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TEXTILE MATERIAL AND METHOD OF MAKING THE SAME

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This invention relates to the treatment or preparation of staple fibres which are more suitable for spinning or other textile operations.

An object of my invention is to prepare or treat staple fibres, particularly fibres made of organic derivatives of cellulose with a material adapted to destroy or diminish the tendency of such fibres to develop electrostatic charges when manipulated, so that the staple fibres may be successfully associated together to form "spun" yarn.

Other objects of my invention will appear from the following detailed description.

The formation of "spun" yarn from comparatively short lengths or staples of filaments or threads composed of organic derivatives of cellulose presents serious difficulty. This is due to the fact that such organic derivatives of cellulose have a very high di-electric constant and when the filaments are rubbed together during the various operations involved in spinning, a great static charge of electricity is produced. Because of the static electrical charge, the staple fibres do not adhere to each other readily and cause great difficulty in the spinning operation.

I have found that if a solution of an electrolyte in a solvent of relatively high boiling point is applied to or incorporated in staple fibres, the tendency to generate static electricity during the spinning operation is greatly reduced. Moreover, I have found that if such solution of electrolyte is applied to or incorporated in continuous lengths of artificial filaments, especially those made by the dry or evaporative method, the great difficulty encountered in cutting such filaments to uniform staple lengths is overcome.

In accordance with my invention I prepare staple fibres containing a solution of an electrolyte in a solvent of relatively high boiling point. This solution of electrolyte may be incorporated in relatively continuous lengths of artificial filaments in any suitable manner and the continuous lengths may then be cut into the staple fibres, or else the staple fibres themselves may be treated with the solution of the electrolyte either before any spinning operation or at any suitable intermediate stage of the spinning operation or to the "spun" yarn itself.

While this invention is of general application and is applicable to the treatment of natural fibres such as cotton or wool, or staples cut from natural silk or yarns or filaments made of reconstituted cellulose (such as may be made by the viscose, cuprammonium or nitrate method), it is of particular importance in connection with staple fibres made of organic derivatives of cellulose such as organic esters of cellulose and cellulose ethers. Examples of 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. Therefore this invention will be described more particularly in connection with the preparation or treatment of staple fibres made of cellulose acetate or other organic derivatives of cellulose.

The artificial filaments of organic derivatives of cellulose may be formed from solutions of the same in suitable solvents by extruding such solutions through orifices into a drying evaporative atmosphere, as in dry spinning, or by extrusion through orifices into a bath containing a precipitating liquid as in wet spinning. Such filaments may be treated while in the untwisted state by my process, or two or more of such filaments may be associated together by twisting, to form yarns or threads, which yarns or threads may be treated by my process.

By treating with or incorporating in the staple fibres, a solution of an electrolyte in a solvent of relatively high boiling point, because of the high electric conductivity of such solution, the building up of electric static charges is largely or entirely avoided.

While any suitable organic or inorganic electrolyte may be employed, I prefer to employ a hygroscopic electrolyte, examples of which are magnesium chloride, magnesium acetate, magnesium nitrate, magnesium chlorate, ammonium citrate, calcium chloride, calcium nitrate, zinc chloride, amines or their salts such as triethanolamine, triethanolamine stearate, triethanolamine oleate, methylamine, methylamine hydrochloride or a mixture of two or more of these.

As a solvent for the electroylte I prefer to employ a liquid having a relatively high boiling point, i. e. above 100° C., so that it does not tend to evaporate too readily from the filaments or staple fibres with the result that the resistance against electrification is preserved for a long period of time. The solvent will usually be an organic liquid which preferably, but not necessarily, is hygroscopic. Examples of such liquids are diethylene glycol, ethylene glycol, glycerol or diacetone alcohol or mixtures of two or more of these, which liquids have a more or less softening action on organic derivatives of cellulose. In case of treatment of staple fibres made of cellulose acetate or other organic derivatives of cellulose, there may be added to the solution, softening agents such as ethers of ethylene or poly-

olefine glycols such as the monomethyl ether of ethylene glycol, the mono ethyl ether of ethylene glycol or the diethyl ether of diethylene glycol. In order to stablize the solution against change of volume, viscosity or concentration due to evaporation or absorption of water, it is preferable to add a quantity of water substantially equal to the amount of water these liquids tend to absorb from the air, the amount of water being 30% in the case of diethylene glycol, 13% in the case of ethylene glycol and 33% in the case of glycerol.

The amount of electrolyte present in the solution and the amount of solution applied will vary in accordance with the nature of both the electrolyte and solvent, the nature of the staple fibres and the result to be obtained. Generally the electrolyte will be present in concentrations of 1 to 25%, and the amount of solution applied or incorporated in the fibres will be from 1 to 40% of the weight of the fibres.

The filaments or yarns may be treated with the solution of the electrolyte while they are still in the comparatively continuous lengths in which they are formed. Conveniently the solution of electrolyte may be applied by means of wicks, rollers or other furnishing devices to the yarns or filaments while they are in transit. A desirable method is to apply the electrolyte solution to the artificial silk immediately after they leave the spinning cabinet in which they are formed while on the way to a cutting device which cuts them into staple fibre. A suitable arrangement for cutting the yarn after leaving the spinning machine is shown and described in the U. S. application No. 278,884 filed May 18, 1928. If desired, the relatively continuous lengths may be treated in the form of hanks or other suitable package prior to being cut into staples or chappé of suitable length.

Instead of treating the filaments after their formation with the solution of electrolyte, such solution may be added to or incorporated in the spinning solution from which said filaments are formed, whereby filaments containing such solution are formed directly.

Alternatively the staple fibres, either occurring naturally, or cut from continuous lengths of natural silk or artificial filaments may be treated with the solution of electrolyte in which case the staple fibres may be placed in bags which are immersed in the bath of the solution and which for convenience may be tied in bundles prior to immersion in the bath. The treatment of the staple fibres during an intermediate stage of the spinning operations such as immediately after lapping, carding, drawing or slubbing is not excluded from this invention.

As to the length of the staples, lengths ranging from 0.75 to 10'' or more in length are suitable. The artificial filaments may be of any suitable weight per unit length, say from 1 to 30 deniers or more, examples of which are 1.9, 3.5 or 5.5 denier.

After treatment with the solution of electrolyte, the short lengths of filaments or threads are then subjected to a suitable spinning operation, such as is used for the spinning of short lengths of natural silk, cotton or wool fibres to form threads by any of the well known systems, such as the "Cotton", the "French", the "Worsted", the "Wool", the "Spun Silk", the "Bradford" system, etc. This spinning operation also includes the preliminary treatments necessary to present the filaments or fibres in the form required for the actual operation of twisting them into yarn.

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

Example I

From a spinning metier spinning 180 ends, each end containing 40 filaments of 2 deniers of acetone soluble cellulose acetate, the ends are drawn at the rate of 100 meters per minute to a rotary cutting device such as is described in U. S. application 278,884 filed May 18, 1928. On their way to the cutting device, the ends are caused to pass over wicks which furnish 2 to 3% of the weight of the filaments of the following finish:

	Parts by weight
Diethylene glycol	100
Water	30
Magnesium chloride	10

Application of this finish is conveniently accomplished by contacting the filaments with hard lamp wicks which dip into the finish, the wicks being positioned at the foot of the spinning cabinets so that the filaments contact with the finish immediately after they leave the spinning chamber. Cut fibres so produced are substantially free of and resistant to the development of electrostatic charges and may be spun into yarn without any difficulty.

Example II

The process of Example I is repeated with the exception that the amount of finish applied is increased to 8% of the weight of the finish. To accomplish this, softer wicks of higher capillarity are employed, or the wicks may be replaced by furnishing rollers dipping in a trough containing the finish and rotating at convenient speeds. The results are similar to those obtained in Example I, but the fibres have a slightly damp handle and a slight scroop which causes better binding or adhesion between the fibres in the building up of the yarn by a spinning process.

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 my invention.

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

1. The method of forming "spun" yarn comprising spinning staple or short lengths of artificial filaments made of organic derivatives of cellulose, which filaments contain a hygroscopic solution comprising an electrolyte having no deleterious action on the filaments and a major proportion of an alcohol having a boiling point above 100° C.

2. Method of forming "spun" yarn, which comprises spinning staple or short lengths of artificial filaments made of organic derivatives of cellulose, which filaments contain a solution comprising magnesium chloride and a major proportion of diethylene glycol.

3. Method of forming "spun" yarn, which comprises spinning staple or short lengths of artificial filaments made of cellulose acetate, which filaments contain a solution comprising magnesium chloride and a major proportion of diethylene glycol.

4. Method of forming staple fibres comprising extruding a solution of cellulose acetate through orifices into a setting medium, applying to the filaments so formed a solution comprising an

electrolyte having no deleterious action on the filaments and a major proportion of an alcohol having a boiling point above 100° C. and then cutting the filaments into relatively short lengths.

5. Method of forming staple fibres in a continuous manner comprising continuously extruding a solution of cellulose acetate through orifices into a setting medium, continuously applying to the filaments so formed a solution comprising an electrolyte having no deleterious action on the filaments and a major proportion of an alcohol having a boiling point above 100° C., and then continuously cutting the filaments into relatively short lengths.

6. Relatively short artificial fibres or filaments made of cellulose acetate containing a hygroscopic solution of an electrolyte having no deleterious action on the fibres or filaments and a major proportion of an alcohol having a boiling point above 100° C.

7. Relatively short fibres or filaments made of organic derivatives of cellulose containing a hygroscopic solution containing magnesium chloride and a major proportion of an alcohol having a boiling point above 100° C.

8. Relatively short fibres or filaments made of cellulose acetate containing a hygroscopic solution containing magnesium chloride and a major proportion of an alcohol having a boiling point above 100° C.

9. Relatively short fibres or filaments made of cellulose acetate and containing a hygroscopic solution containing magnesium chloride and a major proportion of diethylene glycol.

10. "Spun" yarn comprising relatively short lengths of filaments containing an organic derivative of cellulose and being coated with a hygroscopic solution, said solution comprising an electrolyte having no deleterious action on the filaments and a major proportion of an alcohol having a boiling point above 100° C.

11. "Spun" yarn comprising relatively short lengths of filaments containing cellulose acetate and being coated with a hygroscopic solution, said solution comprising an electrolyte having no deleterious action on the filaments and a major proportion of an alcohol having a boiling point above 100° C.

12. "Spun" yarn comprising relatively short lengths of filaments containing an organic derivative of cellulose and having incorporated therein a hygroscopic solution, said solution comprising magnesium chloride and a major proportion of diethylene glycol.

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