material when it is present, but after it is removed by any suitable means, the resulting textile material has as high a melting point and safe ironing point as the untreated textile material.

Cellulose acetate yarn treated in accordance with this invention has many important advantages. As stated they are very pliable and flexible, and even after storage for a prolonged period of time, retain this pliability and flexibility.

This yarn may be knitted on circular knitting machines or on warp knitting machines to produce fabric of many wales and courses per unit length, which fabrics are substantially free of pin holes, distortions, tension lines, etc. and have a much better appearance than fabric made from untreated yarns. Cellulose acetate yarn when treated by this invention may be knitted on certain circular knitting machines which are not capable of knitting untreated cellulose acetate yarn or cellulose acetate yarn finished by previous methods, to form a commercially satisfactory fabric and likewise may be netted successfully on lace-making machines to form highly satisfactory lace. Moreover when yarn treated by this invention is exposed for several days to normal atmospheric conditions without any precautions whatever, the yarn still retains its good knitting properties. Furthermore yarn treated by this invention may be knitted at a higher rate than yarn treated by previous methods.

In order further to illustrate our invention, but without being limited, the following specific examples are given.

Example I

A conditioning fluid is made up as follows:

	Parts by weight
Ethyl oxy butyrate.....	14
Diethylene glycol.....	56
Water	30

This conditioning fluid is applied to a yarn consisting wholly of acetone-soluble cellulose filaments by causing the yarn to pass over a wick dipping into a solution of the same, while it is being transmitted to a coning machine, the amount of conditioning fluid applied being 12% of the weight of the yarn. Such yarn has all the advantages set forth above.

Example II

A conditioning fluid is made up as follows:

	Parts by weight
Ethyl oxy butyrate.....	4
Diethylene glycol.....	56
Water	40

This conditioning agent is applied to the yarn and in a manner similar to Example I.

The water and diethylene glycol are employed in the above examples not only as diluents for the ethyl oxy butyrate but to incorporate an amount of water to condition the yarn. This water is held by the very hygroscopic and higher boiling diethylene glycol, and therefore its tendency to evaporate during storage is inhibited.

The term "solvent" as employed hereinafter in the claims is to be construed as meaning true solvents and it is not intended to include plasticizers within its scope.

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:

5 1. Process for the production of fabrics containing yarns of organic derivatives of cellulose, which comprises applying to said yarns, prior to a fabric-forming operation, an agent comprising a solvent for the organic derivatives of cellulose
10 to render the yarns more pliable, subjecting the yarns to a fabric-forming operation and removing said agent from the fabric.

2. Process for the production of fabrics containing yarns of cellulose acetate, which comprises applying to said yarns, prior to a fabric-forming operation, an agent comprising a solvent for the cellulose acetate to render the yarns more pliable, subjecting the yarns to a fabric-forming operation and removing said agent from the
20 fabric.

3. Method of conditioning yarn containing cellulose acetate comprising applying thereto a conditioning agent comprising ethyl oxy butyrate.

4. Method of conditioning yarn containing cellulose acetate comprising applying thereto a conditioning agent comprising ethyl oxy butyrate, diethylene glycol and water.

5. Yarn comprising cellulose acetate containing a conditioning agent comprising ethyl oxy butyrate.
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6. Yarn comprising cellulose acetate containing a conditioning agent comprising ethyl oxy butyrate, diethylene glycol and water.

7. Fabrics, garments or other articles made from the yarn defined in claim 5.
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8. Process for the production of fabrics containing yarns of organic derivatives of cellulose, which comprises applying to said yarns, prior to a fabric-forming operation, an agent comprising a solvent for the cellulose derivative diluted with a non-solvent for the cellulose derivative, the concentration of the solvent in the agent being such that the filaments of the yarns retain their individual structure, subjecting the yarns to a fabric-forming operation, and removing said agent from the fabric.
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9. Process for the production of fabrics containing yarns of cellulose acetate, which comprises applying to said yarns, prior to a fabric-forming operation, an agent comprising a solvent for the cellulose acetate diluted with a non-solvent for the cellulose acetate, the concentration of the solvent in the agent being such that the filaments of the yarns retain their individual structure, subjecting the yarns to a fabric-forming operation, and removing said agent from the fabric.
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10. Process for the production of fabrics containing yarns of organic derivatives of cellulose, which comprises applying to said yarns, prior to a fabric-forming operation, an agent comprising a relatively non-volatile solvent for the cellulose derivative diluted with a non-solvent for the cellulose derivative, said solvent having a boiling point above 120° C., the concentration of the solvent in the agent being such that the filaments of the yarns retain their individual structure, sub-
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jecting the yarns to a fabric-forming operation, and removing said agent from the fabric.

11. Process for the production of fabrics containing yarns of cellulose acetate, which comprises applying to said yarns, prior to a fabric-forming operation, an agent comprising a relatively non-volatile solvent for the cellulose acetate diluted with a non-solvent for the cellulose acetate, said solvent having a boiling point above 120° C., the concentration of the solvent in the agent being such that the filaments of the yarn retain their individual structure, subjecting the yarns to a fabric-forming operation, and removing said agent from the fabric.
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12. Process for the production of fabrics containing yarns of organic derivatives of cellulose, which comprises applying to said yarns, prior to a fabric-forming operation, an agent comprising a relatively non-volatile water-soluble solvent for the cellulose derivative diluted with a non-solvent for the cellulose derivative, said solvent having a boiling point above 120° C., the concentration of the solvent in the agent being such that the filaments of the yarns retain their individual structure, subjecting the yarns to a fabric-forming operation, and removing said agent from the fabric.
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13. Process for the production of fabrics containing yarns of cellulose acetate, which comprises applying to said yarns, prior to a fabric-forming operation, an agent comprising a relatively non-volatile water-soluble solvent for the cellulose acetate diluted with a non-solvent for the cellulose acetate, said solvent having a boiling point above 120° C., the concentration of the solvent in the agent being such that the filaments of the yarns retain their individual structure, subjecting the yarns to a fabric-forming operation, and removing said agent from the fabric.
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14. Process for the production of fabrics containing yarns of cellulose acetate, which comprises applying to said yarns, prior to a fabric-forming operation, an agent comprising a relatively non-volatile water-soluble solvent for the cellulose acetate diluted with a glycol, said solvent having a boiling point above 120° C., the concentration of the solvent in the agent being such that the filaments of the yarns retain their individual structure, subjecting the yarns to a fabric-forming operation, and removing said agent from the fabric.
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15. Process for the production of fabrics containing yarns of cellulose acetate, which comprises applying to said yarns, prior to a fabric-forming operation, an agent comprising a relatively non-volatile water-soluble solvent for the cellulose acetate diluted with an ether of a glycol which is a non-solvent for the cellulose acetate, said solvent having a boiling point above 120° C., the concentration of the solvent in the agent being such that the filaments of the yarns retain their individual structure, subjecting the yarns to a fabric-forming operation, and removing said agent from the fabric.
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CAMILLE DREYFUS.
GEORGE R. BLAKE.